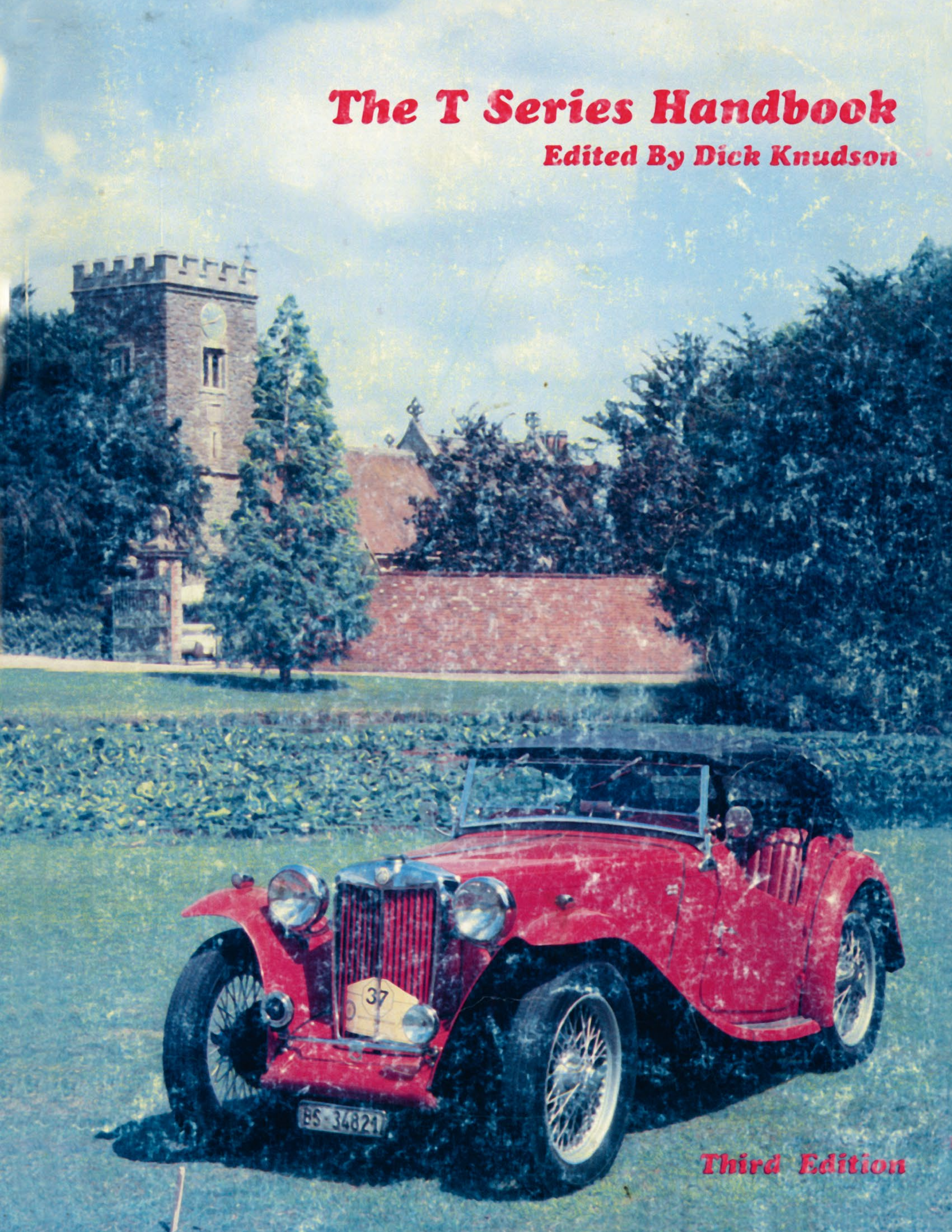
# The T Series Handbook

Edited By Dick Knudson




Third Edition

# THE T SERIES HANDBOOK

essential information from the pages of

THE SACRED OCTAGON

DICK KNUDSON: EDITOR
F.E. OLD III: TECHNICAL EDITOR

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## Introductions and Acknowledgements

You have in your hands a labor of love. It represents a love for one of the truly great sports cars, the M.G. This book is meant to pay tribute to the gutsy T Series cars from Abingdon and to help them go on forever.

The first lovers in this story are those dedicated men and women who built these cars in Abingdon, England. To them we owe everything. Inspired by M.G.'s originator, Cecil Kimber, they continued to approach their work with a dedication unmatched in modern British industrial history. They cared about the cars they built.

The next lovers to be recognized are the great band of American sports car enthusiasts. It was they who first gave the M.G. T Series cars classic status, and it was they who treated their M.G.s with a reverence which ultimately led to the preservation of so many. It was in America that parts manufacturers led the way to insure that these cars would never die. In other countries the T Series was treated with a contempt which might have led to the scrapping of many cars that since have been saved.

Immodestly, The New England M.G. T Register must be placed near the top of the list of lovers who have caused the T Series M.G. to grow to a position of world wide classic status. Started in 1964, this Register has brought thousands of enthusiasts together; it found out early on that people who love M.G.s are nice people and worth knowing.

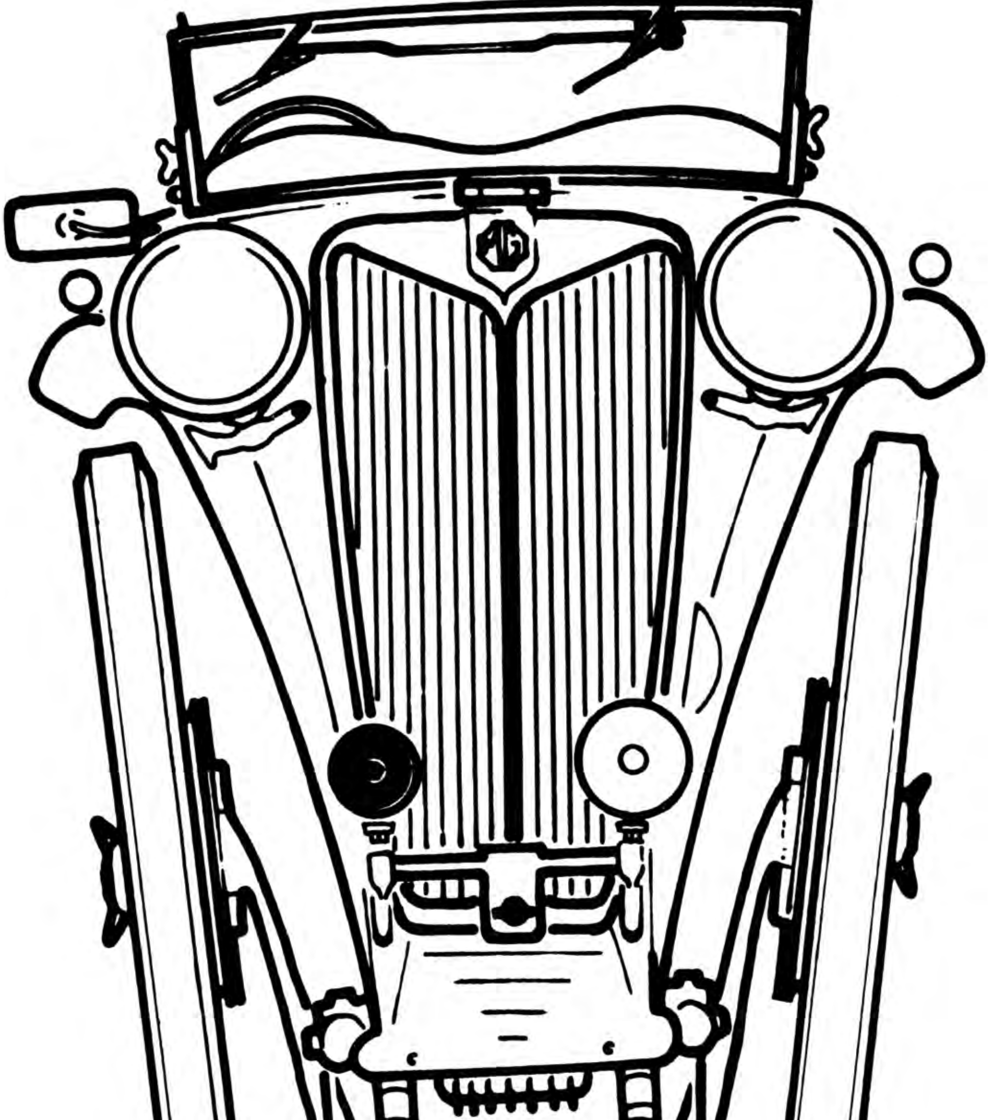
The Register has communicated through the pages of *The Sacred Octagon*. This popular bi-monthly journal has set the standard for car club magazines. Frank Churchill was the first editor, and he laid an excellent foundation. By the time Clay and Carol Richards took over as editors, *The Sacred Octagon* was well established. Under their direction the magazine continued to grow.

Important to the success of *The Sacred Octagon* has been the technical material. The Register has been blessed with excellent Technical Editors. The first was W.K.F. "Woody" Wood. He had outstanding technical knowledge which gave us some interesting reading. Woody's successor was Chip Old.

Chip Old has done an outstanding job as Technical Editor. His work has always been carefully researched and clearly written. Many of his findings have only been available in *The Sacred Octagon,* and the presence of his work must be credited as causing much of its popularity.

This book is for the last of the M.G. lovers to be acknowledged: today's T Series owner. Enthusiasm for M.G. continues to grow, and today's owners are every bit as nice to know as those of 1964.

Dick Knudson




# MILESTONE M.G.: THE TC

One of the nine original cars selected for the Milestone Car Society was the M.G. TC. It was selected by the membership of the society as one of its first certified milestones and was the oldest of the first group. It was nominated on the strength of its design and performance. The other considerations for certification by the society include: engineering, quality of construction, and innovation. When one considers the five categories in total, then it can be easily seen that the base for selection of the TC (or any genuine sports car, for that matter) is particularly solid. Design and performance are essential to a successful sports car, and the TC may be one of the most successful sports cars ever built when all aspects of that success are considered. Let's take a look.

The TC is one of a long line of M.G. Midgets which started in 1929. Cecil Kimber, the father of The M.G. Car Company, realized that the enthusiastic public yearned for a sports car they could afford. In the spring of 1928 Morris Motors was planning a "baby car" with a potent Wolseley engine to be called a Morris Minor. Kimber took a Morris Minor chassis and fitted a special two seater body furnished by Carbodies of Coventry, thus creating the first M.G. Midget—the M Type. It was shown at the 1928 Motor Show on the company's stand. It was not until March of 1929 that the first M Type was completed at the new assembly facility located at Edmund Road in Oxford.

The M Type proved to be so popular along with the rest of the M.G. line that it soon became necessary to find a larger assembly plant. In late 1929 the company moved to its present location in Abingdon, a few miles from Oxford. And the production of the Midget continued; it is to Kimber's credit that he (and subsequently, the company) never lost sight of the original premise: a sports car within the reach of the working man. That concept in regard to the normal passenger car was made popular by Henry Ford and put many Americans behind the wheel. Without M.G., many people would never have experienced the real joy of owning and driving a sports car. Right through to the last Midget assembled at Abingdon, there was always an effort to provide a maximum amount of performance in a minimum priced machine. Were they successful? M.G. was the world's largest producer of sports cars from the 1930's until Oct. 22, 1980.

It is probably to the J2 that the TC owes most of its styling characteristics. This successful Midget was introduced in 1932 and replaced the M Type. The J2 was the first of the stylized Midgets with the shape that was to say "M.G." and "Sports Car" to the world for at least twenty five years. The familiar radiator grill was right out front and was retained from previous models. For the first time on a produc-


WIRES

tion model, however, were a double-humped cowl and cutaway doors. The J2 designers also replaced the M's boattail with the now familiar slab petrol tank and rear mounted spare tire. It was not until a year later in 1933 that the cycle fenders were replaced by swept clamshell fenders which were delicate and pleasing to the eye.

The TA Midget introduced in 1936 had several features which would later appear on the TC in 1945. The basic shape, of course, was established, but the body of the TA was enlarged a great deal. The bigger body was made possible by the larger chassis: wheelbase, 7'10"; track, 3'9". The major technical change, however, was the use of a pushrod engine instead of the familiar overhead cam power plant. Enthusiasts lamented the demise of the ohc engine, but the company had decided that the fussiness of keeping it in tune should be solved by using an engine which (theoretically) would not require such careful attention. The TA engine was the Wolseley Ten (McComb, p. 90) or, more properly, the Morris Ten and was designated the MPJG. It displaced 1292 c.c. and produced 52.4 b.h.p. at 5000 r.p.m. It did not cost any more than the previous PB, and as soon as the purists recovered from the loss of the smaller, saucier P Type, it was readily accepted.

One might think that with the TA being such a close relative of the TC and with its introduction being not so long ago, that pinpointing its designer would be a simple thing. History is always difficult because it is written after the fact. While it is happening, little record is kept because it does not seem particularly important at the time. In June of 1975 the late Cecil Cousins visited America to be present at a major meeting of The New England M.G. 'T' Register. Mr. Cousins was the first employee of The M.G. Car Company and rose through the ranks to become works director in the years previous to his retirement. Mr. Cousins had a great deal of M.G. lore stored in his head, and the origin of the TC was the subject of a tape recorded interview with him. A transcription follows:

Question: When the TA was designed, was it done by a team, or can one person be credited?

Cousins: Abingdon had its own drawing office until June of 1935 when we were bought off of, I suppose, Lord Nuffield, ot was he Sir William Morris. I don't know. It doesn't matter any-way. Same bloke. He sold us hook, line and sinker to Morris Motors. Up until then it had been a private company owned by Sir William Morris. Well, as soon as Morris Motors got hold of us they shut down our drawing office and said stop all this nonsense of racing and record breaking and make some money. All of our drawing office boys went to Cowley. (Author: Cowley is the location of the headquarters of Morris Motors on the outskirts of Oxford. McComb (p. 86) tells us that H. N. Charles, the longtime chief de-signer, made the move but that Syd Enever and Bill Renwick stayed at Abingdon as de-sign liason men.)

Question: Was that the end of the overhead cam engine?

Cousins: Right. That was the end of the Wolseley engine that we knew it as.

Question: Tell us more about the design history.

Cousins: The first car to come out of the Morris Motors drawing office was the Two Litre SA, which was a modified 18 horse Morris. The first Midget was the TA.

Question: So it was a team effort?

Cousins: You have to remember that Cowley wasn't far from Abingdon. Kimber kept popping in and popping out and saying, "I don't like this, and I don't like that, and I don't like the other."

There was a certain amount of back pressure from Abingdon all the time so that they didn't get too far off the beaten track. The TA was, in fact, the first Midget designed by the new alternative Morris drawing office.

That was all right as we used the existing 10 horse Morris engine in that car. You see, in those days we didn't sell engines by cubic capacity. We built engines on a cranky thing called RAC rating which didn't take into consideration the cubic capacity of the engine. It was based, pure and simple, on the bore of the engine; hence, the fact that for years and donkey years, all the English motor trade suffered with great engines with tiny little bores and whacking great long strokes.

It is, then, difficult to pinpoint a designer for the TA. H. N. Charles must be given credit; indeed, Dave Ash's article about Syd Enever in the January, 1975, issue of *Sports Car* says that the TA is largely the work of H. N. Charles. Evener, of course, must have led the input from Abingdon. Kimber was unquestionably the boss and ultimately responsible; in fact, the TA was the last Midget which received real Kimber input—and if the TA, then certainly the TC which appeared after his death was a product of his imagination.

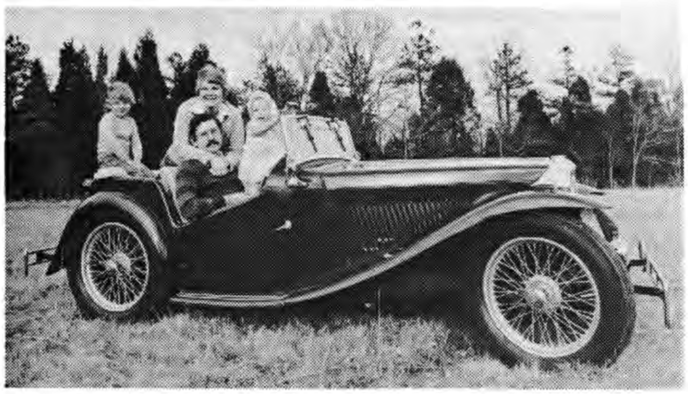
The next Midget to appear was the TB. This was merely a TA with a new engine. It appeared in September of 1939 and only 379 were built before World War II caused the end of production for five years at Abingdon.

The TB's engine was the famous XPAG unit used to power the later TC, Y, TD, and TF models. Displacement dropped from the TA's 1292 c.c. to 1250 c.c., and the dimensions changed from 63.5 X 102 m.m. to 66.5 X 90 m.m. The end result was a most dependable engine which not only powered many sports cars but also a wide variety of racing and record breaking cars as well.

**How can I express how it feels to be over-whelmed with compliments on it when you're finished? The work I did was not for show, but for me only. I did it because it is the way I work; it was my vent of expression. Do you know I spent almost $7,000 in parts and, except for the interior and tires, you can't see any of them. They are all in the interior engine or running chassis and wood. No sheet metal needed replacing, nor trim, chrome, or wheels . . . all of that merely needed cleaning, sanding, and painting. Truly everything in the car was worn out. All functional, moving parts were worn out and needed replacing. But I have never done anything like this and shown it, so I wasn't aware of the compliments coming. It was beautiful! Of course, this says something of the high price of parts, doesn't it? I believe this restoration has taught me the meaning of the word patience. Never before have I had to wait so long for parts. And when they sent the wrong part, well, I have come very close to getting on an airplane . . .**

**Luke Snyder, #5132**


HVC 501



*Luke Snyder, #5132, and his family reflect the obvious enjoyment their TC gives them. Luke and several other members describe what it's like to own a TC in the bold faced boxes accompanying this article.*

During World War II all automotive production ceased at Abingdon, and the M.G. men who did not go to war were busy in a variety of projects which helped in the final victory. These endeavors included everything from tank repair to assembly of a major component of an aircraft. Kimber left the firm during this period and was later killed in a freak train accident on 4 February 1945.

Cecil Cousins had this to say about the return to sports car production after the war ended in 1945:

> Kimber had left and was dead. We had a new managing director who was a very clever businessman by the name of H. A. Ryder. He had been director of the Morris Radiator Company, a very clever engineer, but he'd never made a motor car nor had anything to do with anybody who had. He was a wonderful sheet metal man—the champion sheet metal worker of the Midlands in his earlier day.
>
> After the war we said, "What will we make?"
>
> He said, "Well, we'd better make the TB again."
>
> And somebody wisely said, "Well, we'd better find out what's wrong with it."
>
> So they went through the records to find out what items we had the biggest number of service complaints on and that sort of public criticism. The only two things that anybody could point to was that it wasn't wide enough and that the sliding shackles were the biggest service item. So, they made the body four inches wider across the cockpit and replaced the sliding trunnions with rubber shackles to get over the other problem. And that was how the TC came to be. We announced it in October of 1945 and had built 81 by the end of the year.

The British motoring press (as far as foreign cars were concerned, there was no American motoring press in 1945) enthusiasticly welcomed the TC. Road tests of the car appeared in *The Motor* (10 October 1945) and *Autocar* (12 October 1945) and were lavish in praise for the new sports car from Abingdon.

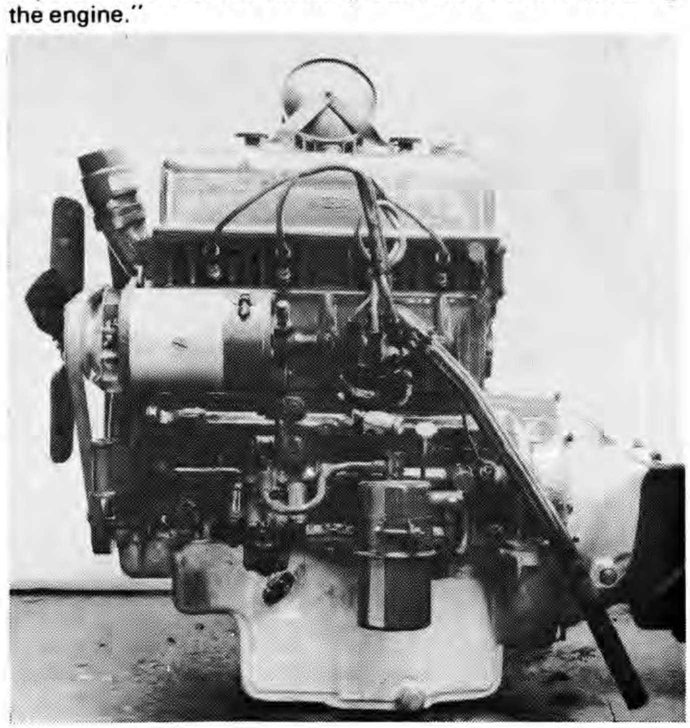
The *Autocar* report ("Hillbusting' on a 1945 Midget," pp. 732-734) was written by Montague Tombs and was a different sort of test with a great deal of subjective evaluation based on a trip over the various hills of the Cotswolds used in pre-war *Autocar* tests. Tombs reported, ". . . a dashing sort of performance, smartness off the mark, and quick acceleration . . ." He concludes, "The little car is rock steady and stable, and handles with a satisfying accuracy. It is quite charming to drive fast . . . In short the car is an extremely well-balanced design."

Tombs also summarizes the improvements and modifications from the TB. In addition to the two major differences previously mentioned, he lists the following:

1. new Luvax-Girling shock absorbers
2. single 12 volt battery accessibly mounted in dash bulkhead under the scuttle
3. large tool box behind battery box and accessible from either side
4. instruments updated, petrol light shows green when reserve is being used
5. under bonnet appearance improved with electrical leads and pipe lines neatly grouped—engine finished in gray instead of black (Author: the gray color later gave way to the deep M.G. maroon as an engine color.)
6. paint work in preliminary production will be black with choice of trim in red, green or biscuit (Author: it appears that black would be an appropriate original color for a 1945 TC. Later color options included: M.G. Red, Regency Red, Shires Green, Almond Green, Ivory and Clipper Blue as well as Black. Wheels were painted silver, and radiator slats usually matched interior colors.)

The test in the *Motor* was much more factual and was based on stopwatch figures and factory specifications. Even these writers were impressed and let the public know about it: ". . . a high performance small car, one that will doubtless give great pleasure to a large number of sporting motorists."

They further praised the high mechanical efficiency of the XPAG engine: "The comparatively high specific output has not been obtained at the expense of low end torque. On the contrary, the power curve reveals a b.m.e.p. in excess of 100 lb. at 1000 r.p.m. and over 120 lb. between 1,700 r.p.m. and 4,200 r.p.m. These figures have been secured not only by careful porting and camshaft design, but also by maintaining a better than usual mechanical efficiency over a wide speed range. The figure on this count reaches 90 percent at 800 r.p.m., and is held to 80 percent at 4,000 r.p.m., which is the equivalent of 2,350 ft. per minute piston speed." Further, "It is, therefore, reasonable to suppose that this car is fully capable of a sustained cruising speed of 65-70 m.p.h., where road conditions permit, without overstressing the engine."



Coupling this 1250 c.c., 54.4 b.h.p. engine to the rearend was a marvelous gearbox. Special builders until recently actively sought the TC transmission to handle racing chores in cars of up to 100 b.h.p. The final ratios were: first, 17.32; second, 10.00; third, 6.93; and in top, 5.125. The gearbox is a delight to use with good gearing and it is nicely located; synchromesh is available on the top three gears. The normal rear axle ratio is 5.125 to 1, giving a speed of 15.84 m.p.h. per 1,000 r.p.m. in top gear.

Other technical details follow:

| | |
|---|---|
| Cubic capacity | 1,250 c.c. (70.3 cu. inches) |
| Cylinders | 4 |
| Valve position | o.h.v. push rod |
| Bore | 66.5 m.m. (2.61 inches) |
| Stroke | 90.0 m.m. (3.54 inches) |
| R.A.C. rated h.p. | 10.9 |
| Max. b.h.p. at r.p.m. | 54.4 at 5200 |
| Max torque (lb. in.) at r.p.m. | 765 at 2600 |
| Compression ratio | 7.25-7.5: 1 |
| Compression pressure (cranking speed) | 90 lb. sq. in. |
| Carburetor | Twin S.U. semi-downdraught |
| Ignition | 12 volt coil, automatic advance distributor |
| Fuel pump | S.U. electric |
| Clutch | Borg and Beck, single-plate, dry |
| Propellor shaft | Hardy Spicer |
| Final drive | Spiral bevel |
| Brakes | Lockheed |
| Drums | 9" X 1 1/2 |
| Lining area | 104 square inches |
| Car weight per sq. in. | 16.53 |
| Suspension | semi-elliptic springs Luvax-Girling shocks |
| Steering gear | Bishop cam, 1 1/2 turns lock to lock |
| Wheelbase | 7'10" |
| Track | 3'9" |
| Overall length | 11'7 1/2" |
| Overall width | 4'8" |
| Overall height | 4'5" |
| Ground clearance | 6" |
| Turning circle | 37' |
| Weight (dry) | 1550 pounds |
| Tire size | 4.50 X 19 |
| Wheels | Dunlop centre lock wire, Rudge Whitworth type with knockoff hubcaps |
| Fuel capacity | 13 gallons |
| Oil capacity | 10 1/2 pints |
| Water capacity | 14 pints |

Aesthetically speaking, the TC was and still is a delight to behold. Most striking are the big, bold radiator and the long bonnet leading to it. Next, the delicate clamshell fenders framing the spidery, nineteen inch wire wheels complete the picture of a classic sports car. The more commodious coachwork is in direct proportion to the chassis dimensions. Even with the windscreen erected and all of the weather equipment in place, the automobile looks correct. John Thornely called the K3 the epitome of the M.G.; he is right when considering the racing M.G.s, but for the sports cars, the TC comes as near to the epitome as any. A TC was chosen as one of eight automobiles for the New York Museum of Modern Art's exhibit of classic design in 1951. There is no question that the TC is an almost perfect combination of classic look and modern performance.

Today, as ever, there is much discussion regarding the classic look especially among automobile enthusiasts. Whenever the discussion centers on sports cars, the TC is always included. The July 1975 issue of *Road & Track* had a feature article about a special show devoted to the automobile as an art form. It was sponsored by The Newport Harbor Art Museum Council and The Junior League of Newport Harbor and was held at the Newport Beach Marriott in California. This April, 1975 show focused on cars which were outstanding combinations of the aesthetic art of the body designer and the technical innovations of the mechanical engineer. The end result was an emphasis on the automobile as a visual art form as it developed since its inception.

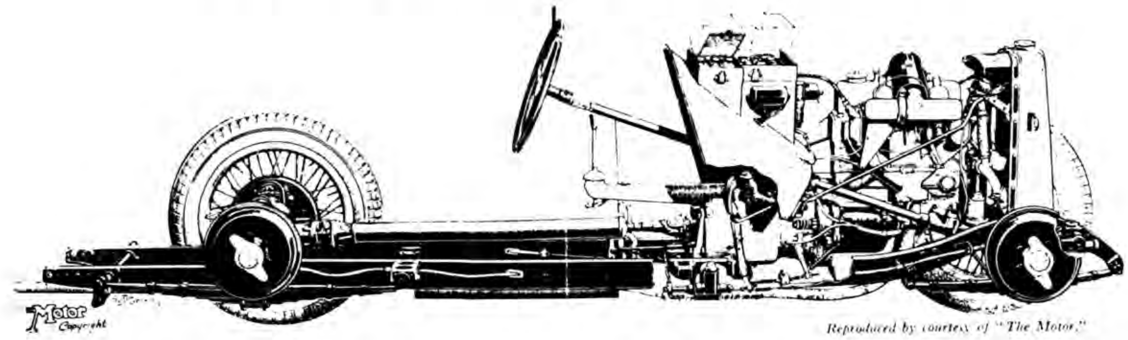
The oldest car in the show was a 1903 Autocar; the newest was a 1975 Scirocco coupe. In between were fifty eight cars which represented a wide variety of marques and which would be readily accepted at any concourse in the world. One of the first post-war cars at the show was a 1948 TC. The judges offered the following reasons for including it in the show:

- Things come together with honesty, clarity, delicacy. The overall balance from any view is so digestible and believable. The major impact: fun, excitement, affordability.
- A classical statement of "dignity" in its smallest automotive form.
- Abingdon's pride won world popularity with its meticulously formed fenders, geometric hood, and neat body.

These words from Harry Bradley, Tom Kellogg, and Strother Mac Minn appeared in the show's lovely catalog and certainly summarize the feelings knowledgeable enthusiasts have for this delightful sports car from the banks of the Thames.

That the TC was America's first introduction to sports cars is an indisputable fact. True, sports cars and road racing

# THE M.G. MIDGET SERIES "T.C."

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Safety MG Fast!

existed in this country prior to World War II; but that was really for a very few exceptional men who were members of the Automobile Racing Club of America. The average American enthusiast was not, however, economically able to think about owning a sports car until after the war. England was flooded with American soldiers at that time, and they were introduced to sports cars which gave amazing performance on twisty country roads even using the low quality gasoline available then. Many of these cars were M.G.s. Given the basic American love of the automobile, it should come as no surprise that many of these G.I.s brought M.G.s home when they returned from the war.

When these cars hit American streets, interest increased. It must be pointed out, however, that a large dealer network was not immediately available. Importation of TCs was not an overnight event, nor did TCs come to this country in huge amounts. There were sufficient numbers of TCs to start the sports car revolution which really developed in the 1950's with the advent of the TD, but American sales of the TC did not account for the majority of the production run.

Even though only 2,001 TCs came into this country, the effect of them was outstanding. Importation was originally handled by Motor Sport, Inc. of New York. This firm was owned by Sam and Miles Collier who were prominent in pre-war A.R.C.A. activities. They were geared to making a few deliveries as in the pre-war days, but the press of post-war demands for M.G.s as well as their own business caused them to give to the larger national sales network which developed.

Prominent on the East Coast was J. S. Inskip, Inc. which took over from Motor Sport just prior to the 1948 auto show in New York. On the West Coast Kjell Qvale started his British Motor Car Distributors in San Francisco in 1947. Qvale had seen the M.G. while in the service and realized the sales potential it had for his part of the country. In 1948 he sold 75 cars and from that has grown a dealer organization of over 100 outlets.

The Hambro Trading Company of America, Inc. became the sold concessionaires in America for the Nuffield organization during the late 1940's. Early in 1950 the following distributors were listed:

British Motor Car Company — San Francisco
International Motors, Inc. — Los Angeles
J. S. Inskip, Inc. — New York
S. H. Lynch — Dallas
Waco Motors — Miami

Since the TC did not arrive in any great numbers until late 1948, it is not surprising that mention of it in the American magazines was slow in coming. The late Tom McCahill was the first to test it. McCahill was the first to test cars (especially foreign cars) in American magazines and most of his work appeared in *Mechanix Illustrated.* His TC test was in the January, 1949 issue and he loved it. In the test he described an impromptu dice between his Mercury and a TC. McCahill recounted that he could beat the TC on a straightaway or long, steep grade, but ". . . the rest of the time, he made me feel like an idiot. He was so agile . . . on winding portions of the road he drove me crazy. He could take a flat, hard curve at 75 and not lean as much as two degrees while I was pulling every trick in the books to keep from rolling over."

Owning a sports car in those early days presented certain problems to the American enthusiasts. While some dealers were excellent others were marginal at best—hmm, maybe things have not changed all that much. The sports car required careful tuning and regular maintenance; if the owner could not do it himself, then he was often in trouble. The M.G., however, was known for running *forever* once in tune. Cecil Cousins once made a good analogy when he was asked about the fussiness of his cars by an American enthusiasts. Cousins said, "Why not compare a knife to an ax? If you want to cut something, you can take a heavy, blunt ax and if you hit the thing enough, you'll wear through. With a good knife, however, you want to hone it until it's at the point where it will do exactly what you want of it. That's the way it is with an M.G."

As the TC and other sports cars became available, the owners became interested in clubs and competitive events for their cars. In those days there was a great camaraderie among owners, and if one made a stop at the side of the road for *any* reason, he could rest assured that the first passing sports car would stop to offer assistance. Waving and flashing headlights were, of course, standard greetings.

Clubs were local as well as national. On the national level, the Sports Car Club of America started in 1944. One early SCCA member who was instrumental in getting road racing started again in America was Cameron Argetsinger of Watkins Glen, New York.

**Our first look was at Silverstone 1975 after flying, training, busing, taxing, and finally hitching to the track for that fabulous weekend. We were stationed in Germany at that time. Jane and I had not been married long but the magic of that weekend quickly won her over. We chanced to share a table in the Silverstone Clubhouse with George and Barbara Edney and their children. By the time lunch was over they were so amazed by our pilgrimage that they decided we were "sufficiently eccentric" about T-Types that they agreed to help us find one. That first one had to be a TC. Why? Who can explain love at first sight? I guess it could, if necessary, be boiled down to the very boxy lines, the wings which flap, the ride which is far from plush, and the tall, spoke wheels which seem to be canted too far out. Or is it that "look" that is early British sports cars? We eventually were sent back to Texas, but the spirit of M.G. prevailed and George and Barbara found us one at a reasonable price and very restorable. Several months later one very dirty and very forlorn looking, fire-plug yellow, brush painted, leather seated, currently registered (with MOT) and surprisingly strong running M.G. TC was off loaded in Houston, waltzed through customs and trailered home with a smile "as big as Dallas." Driving a TC is the best therapy I know for a hard day. Nothing can beat dropping the screen and motoring about with a gleam in your eye, the wind in your face, and that throb under the bonnet that is only M.G.**

**Sherwood Parker, #6544**

Argetsinger had long been interested in automobiles and purchased his first sports car, a TC, from Inskip in 1947. Not long after owning it he realized that he would really like to race it on the open road, and he also realized that the roads of his native village located in the Finger Lake Region of upstate New York would be ideal for such a race. With some local preliminary approval, he went to a national SCCA meeting in May of 1947 with his idea. With the national group's support he went ahead and organized that first race which was held on 2 October 1948. Joint sponsors of the race were the Village of Watkins Glen and the Sports Car Club of America.

That first road race required a great deal of planning and organization. Argetsinger was the General Chairman and he and his committee must be congratulated. If this first race had been ill-conceived and badly-run, then road racing in America might have died at that time. To give an idea of the sort of problems facing the committee, consider their negotiations with the New York Central Railroad. At one point on the 6.6 mile course the route crossed some railroad tracks. Company officials did not want to cancel any trains and for a long time were insisting that each car come to a full stop at the tracks on each lap. Happily, the problem was resolved else the spectators would have been denied the thrill of seeing the competitors airborne as they crossed the tracks at speed.

Partly paved and partly gravel, the demanding course combined narrow country roads, steep up and down grades, and the streets of Watkins Glen. Over 5000 people came to this first race and were treated to two good races. The Junior Prix was a qualifying event to determine starting positions for the Grand Prix. Frank Griswold won in his Alfa. Of the eleven M.G.s entered, six of them finished in the first ten:

| | | |
|---|---|---|
| 3. Haig Ksayian | 59.0 m.p.h. | TC s/c |
| 5. Sam Collier | 56.8 m.p.h. | TC s/c |


*Elliot Tours of Washington, D. C., gets a bit sideways in the 1950 Glen event. From the disarray of the haybales, it appears that others had similar problems at this spot.*

| | | |
|---|---|---|
| 6. Miles Collier | 56.8 m.p.h. | TC s/c |
| 7. Phil Stiles | 56.5 m.p.h. | TC |
| 9. Dean Bedford | 53.7 m.p.h. | TC |
| 10. Bill Gallagher | 53.7 m.p.h. | TC |

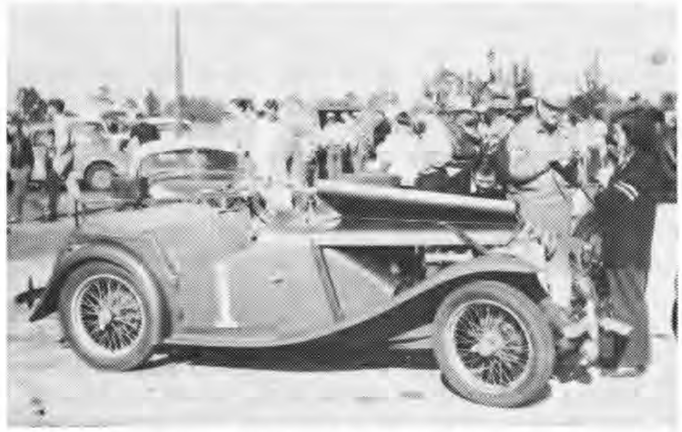
Ksayian, in Briggs Cunningham's blown TC, was the first M.G. across the finish line in the first Watkins Glen Grand Prix. He took a very creditable third, and M.G.s occupied the next seven places in this order: S. Collier, M. Collier, Stiles, Cornett, Gallagher, Argetsinger, and Bedford. Miles Collier described the performance of the Ksayian car in his account of the Collier brothers race strategy which appeared in the October, 1948 issue of *Sports Car*. It follows:

> As our cars were running to a 4,000 r.p.m. rev-limit (or about 75 m.p.h. even on the down-hill concrete) we had to presume that Ksayian was running to a limit somewhat clockwise of 6,000 r.p.m. We therefore maintained our limit and continued to slow for corners early, so we could not be using our brakes to any extent.
>
> After the qualifying race, in which Milliken's brave Bugatti was so unfortunately eliminated, a conference was held on the question of competing with Ksayian. S. Collier was selected to exceed his rev-limit on the hill just after the start and attempt to ascertain how many revs it took to stay with the green car. This was accordingly done but to our dismay, the green car still pulled away from Number 24 (Sam Collier) on the hill. Number 25 (Miles Collier) had gotten himself fouled up on the start, and it was a lap before the second car of our team again regained station, but receiving the signal that has been prearranged, understook that pursuit was to be abandoned for this race also, on the presumption that Ksayian had more power as well as the freer use of revs and brakes.

**A professional car restorer asked me the other day why I liked the TC so much when it was so small and "hard to get into." In answering him, the history of my romance with the TC flashed through my mind. It all started with my noticing those classy looking cars in the late 50's at the local sports car dealer in Manchester, NH. The longing to own one came to a head in 1960 when I found a blue TC in upstate New York that had just come over from Sweden. Unfortunately the price tag of $1800 was just too much at the time so I waited until 1961 when we bought a TD with a parts car for substantially less. That solved the immediate hunger, but the longing still existed for the TC. Eight years later in Florida my dream came true. With my motorcycle sold and some help from my wife's teacher retirement fund, I became the proud owner of a maroon TC that had just come over from The Netherlands. How well I remember that first trip of forty miles bringing it home. Looking out over that long bonnet with those chrome headlamps was ecstasy even if the bobbing and slight weaving was a little unnerving—but that engine sure sounded sweet. Now, some ten years later, another TC acquisition, two complete TC restorations, and many thousands of miles, the romance has not diminished. Even the wife enjoys driving the TC more than the TD. I guess my feelings for the TC got to the car restorer because his parting question was, "Care to sell one?"**
**Bron Prouski, #1965**

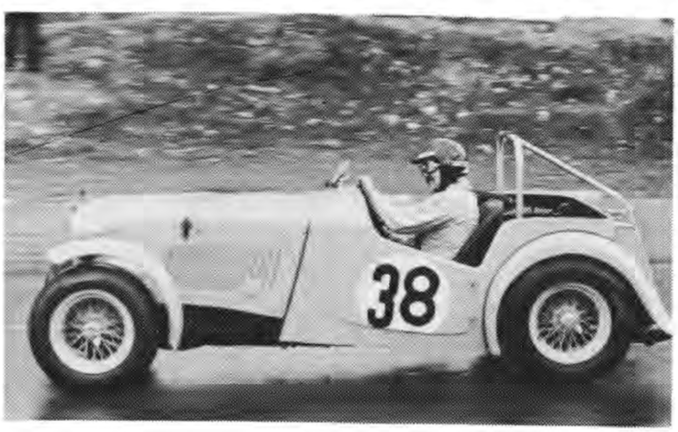
The Collier brothers found out in this very first post-war road race that it was not necessary to play a waiting game with the TC. After the race they closely examined their cars and vowed never again to think that a TC might not finish. This fact, of course, was borne out in the many races that took place around the country in the next few years as the sports car revolution really started rolling in America.

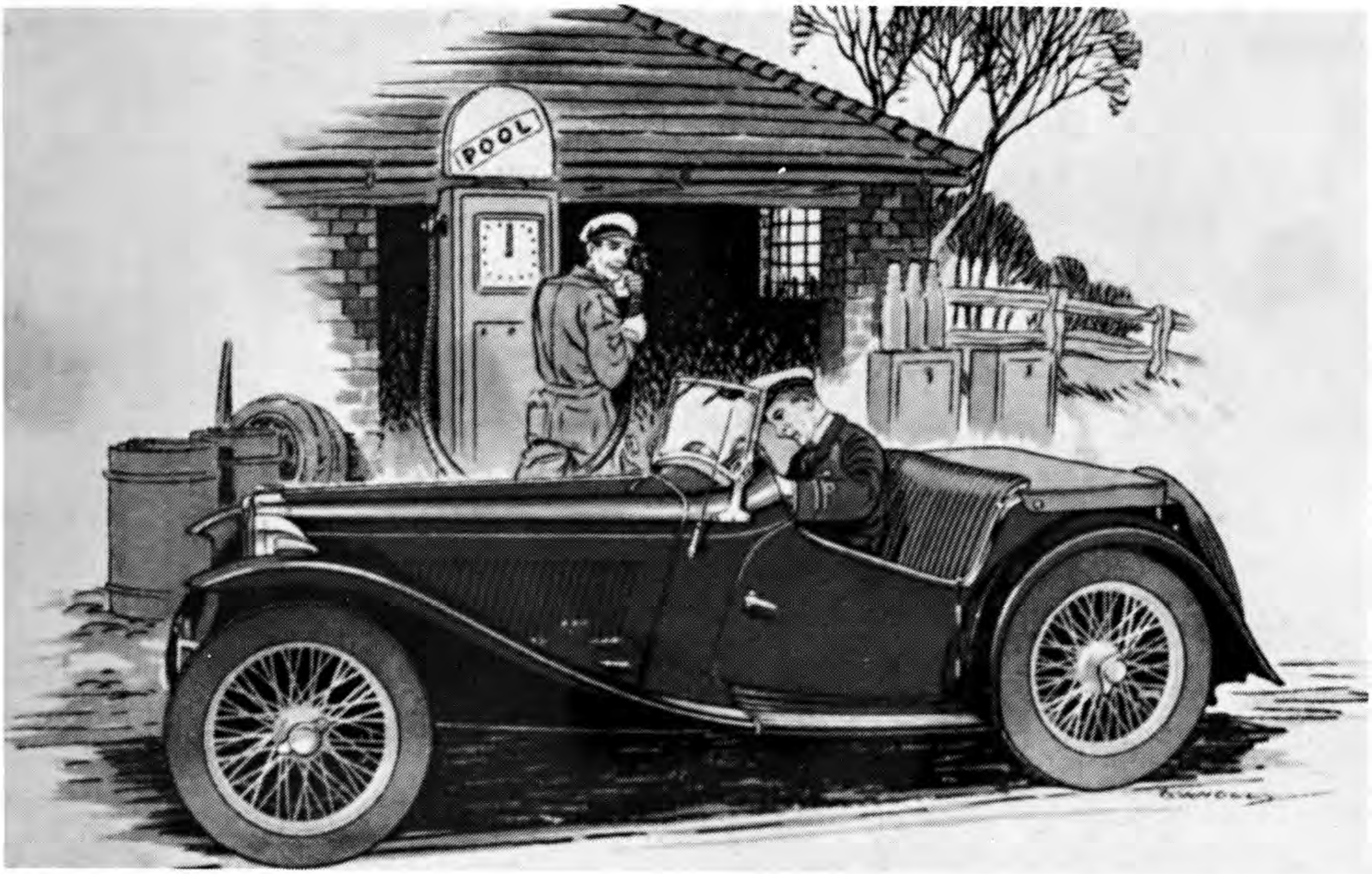
The second major post-war road race was held at Bridge-Hampton, Long Island, New York, on 11 June 1949. There were a great many TCs in the race including the following: Charley Kouns, Richard Lange, Gus Ehrman, John Fitch, Neal Allen, and Bruce Stevenson. In supercharged TCs were Briggs Cunningham, Sam Collier, and Phil Stiles. Sam brought his TC home third in the final race which had some exciting machinery entered. Against Ferrari, Alfa, Bugatti, and B.M.W., Sam expertly showed the TC's gas tank to cars of greater power.



*The highest placed M.G. in the first Sebring endurance race was this TC driven by John Van Driel. He had the honor of wearing #1 because he had won the SCCA Indianapolis Rally earlier in the year.*

In the first Sebring endurance race (called the Sam Collier Grand Prix of Endurance as a tribute to Sam who was killed in the 1950 Watkins Glen Grand Prix driving a Cunningham-owned Ferrari 166) held on 31 December 1950, John Van Driel's TC wore Number 1 in honor of his win in the SCCA's Indianapolis Rally earlier in the year. There were several other TCs entered in this six-hour race and most did quite well. Van Driel was fifth overall (a class win) followed immediately by the O'Hara/Milliken TC. The Keith/Wilder car with its sleeved down, supercharged engine was second in Class G. This fine performance in this first American endurance race did a great deal to enhance the marque in the eyes of stateside enthusiasts.





*The famous M.G. artist, Harold Connally, shows Prince Phillip getting some of the post-war pool petrol for his new TC.*

Sports cars quickly became a way of life for West Coast enthusiasts and races were organized early in that part of the country also. Lacking suitable road courses, enthusiasts raced where they could. One of these was an exciting California oval called the Carrell Speedway. These races were sponsored by the Foreign Car Racing Association. An early competitor (and contest board member) in FCRA events was Phill Hill who later went on the become America's only Formula One World Champion.

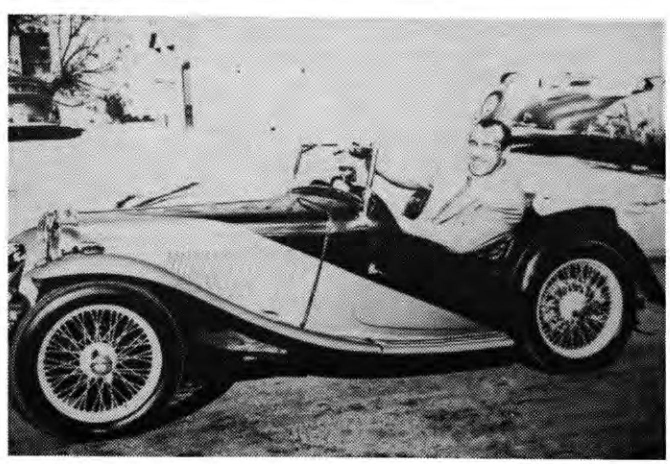
Taking their cue from British enthusiasts, great use was made around the country of airports as racing sites. Prior to the establishment of artificial road courses, racing enthusiasts participated where they could.

Pebble Beach was a beautiful road course in California, and the races there did a great deal to establish the sport on the West Coast. The first race there was held on 5 November 1950, and TCs were prominent in the final results. Good performances were turned in by Bill Kerrigan, Neal Allen, and Dick Scott.

In the mid-West, the races at Elkhart Lake, Wisconsin, stand out as being particularly important. The first event there was held on 23 July 1950 on 3.3 miles of country roads. Second place in the 1,500 c.c. race went to Bayard Sheldon in Brooks Stevens' TC followed by Sandy Mac Arthur in another TC.

This brief overview of American racing is certainly not meant to be a complete history. It is included to give credit to those great enthusiasts who did so much to establish road racing and the sport of sports cars in this country. While a great many marques were a part of this early movement, none was so prominent as the M.G., and no specific model so important as the TC.

In retrospect it is always interesting to consider the famous people who owned (and therefore sanctioned) a particular car. It has always been a popular notion that famous people have good taste. It has been said that the first TC went to the Sheriff of Nottingham; one assumes that it did not see much service on the trails of Sherwood Forest. We know that Prince Phillip owned one and that, therefore Queen Elizabeth II has enjoyed some TC miles. Ernest Hemingway and John O'Hara were two American men of letters who enjoyed the TC. Several Hollywood types owned them, but we cannot be too sure about their reasoning.



*The boxer, Canera, literally dwarfs his duotone TC in this shot.*

*TCs to Switzerland in 1948.*




*Fresh TCs in 1947.*

# THE MG MIDGET

## Brief Specifications

**ENGINE.** 4-cyl. O.H.V. 66.5 mm. x 90 mm. 1,250 c.c. 3 main bearings. Pushrod operated valves. Controlled expansion pistons. Pressure oil feed and filtration. Aluminum ribbed sump. Twin S.U.s. Air cleaner. Cooling by fan and pump. Thermostatically controlled.

**TRANSMISSION.** 4-speed synchromesh gearbox. Overall ratios 5.125, 6.92, 10, 17.32 to 1. Hardy Spicer needle roller propeller shaft.

**CHASSIS.** Underslung. Tubular cross bracing. Half elliptic leaf springs rubber mounted. Hydraulic dampers. Wheelbase 7′10″ (238 cm.), track 3′9″ (114 cm.). Lockheed brakes, cable operated hand brake. Splined hub wire wheels. 19″ x 4.50″ tires. Cam steering. 16½ gallon fuel tank with snap filler. Burgess perforated tube silencer.

**ELECTRICAL.** 12-volt ignition and lighting. Compensated voltage control. 2 C.P. headlamps, 2 side lamps. Fog and stop lights. Rim lit instruments. Map reading light. Twin blade electric windshield wiper. Fused circuits.

**CONTROLS.** Lamp, horn and starter switches and mixture control on the dash. 5″ speedometer, 5″ revolution counter, clock, oil gauge and ammeter. Petrol warning light.

**COACHWORK.** Large open 2-seater body. Fold-flat safety glass windshield. Leather upholstered adjustable seating. Large luggage space. Side screen compartment. Felt lined tool locker under the bonnet. Color finishes: Exterior—black, blue, cream, green or red. Leather—beige, green or red.

## *features*

1. High power-weight ratio. 54.4 b.h.p. 1788 lbs. weight.
2. 4-cyl. O.H.V. high compression engine. Peak revolutions 5,250 r.p.m. Counter-balanced crankshaft.
3. Carburetion by twin semi-downdraft S.U.s. S. U. electric fuel feed. 16½ gallon tank capacity.
4. Four-speed remote control synchromesh gearbox, close ratio top and third.
5. Spiral bevel rear axle. Final ratio 5.125 to 1. 15.84 m.p.h. (25 k.p.h.) per 1,000 r.p.m.
6. Underslung M.G. racing type chassis. Semi-elliptic leaf spring suspension with hydraulic pressure recuperation control.
7. Large open 2-seater body in choice of colors. Leather upholstery. Good all-weather equipment and luggage space.

INTERNATIONAL MOTORS, Inc.

*"The Foreign Car Specialists"*

8536 SUNSET BLVD.

LOS ANGELES 46, CALIF.

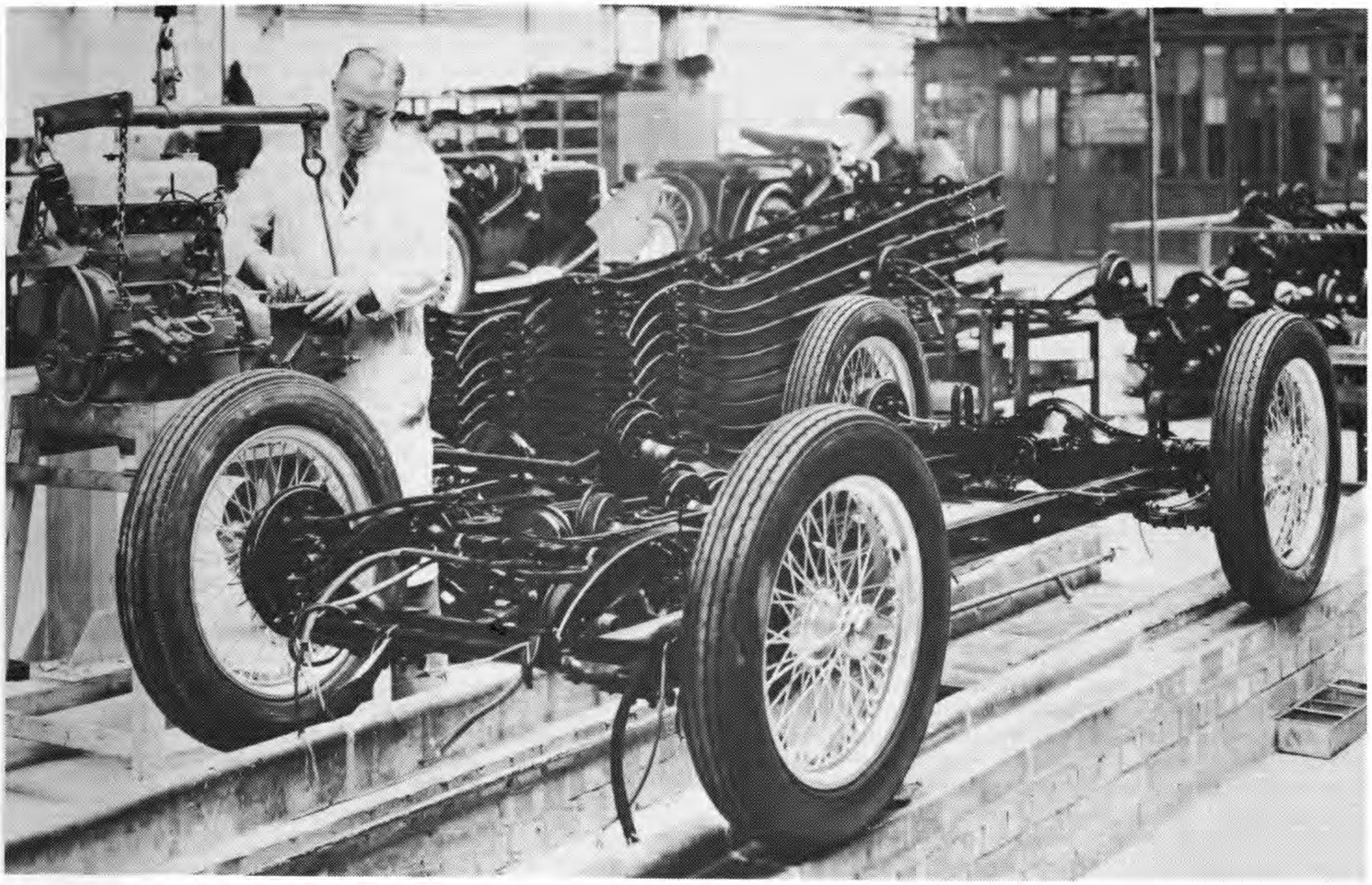
**When the Taggarts of Topeka, Kansas, added a pert and saucy '46 TC to their family, it led to even more than the culmination of a 25-year dream, a new driving pleasure, and another subject for their restoration urges. It led to a new friend in England. Jim and Cathie purchased the TC in a nearby Kansas town in the summer of 1978, they learned the car had only been in the United States since the early 1970's. Her many preceding years were spend in the country of her birth. However, the only other historical information obtained with the car was a sheaf of old Ministry of Transport test certificates from assorted petrol stations and garages on England's western coast. Writing to each of these testing sites eventually produced someone who remembered the TC and forwarded the Taggarts' inquiry to one of the previous owners. The surprised response letter from the previous owner set up what is now an on-going overseas correspondence. That previous owner turned out to be only one of a succession of owners of the TC, but it was she who had restored, maintained, and "loved" the TC while it provided her with 68,000 miles of transportation about England's western coast. She had named the TC "Jennie" and the Taggarts were delighted to resume the use of that name. She sent her almost day-by-day dairy of Jennie's life and the "before" and "after" photos of her restoration. Each new letter to the Taggarts continues to bring another anecdote or remembrance to further enhance the new owners' enjoyment of Jennie.**

**Jim Taggart, #247**


It is impossible to determine how many world caliber drivers had their first experiences in a TC, but there were many. Phil Hill has already been mentioned. On thise side of the Atlantic, Carroll Shelby, Ritchie Ginther, and John Fitch can be included. Ken Miles, a transplanted Englishman, gained much experience in a TC and his famous specials were largely based on the TC. In England, George Phillips, Dick Jacobs and Ted Lund were driving works prepared TCs in a variety of races (McComb, p. 114). Phillips went on to drive a special bodied TC in the 1949 and 1950 Le Mans races; in 1950 he finished second in the 1 1/2 litre class. The aim of all of this name-dropping is to establish that from the outset the TC was appreciated by those who knew motorcars.

To the people who bought the TC for competition, looks must have been of secondary concern if they mattered at all. Performance and handling were the qualities the enthusiast sought. John Christy and Karl Ludvigsen prepared the very useful *MG Guide* (Sports Car Press, New York, 1958) and published the following performance figures which more or less match those published in the various journals over the years:

| | |
|---|---|
| 0-30 m.p.h. | 5.7 seconds |
| 0-40 m.p.h. | 8.8 seconds |
| 0-50 m.p.h. | 14.0 seconds |
| 0-60 m.p.h. | 21.0 seconds |
| 0-70 m.p.h. | 33.3 seconds |
| Quarter Mile | 21.8 seconds |
| Maximum Speed | 73 m.p.h. |
| Miles Per Gallon | 25 |

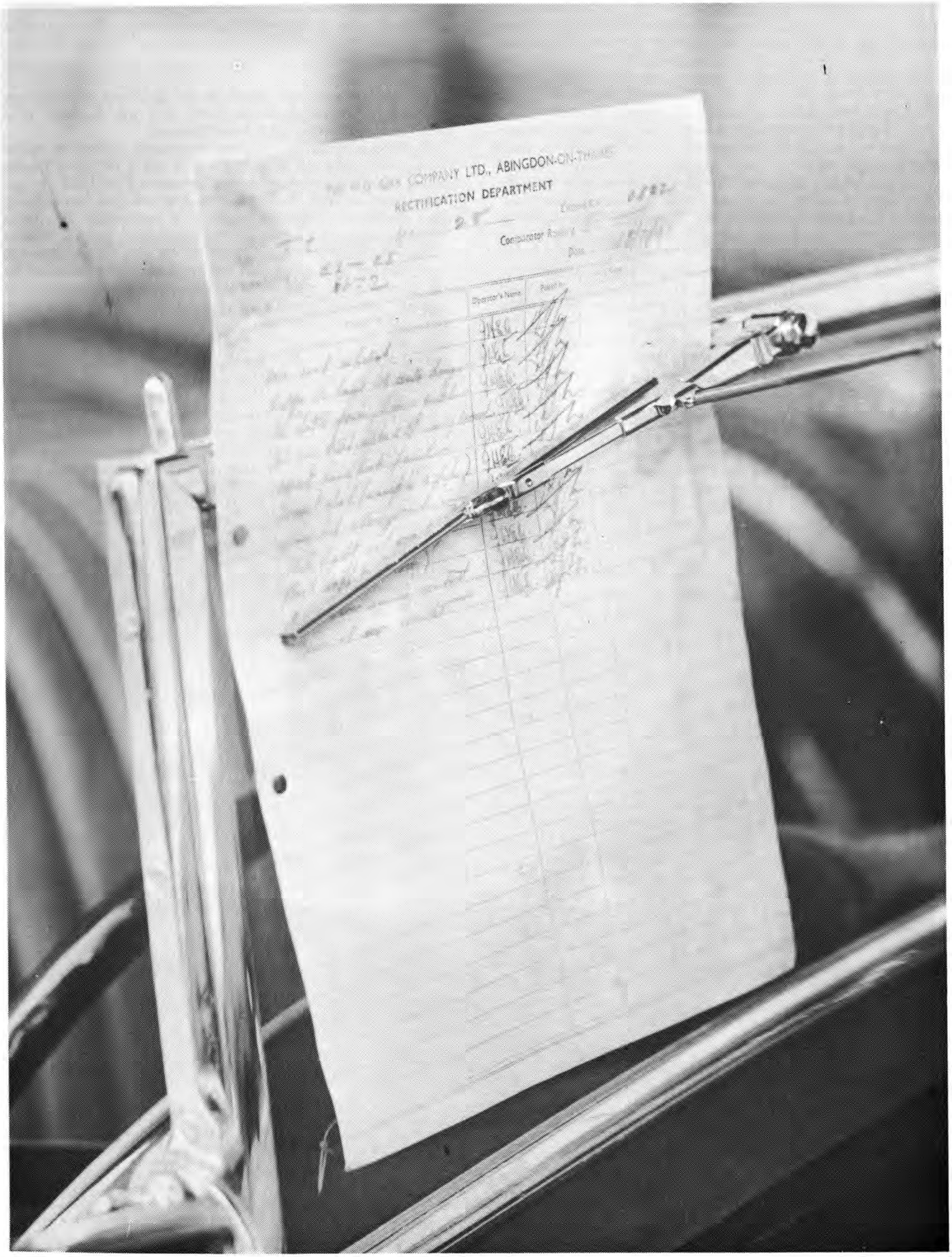



DANGER

While those figures might not show startling power, the competition soon came to know that the TC was as capable of that sort of performance on sharp turns as well as on lon straights. The road test cliche' "cornering as if on rails" could easily have been coined on the TC. Christy and Ludvigsen referred to it as a "coffin riding on four harps" which caricatures the car's square shape and semi-elliptic springs and delicate nineteen inch wire wheels on all four corners.

**It was an absolutely gorgeous day—not a cloud in the sky—no wind or humidity, and the bank sign at Cinderella City was reading 76°—10:10 a.m. when four T-Series cars pulled out heading for high country. Bev and Maxine Francks (TD) took the lead, Bob and Lorraine Greubel (TC), followed by Rocky Krone and friend from Greeley (TD) and Harold Shriner (TD) brough up the rear—so to speak. Bev moved out smartly and soon we found ourselves running through Evergreen. Higher and higher we drove up the old Squaw Pass Road. I felt a certain amount of apprehension as we climbed when I recalled how Alfie developed the high-altitude balk during our GOF run to Vail. This time Alfie never missed a beat—shows what the installation of hi-altitude needles will do. At Echo Lake we paused to refresh and then stormed to the top. If you haven't been atop Mt. Evans lately, you don't know what a rough road really is—especially in a TC. It's like riding a kid's coaster wagon over railroad ties. Talk about being airborn! After some picture taking, conversation and food, Maxine Francks convinced Bev that we ought to head down fast—seems she had a slight case of altitude sickness, or something. Coming off the top of the mountain (14,200 + ft.) at the first switchback, I realized we were in trouble! The brake pedal went straight to the floor. I knew TC brakes were not a "stop on a dime" strong point, but this was ridiculous. After some frantic down shifting, we made it through the switchback. Being forwarned, we negotiated the next series of hairpins fairly well. Not liking the strain, I was putting on the transmission, I engaged Lorraine's services—that of brake person. I'd reign Alfie in by dropping down one gear and then Lorraine would hold a more precise check—just prior or into the switchback, she'd haul back on the handbrake. It seemed to work quite well until we came upon a frantic flat lander who persisted in slamming on his brakes at the approach of every bend, bump or uphill car. Once he almost got his tokus full of TC radiator—it was a Pinto, at that! We finally managed to pass him on a long, sweeping bend. After a time, we got quite adept at our braking procedure. I'd talk to Lorraine the way I used to talk to my old friend "Eda" when I was a kid—she was may favorite horse. I'd just say, "Whoa" to her—loudly or softly, depending on the amount of stopping power I needed. I never did try kicking her in the ribs. At Idaho Springs, we all parted company, and the rest of the trip home was uneventful—except for having a left wind wing blow off on the down Floyd Hill. I guess lfie was movin' to fast.**

**Bob Greubel, #1156**


COMPANY LTD., ABINGDON-ON-THAMES
RECTIFICATION DEPARTMENT
Operator's Name

A close study of race results in the late 1940's and early 1950's proves that the TC not only held its own but also led the way for several years. As late as 1955, a TC actually *won* the SCCA's national championship in Class G in the capable hands of George Valentine of Bainbridge, New York.

While performance is what established the TC as a respected sports car during its production years, its classic beauty is the quality which makes it one of the most desired M.G.s today. The TC has everything that says "M.G." to the world as it embodies the best design elements from every Midget which preceeded it. The square radiator, long bonnet, cutaway doors, and big, spidery wire wheels all combine in a classic look that will always appeal to sports car enthusiasts everywhere.

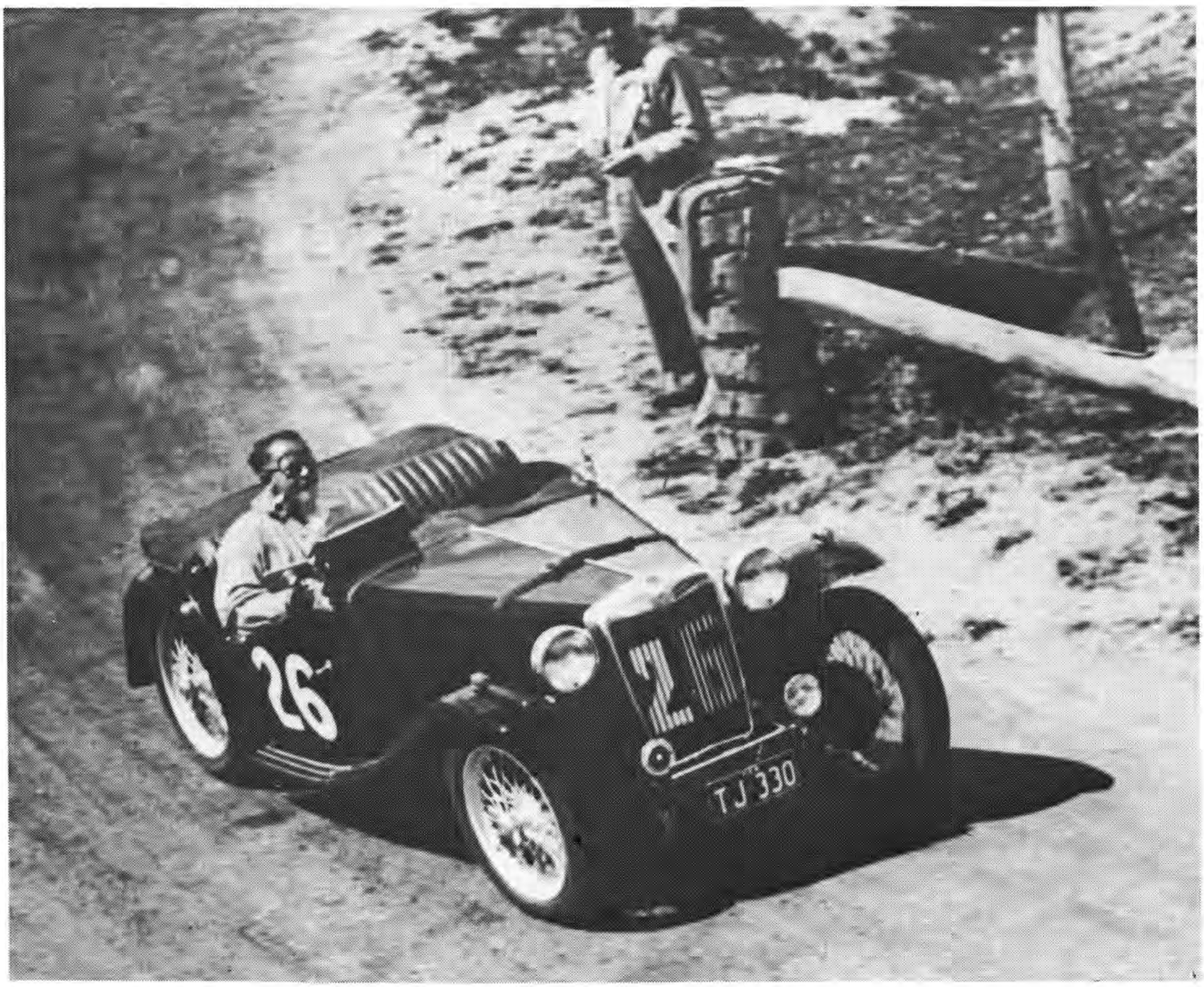
At this writing, a conservative estimate is that thirty percent of the 10,000 TCs produced survive. Of those left, they will (barring natural disasters) all survive. It appears that very few now change hands. Not so long ago major automotive magazines and Sunday newspapers always listed some TCs for sale; today, however, it is rare if one appears. Occasionally one will be on one of the numerous auction blocks that besiege the hobby today; happily, that, too, is a rare happening.

Perhaps the opposite of preserving what is intact is one of the brighter sides of the TC situation today; that is, we no longer hear of parts cars being broken up. Instead the prevailing attitude is that anything can be restored. As a result enthusiasts are starting from a junk chassis and gradually building complete cars. And this can be done as there are sources for remanufactured parts, and the Register is a great source of technical help and service.

Owning a restored TC does not mean having to make a museum piece out of it. The car is not a bit more fragile today than it was when it was introduced in 1945. It can easily keep up with modern traffic, and one can rest assured that if anything does go wrong it is repairable. Driving a TC is as enjoyable today as it always was. People always admire it for what it is, a classic sports car. Those admiring looks, waves, and comments are certainly ample rewards for the hours spent in careful restoration. The real reward, of course, is the pleasure derived from driving it over a piece of challenging country road.

Is it a Milestone Car? Yes. Why? Well, as Louis Armstrong responded when someone asked him to define jazz, "If you got to ask, you ain't ever going to know."





# TECHNICALLY SPEAKING

## POINTS OF ORIGINALITY: THE M. G. TC

**By CHIP OLD**
*Technical Editor*

It should be obvious to anyone who has been around the Register for any length of time that interest in the M.G. T-Series is higher than ever, but that the direction that interest is taking is gradually changing. Restoration has always been a big interest, but more owners now seem interested in restoration to exact original condition. This trend is easy to see in the technical correspondence received by your Technical Editor. Five years ago a large portion of these letters were of the "How do I keep my car going for a few more years of commuting to and from work" variety. Now, however, most writers seem to be interested in points of originality.

Sometimes this interest borders on the fanatical. A year or so ago one fellow wrote to ask (a) what is the correct size and location of every bolt and nut on the TC, (b) which direction should each bolt head face, and (c) which ones were originally painted (and what color), plated or plain? Attention to detail is commendable, chaps, but let's not get carried away! Reliable information on such minute details is just not available. In the first place, these cars were largely hand-assembled at a pace much slower than one would find on any normal high-volume assembly line. Small variations were common even when the cars were brand new, especially where such ultra-minor details as the proper direction for inserting a bolt are concerned.

In the second place, after thirty years who is to say what is original and what is not? I have done quite a bit of research into this matter of TC originality, not because I am any sort of originality freak, but because I receive so many questions on the subject. One overwhelming problem I've come up against is the fact that there is so little authenticated documentation available. In the case of the TC we have the *Instruction Manual,* several editions of the *Service Parts List,* various *Service Information Sheets,* and a number of advertising brochures. Except for additional bits and pieces which come to the surface from time to time, that's all the factory left us, but is is the only truly trustworthy material available. Very useful, but not always so trustworthy, are the many articles and road tests which appeared when the cars were new. Also useful, but even less trustworthy, are the large number of articles which have appeared over the years since TC production ceased. I don't mean to belittle the efforts of those earlier writers, because most of them put a great deal of effort into their articles and, I'm sure, did not intentionally include faulty information. However, one need only read a few of these articles to notice a great deal of disagreement from one to the next. They obviously cannot all be right, but how do we separate fact from fiction? This problem usually stems from the difficulty many writers have in separating documentable facts from personal opinion, and from the tendency to draw heavily upon earlier articles for information which may or may not be accurate in the first place. A few writers, of course, have suffered under the delusion that they know all there is to know on the subject, but luckily they have been few and far between.

If I seem to be belaboring the point, it is only because so many people automatically accept the written word as gospel, and I don't want you to make that mistake as you read this article. Every possible effort has been made to authenticate the information in this article (and all others I have written for TSO), but I make no guarantees. Neither I, nor the Register, nor anyone else I know can claim to be the last word on this subject. This is not the way I **know** the TC should be; it is only how I **think** it should be.

The avid restorer will find two things conspicuously wrong with this article. First, a great deal of ground is left uncovered. This is because to go into more detail would require far more space than is available. Perhaps someone will write a book on the subject some day. Any volunteers? However, I have attempted to cover the topics most often asked about, and have included bits of information which I have not seen elsewhere. Second, there are no photographs to illustrate the points covered in the text. This is because no suitable ones could be found. If you have photos which you think might be useful, please let me borrow them for publication in TSO at a later date.

### PRODUCTION STATISTICS

TC 0251 is generally acknowledged to be the first TC, but it is not certain whether this was the prototype or an actual production line product. The daily production records show no production date for this car, but bear the notation "Ex Car Ref MG/21," whatever that means. If TC 0251 was in fact the prototype, then the first actual production TC was TC 0252, which rolled off the line on 17 September 1945 and, according to many accounts, was sold to the Sheriff of Nottingham. TC 0252 is now being restored in this country. Does anyone know the whereabouts of TC 0251?

Throughout most of its history, the M.G. Car Company did not produce cars according to model years, so to label a car as a 1946 or a 1949 or whatever is meaningless except to your local Department of Motor Vehicles. In fact, in this country the model year was often assigned by the dealer only on the basis of when the car was first sold. For this reason we sometimes see a car registered as a "1950 M.G. TC," even though production ended in 1949.

Lists of production dates have appeared in many publications over the years, but these are noteworthy only because they seldom agree with one another. The dates which follow are taken directly from the daily production records, and unless someone at the factory got careless we can assume that these figures are accurate. Incidentally, these figures disagree slightly with those supplied to the Register by former Works Manager Cecil Cousins shortly before his death. I wonder why?

| YEAR | FIRST CAR & DATE | LAST CAR & DATE |
|---|---|---|
| 1945 | TC 0252 (17 Sept.) | TC 0351 (21 Dec.) |
| 1946 | TC 0352 (1 Jan.) | TC 2051 (31 Dec.) |
| 1947 | TC 2052 (1 Jan.) | TC 4411 (31 Dec.) |
| 1948 | TC 4412 (5 Jan.) | TC 7502 (24 Dec.) |
| 1949 | TC 7503 (5 Jan.) | TC 10251 (29 Nov.) |

### PRODUCTION CHANGES

Like almost all auto manufacturers, M.G. made design improvements more or less continuously as production proceded. Most owners of T-Series when inquiring about points of originality, make the mistake of giving only the model year, which is an artificial designation and almost meaningless in terms of these production changes. Each change was listed by the factory according to the chassis number of the car on which it was introduced, so the person who says only that he has a 1948 TC and wants to know which type of foglamp is correct cannot expect an accurate answer.

Fortunately for TC owners, there were very few production changes made on the TC, and with one notable exception (the TC/EXU) these were all very minor. Most observers would be hard pressed to detect any difference between the first TC and the last. The opposite is true of the TD, which was changed around with machine gun rapidity during its production run, but that's material for a future article.

Although the chassis numbers quoted below are the official factory-issued numbers for each change, in actual practice many of these numbers are only approximate. It is known, for example, that both types of foglamps (FT 27 and SFT 462) were used for a short period of time, probably because additional supplies of the older type were found and used up after the changeover was officially made. The same applies to most of the other items discussed below. The dates given are those listed in the daily production records as the production date for each of these cars.

**TC 1850** (26 Nov. 1946): The headlamp lens design was changed from flat glass with a horseshoe pattern to the more familiar curved glass with a cat's eye pattern.

**TC 2196** (20 Jan. 1947): The speedometer cable was re-routed to reduce the likelihood of breakage and of gearbox oil seeping up the cable and into the speedometer. An improved cable housing was adopted to reduce the infiltration of dirt. This was recommended as a service change for earlier cars in Service Information Sheet #67.

**TC 3414** (26 Aug. 1947): The voltage regulator was changed from a Lucas RF 91 with the fuses inside the regulator cover, to an RF 95/2 with exposed fuses. The RF 95/2 regulator was fitted to earlier cars when the original went bad, so the old type is seldom seen these days.

**TC 3856** (21 Oct. 1947): Hydraulic piston dampers were added to the carburetors to improve acceleration from low speeds.

**TC 4251** (8 Dec. 1947): 2½° tapered packings were installed between the front axle and the springs, reducing caster from the original 8° down to 5½°. This decreased steering effort slightly and supposedly improved directional stability. This was recommended as a service modification for earlier cars in Service Information Sheet #73.

**TC 4739** (9 Feb. 1948): The foglamp was changed from a Lucas FT 27 to a slightly more modern SFT 462.

**TC 5039** (16 March 1948): The steering box drop arm was redesigned slightly.

**TC 7380 EXU** (14 Dec. 1948): This was the first of 494 TC/EXU cars equipped specifically for the U.S. market.

**TC 10136 EXU** (9 Nov. 1949): Last TC/EXU produced.

**TC 10251** (29 Nov. 1949): Last TC produced.

In addition to these documented changes, there are several other known changes for which chassis numbers are not recorded. Early cars had front fenders identical to those used on the TB and late TA, with a deep cut-back on the leading edge between the fender tip and the chassis. On later TC fenders the depth of this cut-back was reduced. On early examples there is a sharp offset in the side rail of the top frame, near where it meets the windshield. This was probably another leftover from the TA/TB days; later TC top frames did not have this offset. The color of the instrument panel was changed from black to tan, and the facia was changed from walnut veneer to Rexine. Leather-covered door panels were changed to Rexine-covered fairly early on. If anyone can supply any information regarding the approximate dates or chassis numbers for any of these changes, please get in touch with me.

There were also a few engine equipment changes made during the course of TC production, but these were all very minor and will be dealt with in a separate article on the XPAG/XPEG engine. One change worth noticing at this point, however, is that between XPAG 2020 and XPAG 2965 a polished aluminum rocker cover with a flip-top oil filler cap was standard equipment. A pressed steel rocker cover was standard on all earlier and later XPAGs. Reproductions of this aluminum cover are now available from several sources.

## TC VARIATIONS

Before World War II, M.G.s were intended for sale primarily in Great Britian, and were designed to meet British tastes and the regulations of the Ministry of Transport. If a few orders were received from elsewhere that was all well and good, but no special effort was made to modify the cars to suit the different requirements of the country of destination. That responsibility fell on the dealer or new owner, which didn't really upset anyone since only about 15% of Abingdon's pre-war production was exported.

The picture changed dramatically after the war. Great Britian was almost bankrupt due to her long years at war, so the Board of Trade decreed, among other things, that steel would be rationed out to each auto manufacturer in proportion to the number of cars they exported each year. The idea was to stimulate exports, which would bring much-needed foreign money into the country. M.G. already had a car with great export potential—the Midget which so many foreign servicemen had admired while they were stationed in Great Britian—so the Company was ready to start exporting without any great deal of internal upheaval. Now, however, M.G. began to pay a bit more attention to the requirements of foreign customers, and as a result there were three distinct versions of the TC produced (four, if you include one sub-type):

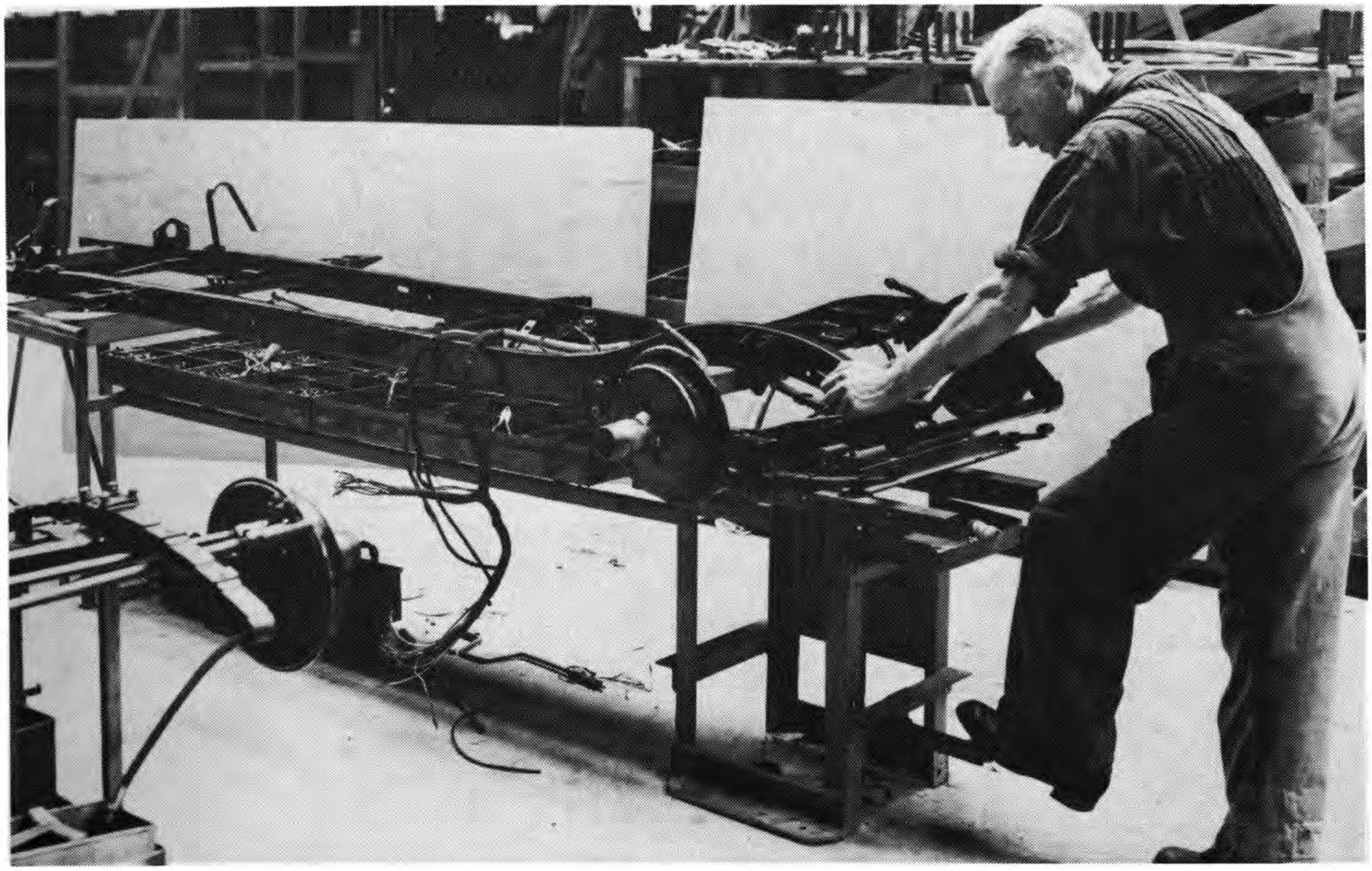
**HOME MODEL:** Originally intended for sale only in the British Isles, many of this type have found their way to our side of the Atlantic in recent years.

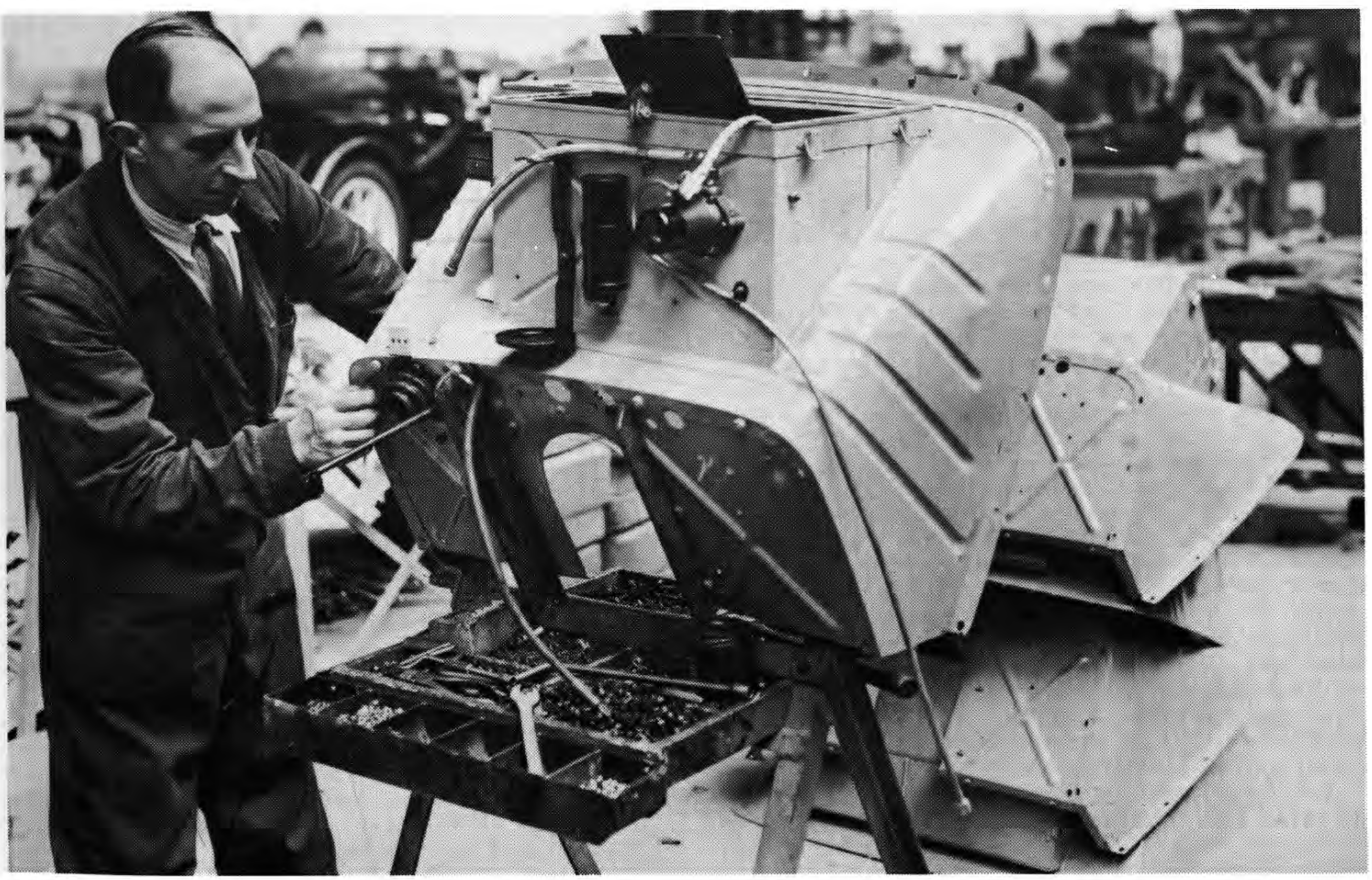
**GENERAL EXPORT MODEL:** This version was identified within the Nuffield Organization as the **TC/EXR,** standing for **EX**port, **R**ight Hand Drive, and was shipped in large numbers (as compared to previous exports) to all parts of the globe. The EXR differs from the Home Model only in very minor ways, as will be explained later. A sub-type of the General Export Model was designated the **TC/EXR/K,** and differs from the EXR only in the fact that the speedometer is calibrated in kilometers instead of miles.

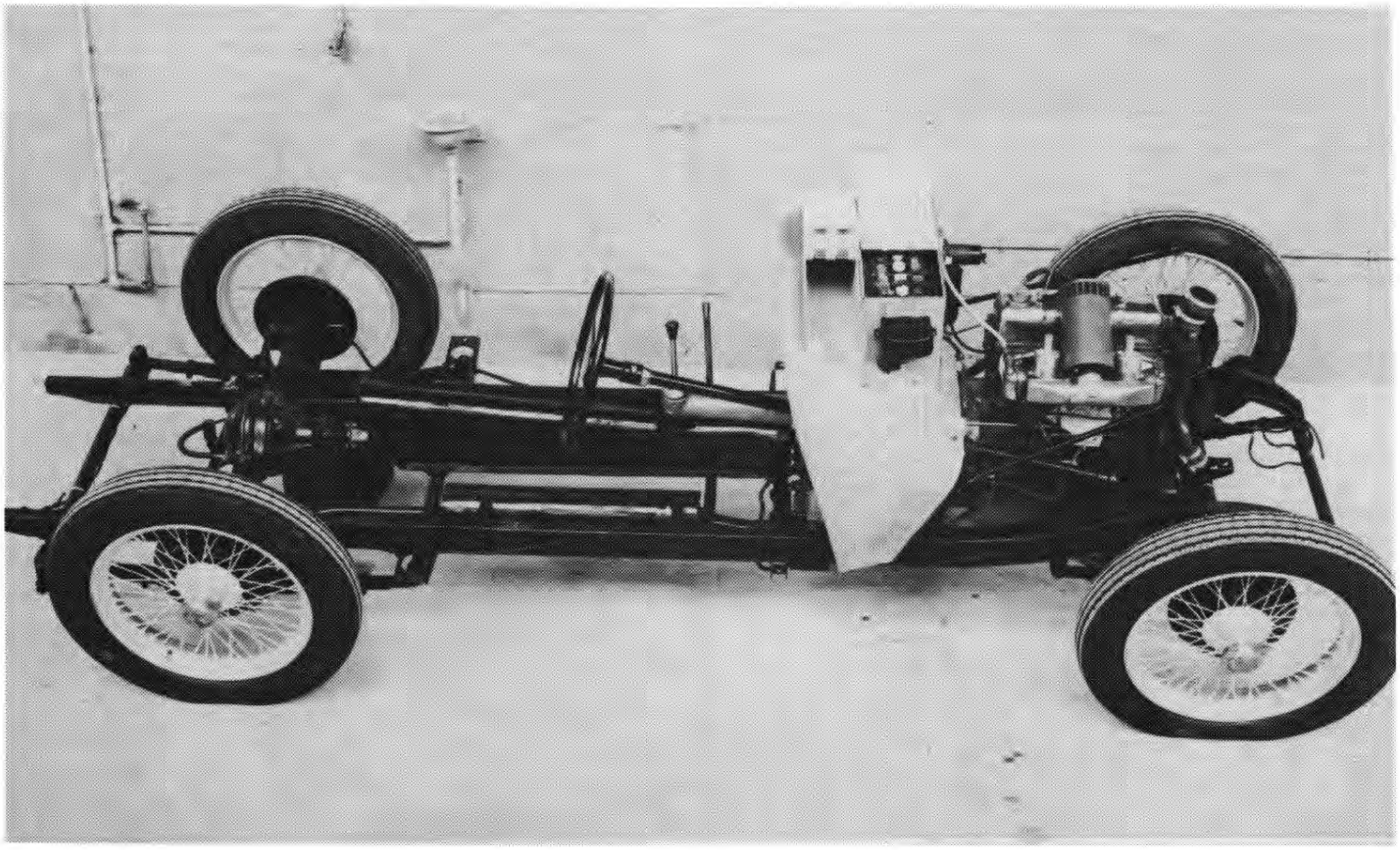
**U. S. EXPORT MODEL:** The response to the TC was so good in the United States that in late 1948 the Factory began producing cars equipped specifically for the American market. Known as the **TC/EXU,** this version differs in many ways from the Home and EXR models, as we shall see later. As far as can be determined from Abingdon's daily production records, only 494 TC/EXU cars were built, far fewer than many of us had previously thought. M.G. historians seem unable to agree on exactly how many TCs in all were originally exported to the United States, but the figure most often quoted is about 2,000. It seems safe to assume, then, that the first 1,500 or so were EXRs, and the rest were EXUs.

The TC/EXU in its original form is something of a rarety these days. Normal attrition plus the fact that so few were produced accounts for much of this rarety, of course. However, the survival rate has not been helped at all by the owners who over the years have discarded most of the special EXU equipment because they mistakenly believe it to be non-original.

An interesting point, for those of you who like to decipher the meaning behind the various types of M.G. serial numbers, is that the TC/EXU is the first M.G. two-seater to include what we sometimes call a "market code" as part of the car's serial number. Earlier cars, whether for export





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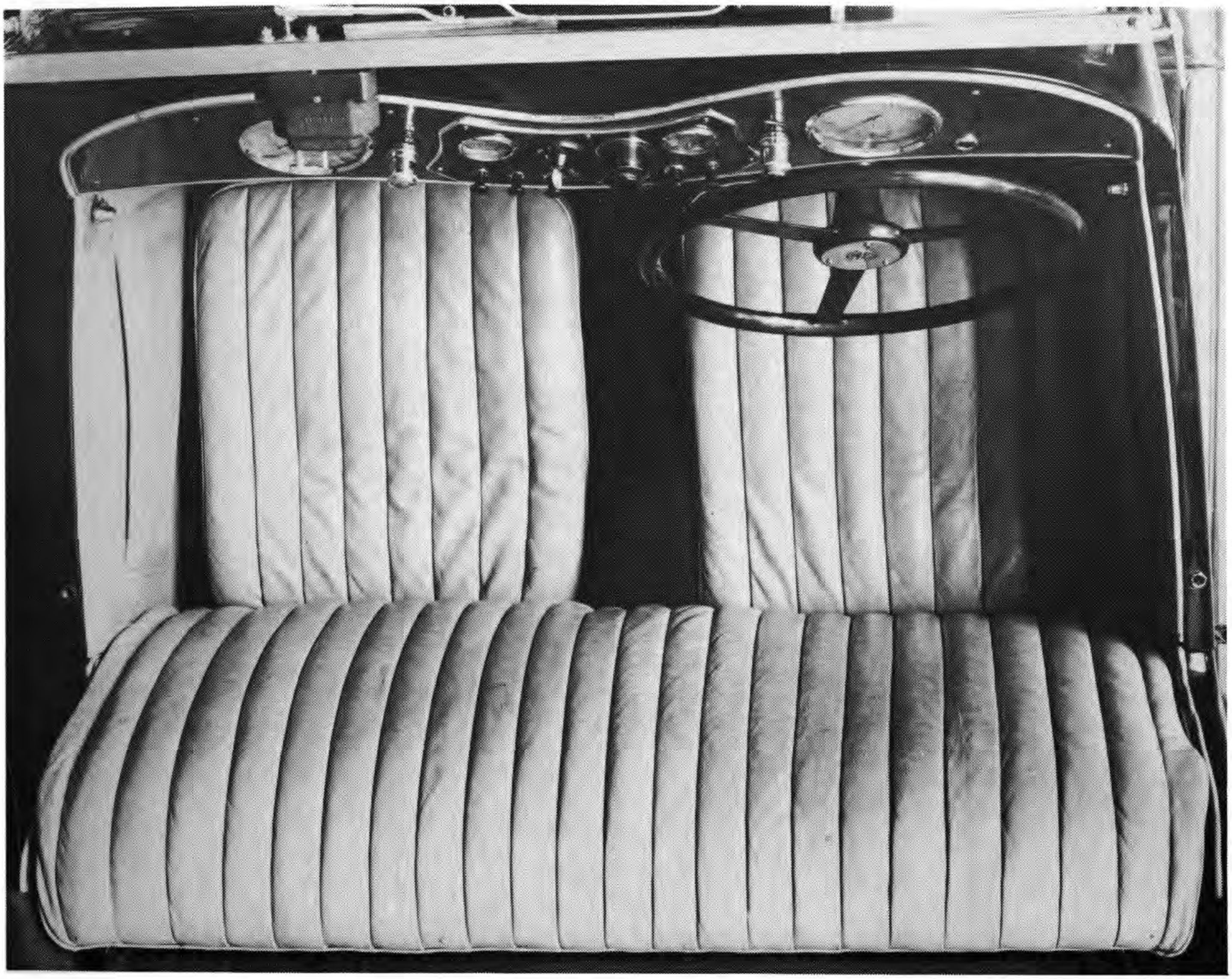


or the home market, are simply "TC 1234" or whatever, but on the U. S. Export model the designation "EXU" is added to the number. Sometimes it appears before the number (TC/EXU 9999), sometimes after (TC 9999 EXU); the man with the stamps apparently couldn't make up his mind. Why the designations "EXR" and "EXR/K" were not included in the serial numbers of General Export cars is not clear. Y-Series saloons and tourers, which were being produced at the same time, use a wide variety of codes to indicate the export market (EXR, EXL, EXU, EXLU and others), and these codes are almost always included in the serial numbers.

Whatever the reason, the only way to identify a TC/EXR or TC/EXR/K is by the way it is equipped, so let's take a look at some of the most obvious differences between the various types of TC. In what follows, all references to the EXR also apply to the EXR/K, because these two types are identical except for the speedometer.

**BUMPERS:** Like all its ancestors with the exception of some pre-war saloon models, the TC in its original form was not factory-equipped with bumpers. However, add-on bumpers in several styles were available from American accessory houses, and were often installed by dealers to meet customer demand or state motor vehicle regulations. The most common types were the "antenna" type still sold by Moss Motors, and the flat-bladed full-width style sold by Inskip and others. The latter type usually consisted simply of a flat, chrome plated steel blade bolted directly to steel brackets protruding fore and aft from the frame ends. Flat steel overriders were sometimes used, but more often not. The front bumper brackets usually were bolted on under the front dampers in place of the flat steel plate normally found there.

It was not until late 1948 that bumpers were installed by the factory, and then only on the EXU version of the TC. It is these bumpers more than any other feature which set the TC/EXU apart visually from the others. Like the Inskip bumper, the factory type is mounted on steel brackets attached to the frame ends, but the rest of the assembly is somewhat more complex. Curved secondary brackets extending across the front (or rear) of the car are bolted to the main brackets. A flat spring-steel bar is bolted across these secondary brackets, covered by a rolled and plated face bar. Overriders similar to (but smaller than) those used later on the TD and TF are bolted to the face bar. In fact, the whole assembly is similar in many ways to the TD/TF bumper assembly. At the rear of the car a license plate bracket is bolted on above the bumper. partly obscuring the M.G. medallion on the spare wheel knock-off. A diecast M.G. medallion is mounted in the center of rear bumper's face bar. The TC/EXU bumpers are rather cumbersome items which alter the appearance of the car

"D" lamp is in fact correct equipment for all TCs except the EXU. The lamp is mounted on the rear British-style number plate, usually on the right-hand side. However, on some cars intended for right-side-of-the-road countries the lamp was switched to the left side to place it nearer the center of the road.

The problem with "D" lamps is that Lucas has produced them more or less continuously since some time in the 1930s, and in a bewildering variety. All are about the same size and shape. Some are chrome-plated, some painted, and some made of rubber. Most have a divided rear lens, but some (including all recent production) have a single lens. Some have one single-filament bulb, some have two, and still others (the single-lens variety) have one dual-filament bulb. There is even one split-lens variant (the SR 51) on which the smaller half of the lens is red to serve as a tail light, but the larger D-shaped part is clear to serve as a back-up light.

The ST 51 "D" lamp originally used on the TC has a chrome-plated body, divided rear lens (both sides red), and two single-filament bulbs separated by a sheetmetal divider. The bulb behind the smaller rectangular portion of the rear lens serves as the tail light, and also shines through the clear lens on the flat side of the "D" to illuminate the license plate. The other bulb, behind the larger D-shaped part of the lens, serves as the brake light.

Both bulbs in the original "D" lamp are low-wattage types which, while adequate for tail light use, were much too dim to meet the brake light standards of some states even in the late 1940s. When the TC/EXU was designed for the American market the factory did away with the "D" lamp and substituted two Lucas 482-1 lamps mounted high on the end panels of the fuel tank. The 482-1 lamp has a small, bullet-shaped body with a small, round lens, and contains one dual-filament bulb. The low-wattage filament serves as the tail light, while the more powerful filament does double duty as brake light and turn signal.

**LICENSE PLATE LAMP:** When the factory did away with the "D" lamp for the TC/EXU this left the license plate without illumination. To cure this deficiency a Lucas 467/1 lamp was mounted above the license plate bracket on the rear bumper. Since the bumper was mounted fairly high to begin with, the whole license plate and lamp assembly stuck pretty far up into the air. It wasn't unusual for the owner to move the license plate holder assembly to a position under the bumper, where it looked better until the first time it dragged over a bump. The 467/1 license plate lamp is the same type later used on the TD and TF.

**FOG LAMPS:** As has already been mentioned, the factory switched foglamp types at or about TC 4739. Before that number, Home and EXR models were equipped with the Lucas FT 27 lamp, which was a holdover from pre-war days. This lamp has a shallower, less rounded body than the more familiar later type. Later cars were equipped with the Lucas SFT 462 lamp, with the familiar bullet-shaped body. Internally the two types are quite different. The FT 27 is closely related in design to the M 140 headlamp described earlier, with separate lens, reflector and bulb holder, and a bulb which has to be focused by hand to give the correct light beam. The SFT 462 lamp is more closely related to the "British semi-sealed" light units also described earlier, with a crimped-together lens/reflector assembly and a pre-focused bulb. Contrary to popular belief, there is no significant difference in light output between the two. Both are pretty poor by modern foglamp standards. However, the newer SFT 462 lamp is somewhat easier to keep in good working order.

These foglamps were always mounted on the badge bar bracket closest to the curb side of the car. On EXRs intended for the U. S. and other right-side-of-the-road countries the lamp was mounted on the right. On Home Models and EXRs intended for other "left-handed" countries it was on the left.

When the factory designed the TC/EXU they eliminated the foglamp completely, which is odd considering the fact that foglamps and driving lights have always been popular sports car accessories in this country. Whatever the reason, the TC/EXU left the factory with a bare badge bar. The hole in the instrument panel normally occupied by the foglamp switch contained instead a high beam warning light. When the TC/EXU hit our shores, many dealers and owners added fog or driving lights of various types, often more efficient illuminators than the original FT 27 or SFT 462 units.

**HORNS:** All Home and General Export TCs came from the factory with a single Lucas HF 1234 "Altette" horn mounted on whichever badge bar bracket was not occupied by the foglamp. This horn, often mistakenly identified as the only correct one for any TC, was not used on the EXU. Instead, two Lucas WT 614 "Windtone" horns similar to those used on the TD and TF were mounted on the firewall, under the bonnet. An extra fusebox for these more powerful horns was mounted on the firewall.

**MAP LIGHTS & "THIRTYLITE":** Until a few years ago most of the TCs seen in this country were EXR and EXU models, which had a Lucas DF 41 map reading light mounted on each side of the facia between the central instrument panel and the speedometer or tachometer. When more Home Model cars began to be brought over a fews years ago to swell the ranks, owners were often puzzled by the odd contraption fitted in place of the driver's-side map light. Called a "30 mph warning lamp," this Lucas unit is basically identical to the more familiar map light except that there is no hole in the side of the chrome cover for the light to shine through. Instead, the thirtylite has a green plastic lens in the end of the cap, where the Lucas "King of the Road" emblem is found on the map light. This lamp is wired to the speedometer, which has internal contacts which cause the thirtylite to light up at about 20 mph and go out again at a bit over thirty. If the light bothers the driver, it can be turned off by rotating the lamp body, just like the map light. The reason for fitting this lamp to Home Model cars is a bit murky, to say the least. Would any of our British readers care to explain?

**MISCELLANEOUS:** According to the Export Supplement (section P) of the *Service Parts List* there are dozens of minor details in which the TC/EXR and the TC/EXU differ from the Home Model, in addition to those already mentioned. Most of these changes are found only in the TC/EXU; the TC/EXR is identical in most respects to the Home Model. Even most of the EXU changes are invisible unless you dismantle the car and examine it piece by piece, but there are a few other things which can be seen if you look closely at the complete car:

The Home Model has no interior rear view mirror, but the EXU has a Lucas mirror mounted in the center of the cowl, just above the instrument panel. The EXR either does or does not have this interior mirror, depending on which edition of the *Service Parts List* you choose to believe. Early editions list it, but later editions do not. I've often read that mirrors were installed by American dealers, so apparently the early editions are wrong.

The windscreen glass on the Home and EXR models is Triplex "Toughened," which breaks into tiny rounded (and relatively harmless) fragments when hit. This would seem at first to be a good thing, but if the glass fails to fall out of its frame the driver is faced with a suddenly opaque windscreen. For the EXU model the glass was changed to Triplex "Laminated" to meet U. S. motor vehicle regulations.

The vehicle identification plates (engine number octagonal plate, car number plate, patent plate, and body number plate) used on all versions of the TC were identical except that on most Home Model cars they seem to be bare brass while on Export cars they are usually nickle plated. In addition, all export cars (EXR and EXU) have a "Made In England" plate mounted on the battery box near the car number plate. This plate is not found on Home Model cars.

The steering wheels used on Home Model and General Export cars are (or were originally) almost always black plastic with black solid-steel spokes. Most have three spokes, but some have four. The TC/EXU wheel was usually tan and gold pearl, with chrome-plated steel spokes.

### PAINT AND UPHOLSTERY

According to most reliable sources almost the entire first twelve months' production run was painted black, with a choice red, green or beige upholstery. It was not until September 1946 that two new colors became available: red with red or beige upholstery, and green with green or beige upholstery. Two more colors became available during the early part of 1948, but the exact month is not known: cream with red or green upholstery, and blue with beige upholstery. From mid-1948 through the end of TC production the complete lineup was as follows:

| Body | Upholstery |
|---|---|
| Red | Red or Beige |
| Green | Green or Beige |
| Cream | Red or Green |
| Blue | Beige |
| Black | Red, Green or Beige |

A great deal of confusion has been caused by the fact that TC advertising brochures are inconsistent in the way they describe the available colors. Most of the brochures speak simply of red, green, cream, blue and black. Sometimes, though, the red is described as either Regency Red or M.G. Red; green becomes Shires Green, M.G. Green or Almond Green; cream becomes Sequoia Cream or Ivory; blue becomes Clipper Blue. Some have claimed that each of these color names represents a different shade of the basic color: that there were, in other words, two different reds, three greens, and two creams offered at various times during TC production. Others claim that there was only one shade of each basic color available, but that the color names were changed occasionally as an advertising gimmick.

Nobody seems to know the answer to this dilemma, but most evidence seems to be in favor of the "one color, several names" theory. Changing around the color names without actually changing the color is fairly common practice in the auto industry, and M.G. has done it a number of times. Furthermore, Rinshed-Mason was the official source of refinishing suppliers for American M.G. dealers during much of the T-Series period, and after their old listings seem to show only one of each basic color.

All factory literature describes the paint type used as "cellulose enamel," which has led many American restorers to conclude that enamel is the only correct paint type for an authentic restoration. This is not the case at all. The paint known in Britian as cellulose enamel is what we call nitrocellulose or "straight" lacquer on this side of the Atlantic. The original supplier to M.G. was ICI-Belco, a company which is still one of the major suppliers of automotive paints in Great Britian. Occasionally, however, M.G. had to return to other suppliers when Belco's supply ran short, which helps to explain why two TCs nominally the same color did not necessarily look the same even when new.

ICI-Belco paints are not readily available in the United States, but several of our domestic manufacturers can supply very good duplicates of the original colors. Modern equivalents from Ditzler and Rinshed-Mason seem to be the most widely accepted by restorers, and their code numbers are as follows: Note however, that these are in acrylic lacquer, not the obsolete original nitrocellulose lacquer.

| Color | Ditzler Code | Rinished-Mason Code |
|---|---|---|
| Red | DDL 71993 | BM 121 R |
| Green | DDL 44159 | BM 076 |
| Blue | DDL 12297 | BM 042 |
| Cream | DDL 81271 | BM 127 |

Most TC brochures describe the upholstery colors simply as red, green and beige, but a few of the brochures transform these basic colors into Regency Red, Shires Green and Vellium Beige. It seems unlikely that these fancier names represent new colors. Leather for the seats was supplied by Connolly Brothers, and their code numbers for the original colors follow: red = VM 3171, green = VM 895, and beige = VM 847.

Unlike most of Abingdon's pre-war products, the TC could not be had with duotone paint schemes, non-standard colors, or non-standard interior/exterior color combinations.

### INTERIOR DETAILS

Early examples of the TC had leather seats and door panels, but the rest of the interior was done in matching "Rexine," an early vinyl material. At some unknown time during TC production, apparently fairly early, the door panels were changed from leather to Rexine, although the pattern remained the same. The seats are usually described as being leather, but only the front of the seat back and the top, front, and outboard side panels of the seat bottoms were real leather. The rest of the seat covering was Rexine leathercloth.

Many restorers place great importance upon having only the most expensive custom-sewn interiors in their cars, but the fact is that a custom upholstery shop cannot hope to duplicate the original interior without a pattern. The interior kits now offered by Moss Motors, Abingdon Spares and others are very accurate reproductions, are fairly easy to install, and are much less expensive than most custom work.

The floors were originally covered with short-pile black carpet laid over felt padding and secured by lift-the-dot fasteners. The driveshaft tunnel was also carpeted, but the gearbox cover and the luggage area behind the seats were not.

The facia panel on early cars was walnut-veneered plywood, but this was changed to Rexine-covered plywood matching the upholstery color some time during 1948. The Lucas instrument panel in the center of the facia was black with white lettering on early cars, but was changed to tan with black lettering at about the time of the facia change. The TC/EXU instrument panel was also tan, but had no lettering. The bases of the map light and thirtylite matches the instrument panel color.

A "scuttle masking board" covered with Rexine to match the upholstery extended from the bottom edge of the facia to the firewall, covering all the wires, cables and so on behind the facia. Most of these seem to have disappeared over the years, probably because the panel is difficult to remove when access to the wiring and instrument light bulbs is necessary.

The original tops and side curtains were tan canvas material, sometimes with a single rear window and sometimes with a divided one. The metal frames for the top and side curtains were painted tan to match the canvas. The original tonneau cover was either tan canvas or black vinyl, and covered only the area behind the seats. The front of the cover tucked over the tonneau rail on the seat back and was secured by elastic straps. It was secured by snaps at the rear and on the sides.

## CHASSIS DETAILS

It has been stated fairly often in TSO that the chassis and nearly all the bits and pieces attached to it should be black, but still the letters pour in asking for a detailed part by part list of colors. Let's try a simpler approach. Remove the complete body, the radiator shell, the engine and gearbox, the wheels, the brake cables, the rubber parts, and the wiring. With the exception of the chrome plated handbrake lever sticking up in the middle, everything left should be black. Some publications have stated that the brake drums and frame ends on the EXU model were apinted body color, but according to Cecil Cousins this was done only on some show cars. The few EUXs I have been able to examine closely show no signs of anything but basic black in those areas.

The radiator grille was sometimes painted to match the exterior color, sometimes to match the upholstery. Which color was chosen for any given car may have depended upon the exterior/interior color combination used on that car, but no ironclad rule has been discovered. TC grilles were never chrome plated.

## ENGINE COMPARTMENT DETAILS

The correct color for early TC engines remains something of a mystery. Some sources claim that grey is the only correct color up until some time in 1948. Others are equally certain that the earliest engines were dark green, but that a switch was made to greenish grey fairly early in the game. This argument has been going on for at least the past fifteen years, and will probably continue until the last TC has rusted away into peaceful oblivion. I think (not "I know) that the earliest TC engines were, in fact, a dark green, and that after a very short while a switch was made to greenish grey. The problem here is that the caustic bath used to clean engines prior to rebuilding strips off all the paint along with the grime and sludge, so there are almost no original examples left to study.

At approximately TC 5000 the engine color was changed to the very dark red (some call it maroon) more familiar to most of us. Several of the T Series parts suppliers offer spray cans of engine enamel in approximately the correct shade of red. If you prefer to use your own spray equipment or even a brush, try Ditzler DQE 50782Y, Dupont 5321DH, Sherwin Williams J31261-R, or Acme AC419. While these are not true engine enamels, they will hold up well on all engine parts except the exhaust manifold. Grey-green engine enamel for earlier TCs may be obtained from Bill Hirsch, 396 Littleton Avenue, Newark, N.J. 07103.

Most of the bits and pieces attached to the engine were painted to match the color of the block and head, but some were painted black. The factory was not very consistent about the coloring of the smaller items, so a small bracket or similar piece might be red on one engine and black on another. The following is offered as a general guideline, but is not to be considered infallible.

**BLOCK COLOR:** Cylinder block, cylinder head, cylinder head rear cover, cylinder head water outlet, tappet cover, intake manifold, sump, timing chain cover, engine bearer plate, breather tube, generator pulley, clutch housing, clutch inspection cover, water pump, water pump pulley, oil pump, water branch pipe, and gearbox.

**BLACK:** Air cleaner, air cleaner support struts, generator, starter, fan blades, clutch operating lever, clutch and throttle return spring brackets, driveshaft flange on gearbox, and control cable bracket on rear carburetor.

**BLOCK COLOR OR BLACK:** Breather pipe clamp, generator mounting bracket, generator adjusting link, breather pipe support bracket, thermostat, bypass elbow on thermostat, oil filter mounting bracket, oil filter strap, oil pipes to and from oil pump, and crankshaft pulley.

**GREY GREEN:** Pressed steel rocker cover.

**ALUMINIZED:** The exhaust manifold and manifold clamps were given an aluminum coating by the metalspray process.

**COPPER OR BRASS:** Drain plugs, plug in block above oil pump, and most copper or brass oil and fuel lines and their fittings were usually painted, but sometimes not.

**CHROME PLATED:** Engine and gearbox dipsticks, gearshift lever, air cleaner manifold clamp.

**CADMIUM PLATED:** Starter switch, oil filler cap, hose clamps.

On many engines the cast aluminum sump, timing chain cover and clutch housing seem to have been painted block color, but in at least a few cases they are known to have been left unpainted. Many restorers prefer not to paint them, and most people agree that they look better bare.

Several items of engine equipment were supplied by sources outside the Nuffield Organization, and these suppliers could not be counted on to stick with any set color scheme. Lucas starters and generators were usually black, but a few early TCs are knows to have had grey or grey-green ones. Oil filters were supplied by Wilmot-Breeden, Purolator, Fram, Tecalamit and others, in a wide variety of colors. The thermostat was from Smiths, and was sometimes left black, sometimes painted to match the engine block. The air cleaner was originally an A.C. #1573577 canister unit, and seems always to have been black.

On early TCs the firewall was painted the same unappealing grey-green as the engine, but beginning at approximately TC 5800 the firewall was painted to match the exterior color of the car. The footramp at the bottom of the firewall was sometimes painted to match the firewall, sometimes painted black to match the chassis. The radiator and its support tubes were black, as were most of the ipie clips, wiring clips and miscellaneous small brackets under the bonnet.

## CHROMIUM PLATING

Quite a lot of chrome was used on the TC in its original form, and extra bits and pieces have been plated on many cars by their owners. Rather than try to provide a list of everything which should be plated, which would be quite a long list, let me describe some of the parts which are often found plated but which were not that way originally.

Starting at the front of the car, the headlamp mounting brackets should be body color, not plated. The badge bar is plated, but its mounting brackets should be body color. On the horn only the rim, the rim-securing acorn nut and the large central nut should be plated. The rest of the horn should be black. At the side of the car, the door hinges should be body color, not plated. The front fender support tubes should be either body color or chassis black. At the rear, the fuel tank straps should be body color. The tank end panels are plated, but the flat center portion is then painted body color, leaving chrome showing only around the edge. The spare wheel support frame should be painted either body color or chassis black, not plated. Chrome plated wire wheels are not original, either; they should be painted silver-grey.

Inside the car, the instrument panel is often seen plated all over. Originally the flat center part was painted black or tan, leaving chrome showing only on the beaded edge. The handbrake lever should be plated, but the rest of the handbrake mechanism is chassis black. The tonneau rail on the seat back is another item often found plated, but was originally painted black. The hinges and hinge brackets at the bottom of the seat back should also be black, not plated.

Under the bonnet only those items described in the previous section should be plated. Rocker covers, tappet covers, and numerous smaller items are often found plated, but were not so originally. On some TCs the maker's plate, patent plate, and "Made in England" plate are plain brass, while on others they are nickle plated.

## OPTIONAL EQUIPMENT

Not too long ago I was asked by several concours judges at a local car show to settle a dispute over the acceptability of several accessories on a TC being judged. The owner insisted that they were all acceptable because they were accessories which were widely sold when the car was new, and could easily have been installed by the dealer or the original owner. One judge insisted that only factory-installed or dealer-installed accoessories should be allowed. The second judge wanted to accept only factory-installed options. The third didn't want to accept anything. I wanted to leave.

We often hear the terms "factory option," "dealer-installed option" and "owner-installed accessory" bandied about, but in the case of the TC these terms are artificial and almost meaningless. The distinction between factory options and dealer-installed options is very fuzzy, if indeed there is any real distinction. The *TC Service Parts Lists* does not list optional equipment, but other literature seems to indicate that at least three pieces of optional equipment could be had from the factory: a Bluemel's "Brooklands" wire-spoked steering wheel, 16" wire wheels, and a luggage carrier which mounted above the spare tire. However, it appears that one could not order a new TC already equipped with these goodies, at least not in America. This equipment could be ordered through and installed by a dealer, who would get it from one of the distributors, who in turn got it from the factory. So, are these factory options or dealer options? Does it really matter? Is there a TC-era M.G. dealer reading this who can clarify this for the concours types?

The distinction between dealer-installed and owner-installed accessories is equally fuzzy. Many dealers offered extensive lines of accessories manufactured in this country, and would install any or all of them at the request of a customer. However, in most cases these same accessories could be purchased by the owner from one of the sportscar-oriented mailorder houses. How, then, is a judge supposed to distinguish between a dealer-installed accessory and an owner-installed one? Once again, does it really matter? I suppose it must matter to some owners, because the question is asked fairly often. Sorry, but there is no iron-clad answer.

The list of accessories which could be had for the TC when it was a new or nearly new car is almost endless: bumpers, turn signals, Alfin brake drums, Wellworthy brake drum rings, large diameter drum covers, wind wings, sun visors, special steering wheels, the Tompkins steering kit, leather spring gaiters, Lucas "Tripod" headlamps, extra gauges, all sorts of speed equipment, pancake air cleaners, aluminum rocker and tappet covers, spare wheel covers, center armrests, luggage racks, full-length tonneau covers, wing mirrors, radios, driving lights, oversized badge bars, etc., etc., *ad infinitum*. Some were functional, and others were only for looks, but all were very popular. It has been only within the last few years that much emphasis has been placed on stark "factory" originality. When the cars were new, their owners could seldom resist adding something to set their new toy apart from all the others.

As I said in my opening remarks, a great deal of ground is left uncovered, but enough is enough. Look for a similar article dealing with the TD and/or TF sometime in the not-too-distant future. In the meantime, I'm going to go do something mechanical to clear my head.

## The TD

The TC must be given credit for being the first M.G. to come to this country in any appreciable numbers. But let's face it, the few that actually made it to these shores in the late 1940s had precious little effect upon the American motoring scene.

The car that really set America and Detroit on its ear was the TD. Americans loved it because it was an honest, straight forward sports car that put the fun back in driving. Using the Abingdon philosophy of cheap and cheerful, the TD never pretended to be anything that it really wasn't.

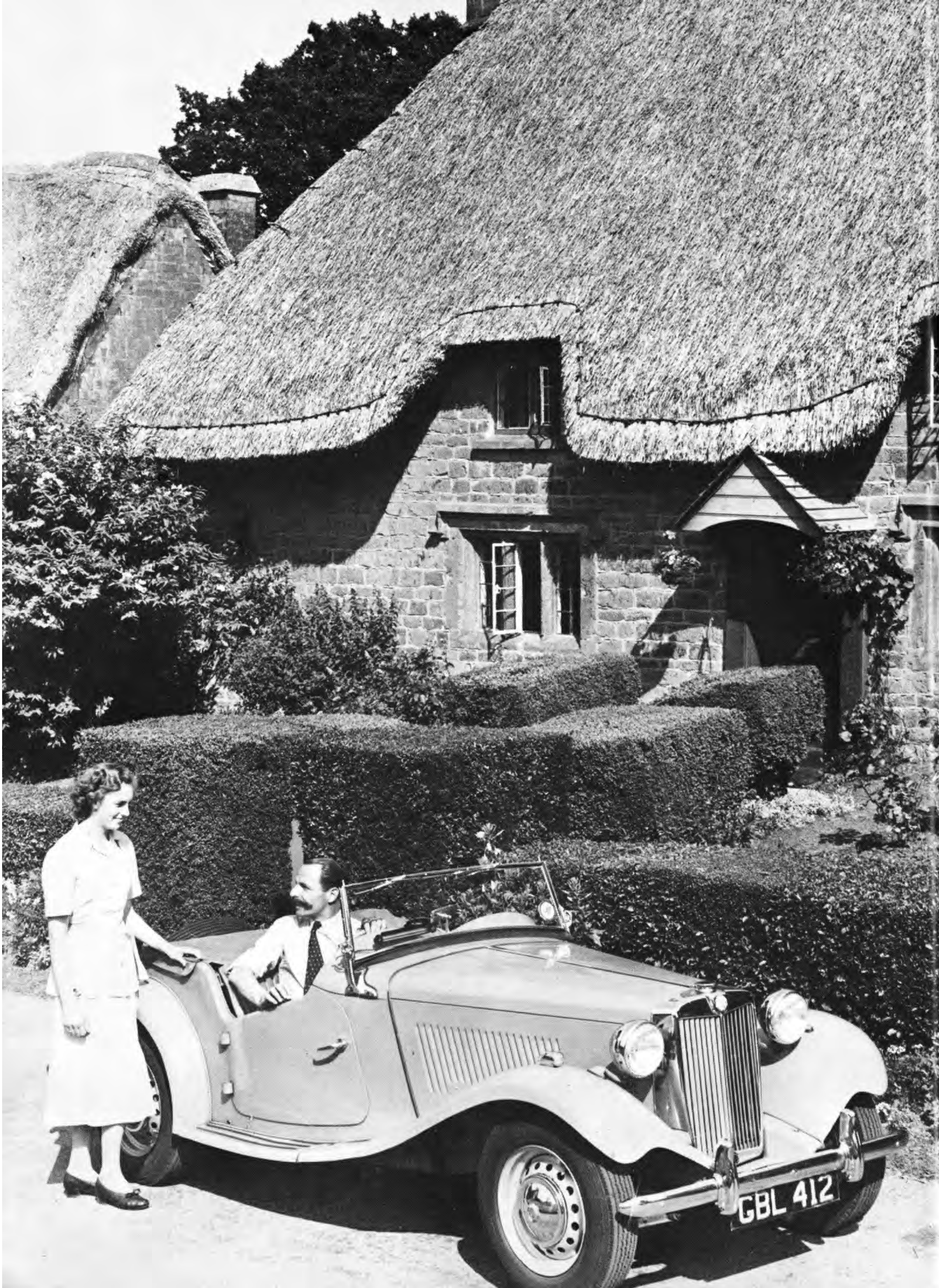
The birth of the TD is a typical Abingdon success story. Syd Enever, the brilliant, practical engineer in charge of the development shop was instructed to come up with a replacement for the cart sprung TD. I can just see Syd, Cec Cousins, Alec Hounslow, and Henry Stone at work now. Using their unusual minds and hearts they conceived the TD. They knew the engine and body shape were popular and right for M.G. at that period. Without any plans, they thought the TD into existence.

They took a Y Type chassis with its independent front suspension and shortened it by five inches, fitted TC body,some free hand panel-beaten wings, and it worked!

Sure, some diehards didn't like losing the wire wheels, but the end result was pleasing and practical: cheap and cheerful.

America loved it and the TD can be credited with starting the sports car revolution. From the TD came the styling craze for floor shifts and bucket seats. Detroit woke up and even produced a sports car or two of its own.

Anyone with a TD can be proud of the important role the car played in automotive history. Long live the TD!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# TECHNICALLY SPEAKING

## POINTS OF ORIGINALITY: THE M.G. TD

**F.E. Old III**
**Technical Editor**

This is the second in a series of articles dealing with points of originality most often asked about in correspondence received by your Technical Editor. The first, which dealt with the TC, appeared in the August 1979 TSO.

In this article, as in the first, we will not attempt to cover such things as which way each bolt and cotter pin should be inserted through its hole, although questions of this nature do occasionally appear on my desk. Reliable information on such minute details is just not available. In the first place, these cars were assembled by people, not by machines, so small variations were common even when the cars were new. In the second place, the youngest TD is now twenty-seven years old. After all those years it is difficult for anyone to say just what is original and what is not, especially where tiny details are concerned.

I have looked into this matter of originality fairly throughly, not because I am any kind of originality fanatic, but because I receive so many questions on the subject. One overwhelming problem I have run up against is a serious lack of documented facts. In the case of the TD we have the *Owner's Manual*, the *TD/TF Workshop Manual*, the *Service Parts List*, various *Service Information Sheets* and *Service Memoranda*, and several advertising brochures. With the exception of additional bits and pieces which come to light from time to time, this is all the factory left us. We do not have detailed production line flow charts showing what was put where and in what order, nor do we have detailed engineering diagrams of the cars. Such things would be of immense value to us, but they seem no longer to exist.

Also useful are the many road tests which appeared in the motoring press when the cars were new. However, not many road testers of those days were famous for their objectivity, so the reliability of their information is subject to question.

Another source of information which needs to be used with care includes the many articles which have appeared in various publications since the TD was a current model. The authors of most of the articles undoubtedly put a lot of effort into research, and I doubt that any of them intentionallly included incorrect information. However, we need only read a few such articles to notice a great deal of disagreement from one to the next. They cannot all be right, but how are we to know which to believe? The problem seems to stem from the difficulty most of us have in separating documentable fact from personal opinion, and is compounded by the tendency many of us have to accept the written word as gospel. Later writers often use these "facts" in their own articles without questioning their accuracy, thus perpetuating any errors which existed in earlier articles.

The obvious point of all this is that you should not accept what follows as indisputable fact. Every possible effort has been made to authenticate the information in this article, but I make no guarantees. Neither I nor anyone else I know can claim to be the last word on the subject. This is not the way I **know** the TD should be; it is only how I **think** it should be.

### ORIGINS

Many M.G. lovers prefer to think of the TD as a direct desendent of the TC, and it is if you tend to trace lineage only by styling characteristics. The visual similarity between the TC and the TD is obvious. However, if you strip away the coachwork to look beneath the styling, you will find yourself looking at two very different cars. The TC was, as far as M.G. was concerned, the last gasp of the typical British sports car of the 1930's. Except for a few minor differences, the TC was not very far removed from EX120, which was the prototype for the 1931 C Type and almost all subsequent M.G. sports models through the TC. In fact, if you ignore the styling similarities between TC and TD, you find that the TC shares more characteristics with its ancestors than it shares with the TD. The TD's body style was obviously inspired by earlier cars, but the inspiration for the rest of the car — the real guts of the car — came from something else entirely.

By the time the people at Abingdon were allowed to start working on a replacement for the TC, they were well aware that it was time for a break with the old traditional design. They had, in fact, known this before the war, but constraints from within the Nuffield Organisation prevented them from doing anything about it. Now, however, it was obvious even to those in power in the Nuffield Organization that the future of the British automobile industry lay in exports, that the largest potential export market lay across the Atlantic in America, and that the Americans wanted something a bit more up to date than the TC.

The TC had sold well in the States, but for every would-be sports car enthusiasts who bought one there were many more who did not because by American standards the TC was too spartan and old-fashioned. The new car would be aimed directly at American tastes and would represent a leap from the 1930's to, if not exactly 1950, at least to the 1940's in terms of automotive technolgy. This called for independent front suspension, a stiffer chassis, a modern rear axle, and coachwork providing smoother looks and greater comfort.

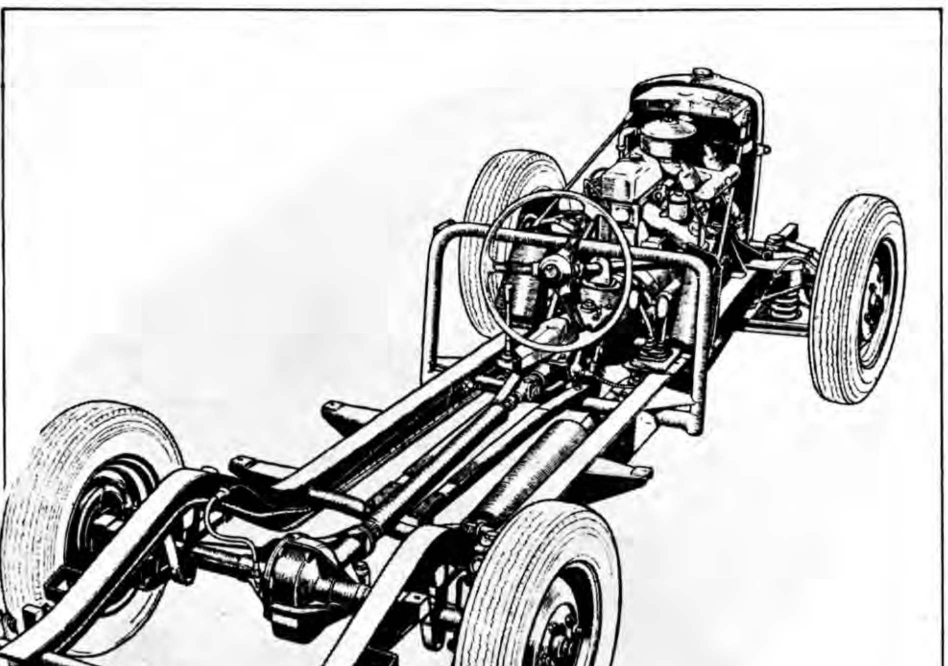
M.G. was already producing a car which had many of the characteristics wanted for the new car: the Y Type saloon which had

been introduced in 1947. When the word came down from Cowley in the summer of 1949 to design a new car, it was done in only a few weeks by cutting a Y Type chassis down to a 94 inch wheelbase and grafting on a TC body. This provided a rather crude prototype, hardly suitable for production, but it served as proof that Abingdon could put together a new model based mainly on existing componants without a lengthy development program. The concept was approved by Cowley, the car was turned over to the Drawing Office to have proper plans laid out, and the new model was in production before the end of the year.

Under the skin the Y Type origins of the new car were obvious. The chassis was very similar, consisting of large, boxed-in frame rails providing a very rigid platform for the independent front suspension. The front suspension was almost an exact copy of the Y Type original, but utilized larger dampers. The rack and pinion steering was also borrowed from the Y. At the rear the chassis departed from its saloon car ancestor in that the frame swept up over the rear axle instead of being underslung. The axle itself was a modern hypoid design taken from elsewhere in the contemporary Morris and Wolseley lines. The gearbox was a Y Type unit with a remote shifter assembly added on. The XPAG/TD engine, although it bore a strong family resemblance to the TC version, was really also derived from the Y Type's XPAG/SC engine. True, all XPAGs were essentially the same, but on the TD version the sump, rocker cover, clutch housing, starter, generator and motor mounts were straight off the Y Type. There were, in fact, a few early TDs which left the factory equipped with XPAG/SC engines. However, the power output was increased to TC specs by using dual carburetors and the TC camshaft, and the engine was mounted farther back in the chassis than it had been in the Y.

The TD body was obviously inspired by earlier M.G. two-seaters, but was wider to provide more elbow room than previous models. The seats were mounted slightly farther forward and the back of the body extended slightly more towards the rear, providing a bit more luggage space. The extra width and length, combined with smaller wheels, more rounded fenders and less angular lines overall, gave the car the appearance of being lower than the TC even though the actual heights of both cars were almost identical.

Unfortunately the more massive chassis and the slightly larger body made the new model almost 200 pounds heavier than the TC had been. Power output and rear axle ratio were the same as the TC at 54 h.p. and 5.125:1 respectively, but accelleration was about the same or slightly better in spite of the added weight because the smaller wheels provided a lower effective drive ratio. On the other hand, this also meant that the engine had to spin faster to keep up with the TC on the open road.



What, then, were the origins of the new TD Midget? It obviously was not just a further development of the TC, but then neither was it entirely derived from the Y Type. It was instead an amalgamation of the best features of both: the sporty looks of the TC and the more modern engineering of the Y.

## IDENTIFYING THE TD

The only correct way to identify a TD or any other M.G. is by the car number stamped on the vehicle identification plate or "maker's plate". All TD car numbers begin either with the prefix "TD", indicating that the car is a standard TD, or with the **prefix "TD/C" indicating a TD Mark II.** Following the prefix is a number which is nothing more than the serial number of the chassis. By comparing this number to the production records we can determine when the car was built, and by referring to the *Workshop Manual,* the *Service Parts Manual,* and other documents we can determine where the car fits into the evolutionary scheme of design improvements which took place more or less continuously during TD production. Stamped in the box below the car number, but still considered part of it, we find a series of letters which tells us whether the car is right or left hand drive and what export market it was intended for. This market code, as it is usually called, appears only on cars built for export. Thus each part of the car number tells us something about the car, and we will explore this thought further later in this article.

Some writers have gone to great lengths to put TDs into catagories according to this characteristic or that, the implication being that all cars in one category should look a certain way and cars in another catagory should all look another way. Some of the catagories are merely confusing, some are misleading, and others are completely erroneous.

We often see the terms "TDI" and "TD2" used to seperate the cars into groups, but there seems to be little or no agreement on what these terms mean. Some writers use these terms interchangeably with TD Mark I and TD Mark II, but this is incorrect because officially there really is no such thing as a TD Mark I. More writers derive the terms from the prefixes which are part of the engine number: XPAG/TD and XPAG.TD2. In this case, the term TD2 refers only to the fact that an engine with this prefix uses a larger clutch, flywheel and clutch housing than earlier examples; this has no bearing at all on the rest of the car.

Other writers are enamoured of the terms "early" and "late", fully expecting these descriptions to conjure up a mental image of the car in question. Now, a TD built in 1949 is obviously an early example, and one built near the end of 1953 is obviosly a late one, but except for these extreme cases the terms early and late are almost meaningless as general catagories. There is no single design feature, car number or production date which conveniently divides TDs into an early group and a late group. Design changes were made more or less continuously as TD production proceded, and it is only within the context of each individual change that the terms early and late become meaningful. If we are talking about wheel styles, then TD 0501 is the dividing line between early and late, but if turn signals are the topic of discussion then TD 22371 becomes the dividing line. Thus any TD can be early in respect to some features but late in respect to others.

My own preference is to forget about categories altogether and to view the TD as a single type. True, the last TD differs in many ways from the first, but these differences came about through a gradual evolutionary process, not through major changes which split TDs into groups. It is also true that the TD Mark II is in some respects a seperate type, but it was produced right along with the standard car and underwent exactly the same evolutionary development. Future writers will undoubtedly try to dream up new ways to catagorize the TD, because of the natural human desire to put everything into pigeonholes. It's a futile undertaking; the only thing that fits well in a pigeonhole is a pigeon.


## PRODUCTION STATISTICS

M.G. did not, until recently, produce cars according to model years, so to label a TD as a 1950 or 1953 or whatever is meaningless except to your local Department of Motor Vehicles. In fact, in some areas the model year was often arbitrarily assigned according to when the car was originally sold, so we occasionally see a TD registered as a 1954 model even though production ended in August 1953.

Previously published lists of production dates for the TD have often been incomplete, and one list seldom agrees with the next. The following list is derived from the factory's daily production records, and unless someone at the factory got careless we can assume that these statistics are correct.

| Year | First Car & Date | Last Car & Date |
|---|---|---|
| 1949 | TD 0251 Nov. 10 | TD 0348 Dec. 20 |
| 1959 | TD 0349 Jan. 2 | TD 5169 Dec. 22 |
| 1951 | TD 5170 Jan 1 | TD 12577 Dec. 20 |
| 1952 | TD 12578 Jan. 2 | TD 23634 Dec. 31 |
| 1953 | TD 23635 Jan. 1 | TD 29915 Aug. 17 |

## DESIGN CHANGES

As I have pointed out already, the TD did not undergo a major design change with the coming of each new year. Instead, improvements were made continuously as production proceded. Most earlier M.G.s changed very little during their production lives, but this was not true of the TD. It was changed around with machinegun-like rapidity, as we will see shortly.

Each change was documented by the factory according to the chassis number of the car on which it first appeared, not by model year, so in the context of these changes model year has little or no meaning. The owner who say's for example, only that he has a 1952 TD and wants to know whether his car should have rectangular or round tail lamps cannot expect a simple anwser.

The list which follows includes all of the major design changes incorporated into the TD chassis and body, and some lesser ones. There were also numerous improvements made to the XPAG engine during the TD years, but these are the subject of another article which should be in your hands by early next year. Our list is by no means complete; a glance through the *Service Parts List* will bring to light literally hundreds of minor changes, most of them necessitated by the larger changes described here.

The chassis numbers given here are those quoted in the official literature, but it is best to consider them as approximate. We often find a car which should, according to its chassis number, have one piece of equipment when in fact it carries an earlier type which was supposedly phased out before the car was built. Perhaps this was because new supplies of the old part were found and used up after the change officially took place. Perhaps it was simply a matter of sloppy record keeping at the factory. Or, perhaps it was some entirely different reason. In all likelihood we will never know, but it does not really matter.

The date given for each change is the date on which that particular car was assembled, as listed in the daily production records. Like the car numbers, these dates should be considered only approximate. There were a few cases where the cars did not roll off the assembly line in strict numerical order. Compare, for example, the production date for TD 22315 with the dates for cars just before and after it in the following list. If we go strictly by car numbers, then the revised screenwiper mounting came before the introduction of turn signals. If we go strictly by dates, then the order of introduction is reversed. Most confusing!

**TD 0351** (Dec. 12, 1949): The original chassis (fig 1) was revised to incorporate a tubular brace (fig 2) to stiffen the cowl.

**TD 0501** (Jan. 20, 1950): The wheels were changed from plain disc (fig 4) to ventilated disc (fig 5).

**TD 4237** (Nov. 7, 1950): A rubber-padded footwell was added to the driver's side floorboard on left hand drive cars.

**TD 4251** (Nov. 8, 1950): The hub and brake drum assembly was changed from a separate drum bolted and riveted to the hub (figs. 6,8) to a one-piece casting (figs. 7,9).

**TD 6035** (Feb. 12, 1951): The outer front wheel bearing grease retainer was changed from a felt washer (fig. 6) to a pressed-on steel cap (fig. 7), and the hub casting was altered slightly to accept the cap. Similar caps could be retrofitted to earlier cars by means of a kit offerred by the factory.

**TD 8142** (Jun. 6, 1951): The original 9-post Lucas RF95/2 voltage regulator (fig. 10) was replaced by a 5-post RB106/1 (fig. 11) and a separate fuse box (figs. 12,13).

**TD 10751** (Oct. 5, 1951): On left hand drive cars the original flat-dialed chronometric speedometer and rev counter (fig. 14) were replaced by dish-dialed magnetic units (fig. 15). At the same time, the 20-amp ammeter (fig. 16A) was replaced by a 30-amp unit (fig. 17A), and the on-off panel lighting switch (fig 18A) was replaced by a rheostat (fig. 19A). These same changes were introduced on right hand drive cars commencing with TD 10779 (Oct. 8, 1951).

**TD 11111** (Oct. 22, 1951): The housing on the steering rack for the inner tie rod end was redesigned.

**TD 12285** (Dec. 10, 1951): The wheel studs and nuts and all threaded fittings in the driveshaft and rear axle were changed from British Standard Fine (BSF) to Unified (UNF or SAE) threads.

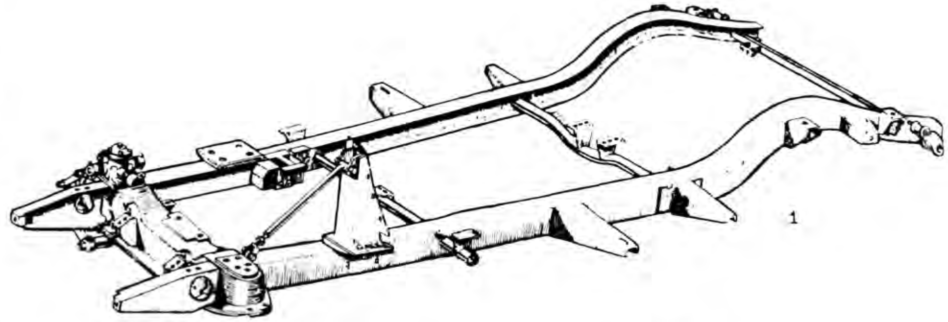
**TD 12419** (Dec. 13, 1951): The studs and nuts securing the spare wheel to its carrier were changed from BSF to UNF threads.

**TD 13914** (Feb. 22, 1952): The original oil pressure gauge (fig. 16B) was superceded by a combined oil pressure and water temperature gauge (fig. 17B). Earlier TDs had no temperature gauge.

**TD 17548** (Jun. 26, 1952): A high beam warning light was added to the speedometer.

**TD 18883** (Aug. 19, 1952): The original combination horn push and headlamp dip switch (fig. 18C) was deleted. The new horn push remained in the original position (fig. 19C), but the dip switch was changed to a foot-operated type (fig. 20). A service bulletin provided instructions for retrofitting the new switches to earlier cars.

**TD 20374** (Sep. 30, 1952): The original two-bow top frame was replaced by a three-bow frame on LHD cars. The side curtains and top covering were modified to suit. These changes were made on RHD cars at TD 20696 (Oct. 10, 1952).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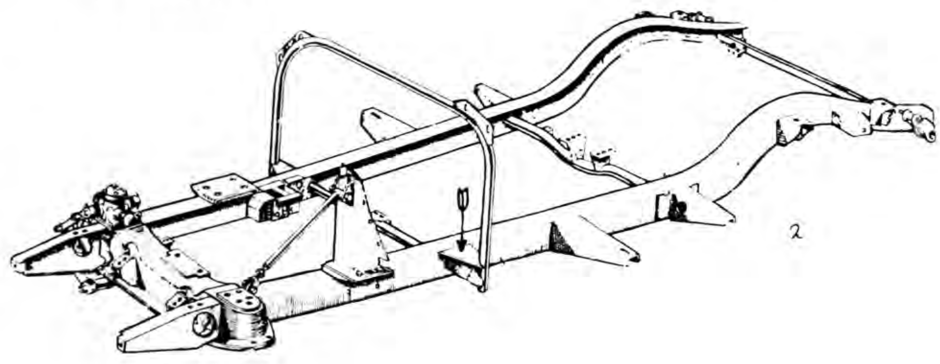
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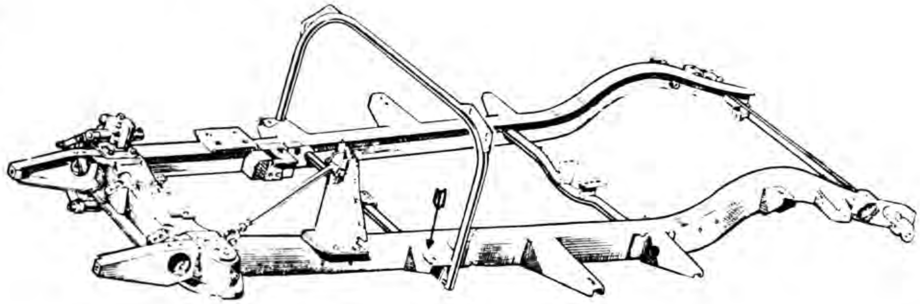
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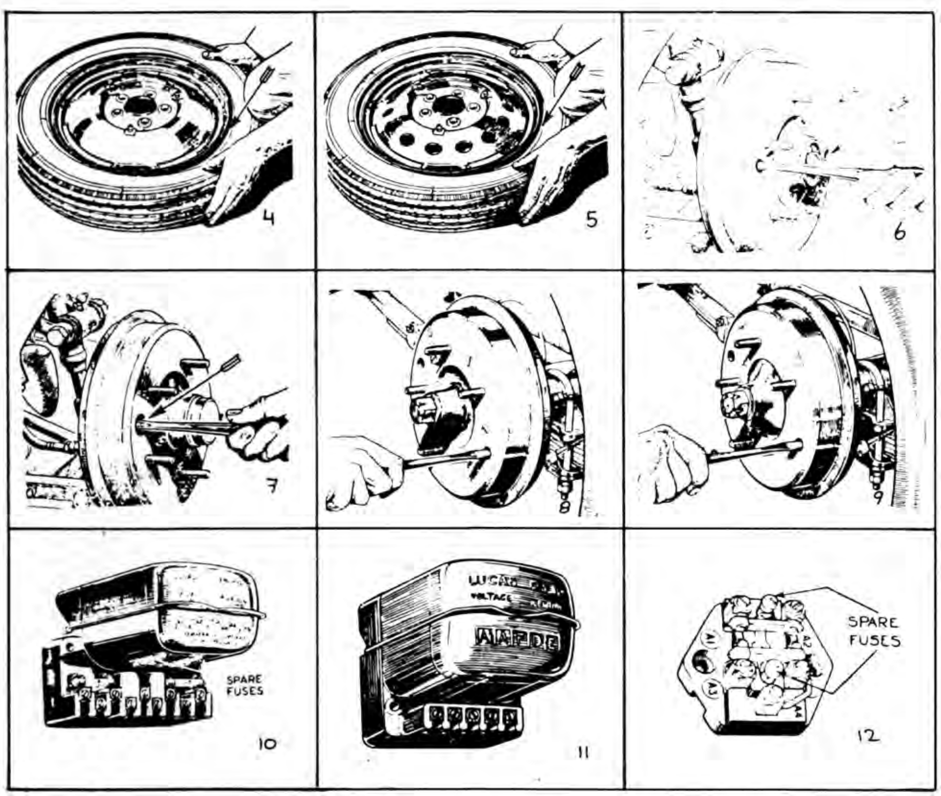

**TD 20749** (Oct. 9, 1952): An extra body mounting point was added to each side of the frame (fig. 3).
**TD 21303** (Oct. 24, 1952): The rectangular rear lamps (fig. 21) were replaced by round lamps mounted on chromed plinths (fig.22). The rear fenders were modified to suit.
**TD 22251** (Nov. 20, 1952): Commencing with this chassis and engine number XPAG/TD2/22717 the original cable-operated clutch linkage (fig. 23) was replaced by a simpler rod (fig. 24), and a stop bolt was added to the pedal bracket on the chassis to limit clutch pedal travel.
**TD 22315** (Dec. 4, 1952): On TDs for North America only, directional signals became standard equipment. A self-cancelling control switch was mounted under the facia on the driver's side. The circuit required a new wiring harness, a flasher, a brake switch override relay, dual-filament bulbs in the sidelamps, and an indicator lamp (fig. 19D) on the instrument panel. On cars for other markets the empty indicator light hole was covered by a small button.
**TD 22407** (Nov. 24, 1952): The floorboard design was changed, but how and why are not clear.
**TD/c 22613** (Dec. 1, 1952): A special trim package was introduced on the TD Mark II only. See Mark II section of this article for details.
**TD 25973** (Mar. 11, 1953): The original outer tie rod ends (fig. 27) were superceded by a new design with improved seals (fig. 28).

In addition to these changes there were several others for which no chassis numbers are recorded. One which continues to worry many TD owners involves the dampers. The vast majority of TDs left Abingdon with Luvax Girling dampers (figs. 29, 31) but later were replaced by Armstrong. (figs. 30, 32). On most Armstrong-equipped TDs the front wings were dimpled to provide clearance over the taller dampers, and I have been told (but cannot verify) that the chassis bracket for the engine stabilizer link was also modified as a result of the new dampers. The *Service Parts List* shows both types of dampers, but does not tell us when the switch from Girling to Armstrong was made. Nor does it list the modified front wings and engine stabilizer bracket. The change was apparently made some time during 1953, but exactly when is unknown.

Another worrisome design change involves the headlamps. On some TDs they are chromium plated all over, while on others the main shell is painted body color and only the rim is plated. Many experts claim that early TDs should have plated headlamps and late ones should have painted ones, but no-one agrees on the correct dividing line between early and late. Other experts are equally certain that early cars had plated lamps, middle ones were painted, and late ones went back to chrome again, but they are fuzzy about the definition of early, middle and late. This argument has been going on for years and may never be

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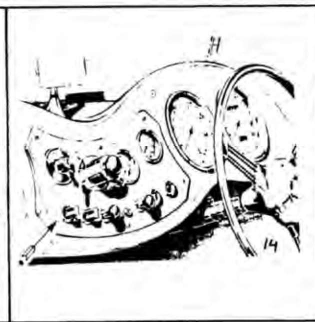
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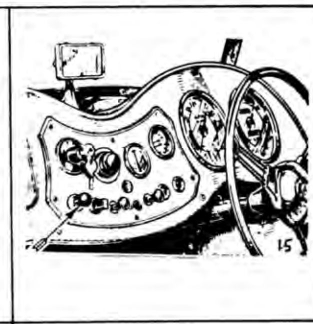
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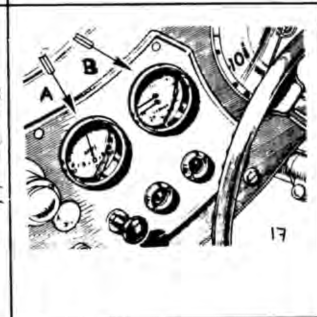

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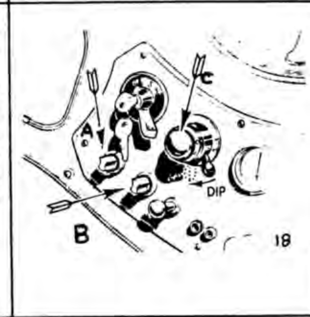

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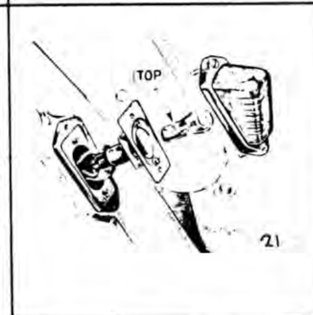

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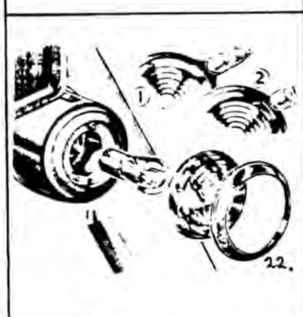

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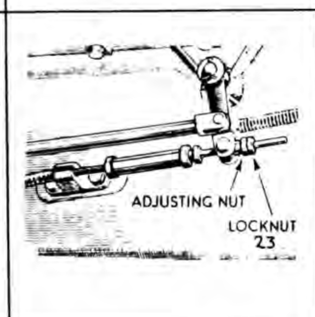

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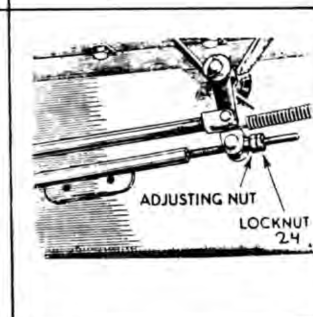

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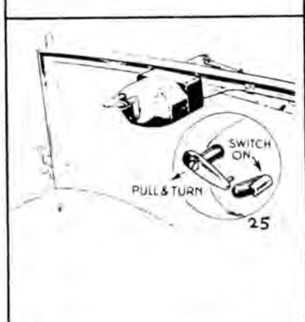

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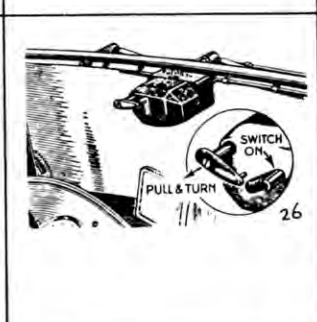

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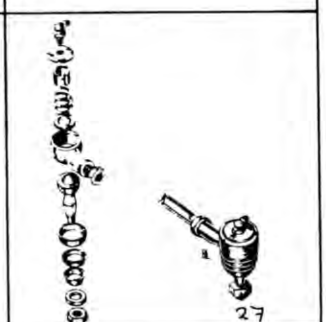
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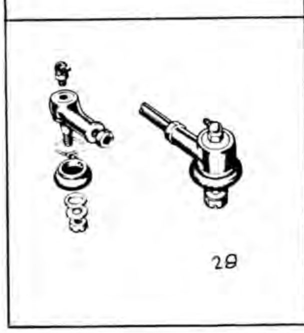
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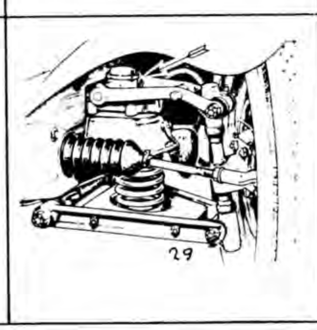
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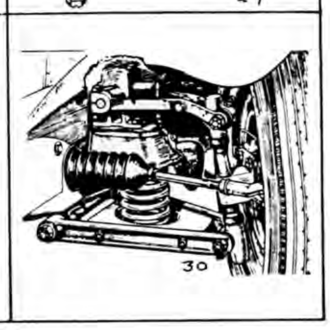
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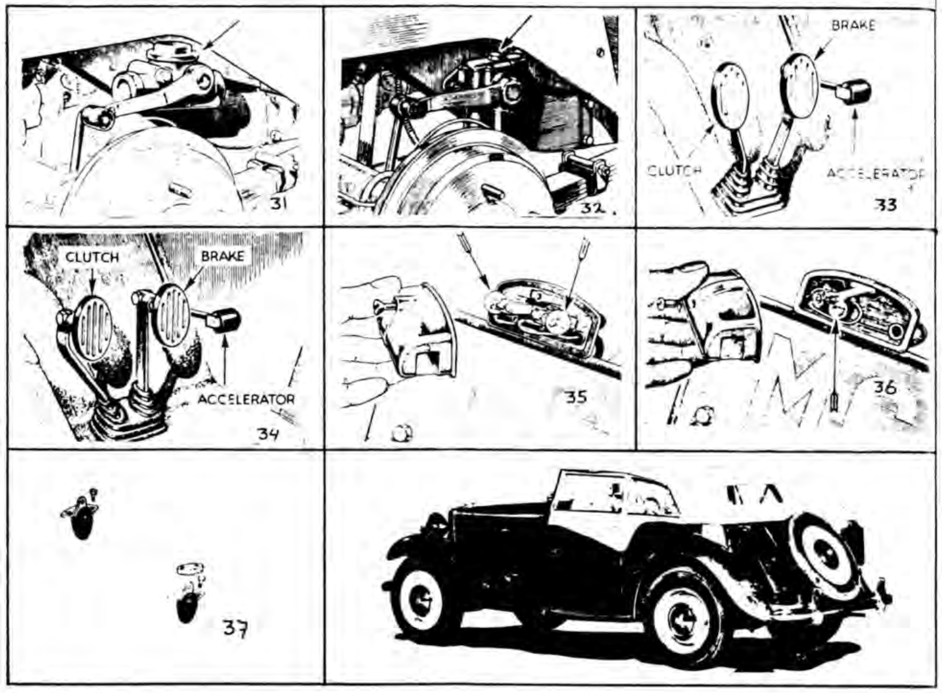
resolved. The *Service Parts List* is no help, because it shows both types as commencing from TD 0251. It does list a change at TD 26180, but it is not clear just what that change was. For what it is worth, the parts numbers listed for plated and painted lamps are the same from that time on. Interesting, but inconclusive.

There were other less controversial changes as well. For example, at some unrecorded time the original front suspension rebound rubber was deleted in favor of a new design requirng an extra spacer (fig. 37). At another time the arms for the clutch and brake pedals were redesigned and spacers were inserted between the arms and the pedals themselves (figs. 33, 34). Still another unrecorded change was from the original dual-bulb license plate lamp (fig. 35) to a similar design using only one bulb (fig. 36). There were probably other unrecorded changes of which I am not aware.




## MARKET VARIATIONS

Prior to World War II M.G.s were built primarily for the Home Market, and were equipped to suit the tastes of the British motorist and the regulations of the Ministry of Transport. Only about fifteen percent of M.G.'s pre-war output was exported, and it was left up to the foriegn dealers and owners to modify the cars if different tastes and regulations prevailed in the country of destination.

After the War, under the Board of Trade's "export or perish" doctrine, the picture changed dramatically. Ten thousand TCs were manufactured between 1945 and 1949 and no less than sixty-six percent of them were exported, so Abingdon had no choice but to pay at least token attention to the needs of the export markets. This resulted in the production of four versions of the TC, each differing slightly from the others according to the needs of the market for which it was intended. Still, the TC was a pre-war British design, and what changes were made on export cars were only the bare minimum required to conform to overseas motor vehicle regulations. Little or no concession was made to the tastes of potential buyers.

The TD represented a dramatic change in policy for M.G. Historians differ on the exact figure, but at least ninety percent of all TDs were exported. Abingdon could no longer ingnore the needs of the export markets, so the TD was designed primarily to satisfy those needs. Consequently there were at least seven export versions produced in addition to the Home Model.

The TC seems to have been the first M.G. for which special market codes were used to identify export cars. A TC/EXR was a General Export car, right hand drive, with a speedometer calibrated in miles. A TC/EXR/K was the same thing, but with a speedometer calibrated in kilometres. Beginning in late 1948, the designation TC/EXU was used for cars specially equipped for the United States market. However, with the exception of the EXU code, these market codes never appeared on the cars or in the daily production records in conjunction with the car numbers.

With the introduction of the TD in 1949 the system of market codes was expanded and most of the codes were now stamped on the vehicle identification plate or "maker's plate" as part of the car number. Only TDs built for the Home Market lacked a market code on the maker's plate; a typical Home Market car number might be simply TD 20696, which is nothing more than the serial number of the chassis. On the production records the code "H" occasionally appears, apparently indicating a Home Model car, but this seems never to have been stamped on the maker's plate.

On the maker's plate of an export car, however, the market code is added to the serial number of the chassis to create a complete car number. A typical export car number might be TD 9769 EXL, for example. To simplify farther explanation of the market codes, we will have to arbitrarily divide the export models into two groups: General Export and U.S. Export. Actually this breakdown is not entirely arbitrary, because these terms occasionally appear in official factory documents.

General Export cars were intended for sale to most of the world outside the British Isles, with the exception of the United States and Canada. On General Export cars the market code stamped on the maker's plate was always either EXL or EXR, standing for Export Left hand drive and Export Right hand drive respectively. There was nothing on a General Export TD's maker's plate to indicate exactly where the car was meant to be sold, so a TD/EXL or TD/EXR might show up almost anywhere in the world.

However, on production records and other internal documents we occasionally find other codes used in conjunction with General Export cars. For example, an EXR would normally have a speedometer calibrated in miles because most EXRs were exported to Commonwealth countries. If, however, an EXR was intended for shipment to a country which used right hand drive cars but had accepted the metric system, then the speedometer would be calibrated in kilometres, and this car was known within the factory as an EXR/K. Similarly, most EXLs were intended for sale in Europe and were equipped with metric speedometers, but if instead a speedometer registering miles was used then the car was known within the factory as an EXL/M.

For those of you who like to keep track of numbers and dates, the first General Export TD was an EXR/K type, designated TD 0332 EXR and built on December 20,1949. The first plain EXR was TD 0549 EXR (Jan. 24,1950), the first EXL was TD 0350 EXL (Jan. 3, 1950), and the first EXL/M was TD 0847 EXL (Mar.1, 1950.

There were other codes which were used during the TD years, but these also seem never to have been used anywhere except on internal documents. For example, an EX/DA car was a drive-away chassis, apparently unbodied. It is probable that Arnolt M.G.s and other custom-bodied TDs originated as TD/EX/DAs. Other codes seen on internal documents include EXE (Eire), EXN (New Zealand), EXNL (Netherlands), EXSA (South Africa), and EXM (Mexico). All of these cars would normally show only EXL or EXR on the maker's plate.

The export market codes used for cars intended for the United States were slightly different. There is some indication that the first few TDs exported to the States carried the EXL code, and it would seem logical to assume that these were EXL/M versions of the General Export model. The next few cars for the States used the code EXU, obviously standing for **EX**port **U**nited States. The first TD/EXU was TD 0443 EXU, manufactured on January 12, 1950. Note that there is no indication whether this car was left or right hand drive. Then, in March 1950, the code for U.S. export cars was changed to EXLU or EXRU, depending on whether the car in question was right or left hand drive. The first of each type were TD 1014 EXLU (Mar. 20, 1950) and TD 1102 EXRU (Mar.28, 1950).

Still later the designation for the United States was changed to EXL/NA, standing for **EX**port **L**efthand drive **N**orth **A**merica. The first example of this type was TD 7781 EXL/NA, produced May 18, 1951, and this designation remained in use from that date until the end of TD production. Whether or not there were ever any EXR/NA cars is uncertain.

This relatively complex system of market codes might lead us to believe that there were major differences between the various types, but such is not the case. The only major differences which could be attributed directly to the market for which each car was intended were those related to whether the car in question was right or left hand drive. The change from right to left hand drive obviously necessitated alterations to the steering gear, pedal mounting, instrument panel and facia, wiring harness and sundry other items, but for the most part these were changes in the location of parts rather than in the type of equipment used.

Aside from this, and aside from the evolutionary changes discussed earlier, all TDs remarkably alike regardless of their intended destination. The only other differences which can be found in the *Service Parts List* involve the wattage of the headlamp bulbs and the manner in which they dip (vertically, down and to the left, or down and to the right).

The difference between a TD/EXLU and a TD/EXL/NA is even more elusive. As far as can be determined from the *Service Parts List* there was no difference. Why, then, did the factory bother to change the market code? Could it have been that cars bound for Canada were included in the EXL/NA group, but had not been included in the earlier EXLU and EXRU groups? This theory has been put forth, but not yet proven.

## PAINT & UPHOLSTERY COLORS

The earliest TD road tests listed color choices identical to those which had been offered on the TC: red, green, ivory, blue or black paint with red, green or beige upholstery. Several advertising brochures issued during 1950 confirm this. The only change from the TC color lineup was apparently that green cars could no longer be had with green upholstery. Therefore, the complete color chart for the very early TDs was as follows:

| BODY | UPHOLSTERY |
|---|---|
| M G Red | Red or Beige |
| Almond Green | Beige |
| Ivory | Red or Green |
| Clipper Blue | Beige |
| Black | Red, Green or Beige |

In late 1950 or early 1951 two new colors were added. The exact date of the additions is not known, but now the lineup looked like this:

| BODY | UPHOLSTERY |
|---|---|
| M G Red | Red or Beige |
| Autumn Red | Red or Beige |
| Almond Green | Beige |
| Ivory | Red or Green |
| Clipper Blue | Beige |
| Sun Bronze | Red or Green |
| Black | Red, Green or Beige |

At this point in time the picture becomes a bit scrambled, and remains so until early 1953. During this period Autumn Red and Sun Bronze paint and Beige upholstery all disappeared from the lineup, but we do not know exactly when each was dropped. Also during this period Clipper Blue was replaced by Silver Streak Grey, and Almond Green was replaced by the darker Woodland Green, but again the dates are not known. At any rate, by 1953 the color choices had been narrowed down to the following, and seem to have remained this way until the end of TD production:

| BODY | UPHOLSTERY |
|---|---|
| M G Red | Red |
| Woodland Green | Green |
| Ivory | Red or Green |
| Silver Streak Grey | Red |
| Black | Red or Green |

All factory literature describes the paint used on these cars as cellulose or cellulose enamel, which has led many american owners to the conclusion that enamel is the only correct paint for an authentic restoration. This is not the case at all. The paint described in the manuals as cellulose enamel is what we Americans know as nitrocellulose lacquer.

The paint originally used by M G was ICI-Belco, manufactured by Imperial Chemical Industries, Ltd, then as now the major supplier of paint to Britain's automobile manufacturers. Belco paints are not readily available in the United States, but several of our domestic manufacturers can supply very good approximations of the original colors. Modern equivalents from Ditzler and Rinshed-Mason seem to be the most widely accepted, and their code numbers for each color are as shown below.

The codes listed below are for modern acrylic lacquer, not for the original nitrocellulose lacquer. At the time of this writing I have not found a source of nitrocellulose lacquer in the correct colors. Although the color may be nominally the same, no acrylic color will look exactly like the same color in nitrocellulose. The differences are difficult to put into words, but have to do with clarity and brilliance. My own impression, when comparing the two, is that looking into the depths of a well-done nitrocellulose lacquer paint job is like looking into a pool of slightly cloudy water; you can see the bottom, but it's a bit murky. Acrylic lacquer, on the other hand, reminds me of a pool of crystal clear water. A strange way to describe it, perhaps, but as I said it's hard to put into words.

Unlike most of Abingdon's pre-war products, post-war T Series cars could not be ordered with non-standard paint or upholstery colors, or with non-standard combinations of the standard interior/exterior color schemes. This was the official policy, but many people believe that unofficially the Company would provide non-standard colors for preferred customers. Even if this is true, and there is some doubt, it is unlikely that many TDs left

| COLOR | DITZLER | RM |
|---|---|---|
| M. G. Red | DDL 71993 | BM 121R |
| Autumn | DDL 50930 | BM 108R |
| Almond Green | DDL 44159 | BM 076 |
| Woodland Green | DDL 2246 | BM 078 |
| Clipper Blue | DDL 12297 | BM 042 |
| Silver Streak Grey | DDL 72030 | |
| Ivory | DDL 81271 | BM127 |
| Sun Bronze | DDL 23662 | |

Abingdon with non-standard paint jobs. It is known, however, that some American dealers repainted new TDs, sometimes at the customer's request and sometimes to try to increase the sales appeal of a car.

## INTERIOR DETAILS

The seats and interior panels were trimmed in a combination of leather and leathercloth. The seats are usually described as being leather, but only the front of the seat back and the top, front and outboard side panels of the seat bottoms were real leather. The rest of the seat covering was leathercloth. With the exception of the top edges of the map pockets, all the rest of the interior trim was leathercloth.

Even the facia was leathercloth covered; TDs did not come from the factory with polished walnut facias. The metal instrument panel in the center of the facia was painted bronze-tan, with a chromed bead showing around the edge. A leathercloth-covered "scuttle masking board" extended from the bottom of the facia forward to the firewall, covering all the wires, control cables and other clutter behind the facia. Many of these masking boards have disappeared over the years, discarded by owners who wanted quick access to the wiring.

Incidentally, the "leathercloth" originally used in these cars was not what we used to call "oilcloth", although many writers have described it as such. True oilcloth is a woven fabric coated with a thin layer of something very much like oil-base paint. Leathercloth, of which Rexine was the brand favored by M G, was similar except that the coating was PVC, more commonly known today as vinyl. The original material is difficult to match today, because even the cheapest vinyl on today's market is usually thicker and softer than the original.

The floor of the car was covered with black carpet having a short, cut pile, laid over rubberized felt padding and secured by lift-the-dot fasteners. The toeboard, driveshaft tunnel, brake cable cover and gearbox cover were also carpeted, but the luggage compartment floor was not.

The top and side curtains were of tan canvas material attached to metal frames painted a matching tan. The tonneau cover was sometimes tan canvas, sometimes black vinyl, and covered only the area behind the seats. The front of the cover tucked over the tonneau rail on the seat back, and was secured at the front by elastic straps. It was secured to the sides and rear of the body by snap fasteners.

## ENGINE COMPARTMENT DETAILS

By the time the TD came into being, Abingdon (or more properly, the Morris engines plant) had standardized the familiar deep red as the color for all XPAG engines. Several of the T Series parts suppliers offer spray cans of engine enamel in approximately the right shade of red. If you prefer to use your own spray equipment or even a brush, try Ditzler DQE 50782Y, Dupont 5321DH, Sherwin Williams J3126-R, or Acme AC419. These are not true engine enamels, but will hold up very well on any engine part except the exhaust manifold.

Most of the small parts attached to the engine were painted red, but some were painted black on occasion. The factory was not very consistant about the coloring of the smaller parts, so a small bracket might be red on one engine and black on another. The following is offerred as a general guide, but should not be considered infallible:

**DEEP RED:** Cylinder block, cylinder head, cylinder head rear cover, water outlet, tappet cover, intake manifold, sump, timing chain cover, breather pipe and clamp, engine bearer plate, front motor mount bracket, clutch housing and inspection plate, water pump and pulley, oil pump, water branch pipe, gearbox and gearbox lid.

**BLACK:** Air cleaner, generator, starter, fan blades, clutch operating rod and levers, clutch and throttle return spring brackets, driveshaft flange on gearbox, engine stabilizer link brackets, exhaust pipe bracket on gearbox, and exhaust pipe.

**RED OR BLACK:** Generator pulley and fan, generator mounting brackets and adjusting link, breather tube support bracket, thermostat and bypass elbow, oil filter mounting brackets and strap, pipes to and from filter (early TD), crankshaft pulley, and fan blade spacer.

**GREY-GREEN:** Rocker Cover.

**NATURAL ALUMINUM:** Gearbox remote control housing, air cleaner manifold. In rare cases the sump, timing chain cover and clutch housing were left unpainted.

**NATURAL BRASS & COPPER:** Drain plugs, plug in block above oil pump, and the copper oil line to the head were sometimes left natural, sometimes painted red.

**CADMIUM PLATING:** Oil filler cap and chain, gearbox dipstick, clutch cable (early cars), engine stabilizer link, hose clamps.

**CHROMIUM PLATING:** Engine dipstick, gearshift lever.

**ALUMINIZED:** The exhaust manifold and manifold clamps were metalsprayed with an aluminum coating.

**MISCELLANEOUS:** Several items of engine equipment were supplied by manufacturers outside the Nuffield Organisation, and these suppliers could not be counted on to stay with any particular color scheme. Throwaway oil filters as used on the early cars were supplied by Wilmot-Breeden, Purolator, Tecalamit, Fram and others in a wide variety of colors. The cannister-type filters with replaceable element used on later cars were usually from Purolator, and were usually a metallic green. A few came from Tecalamit, and in this case the cannister body was coppery brown with an identification and instruction plate riveted on. The thermostat was from Smiths, and was often painted engine red. Sometimes, however, it was left whatever color Smiths was using at the time (usually black).

Most of the sheet metal inside the engine compartment was painted to match the car's exterior color, although in many cases the toeboard at the bottom of the firewall was painted black regardless of body color. The radiator and its support rods were black, as were most of the pipe clips, wiring clips and miscellaneous small brackets under the bonnet.

## CHASSIS DETAILS

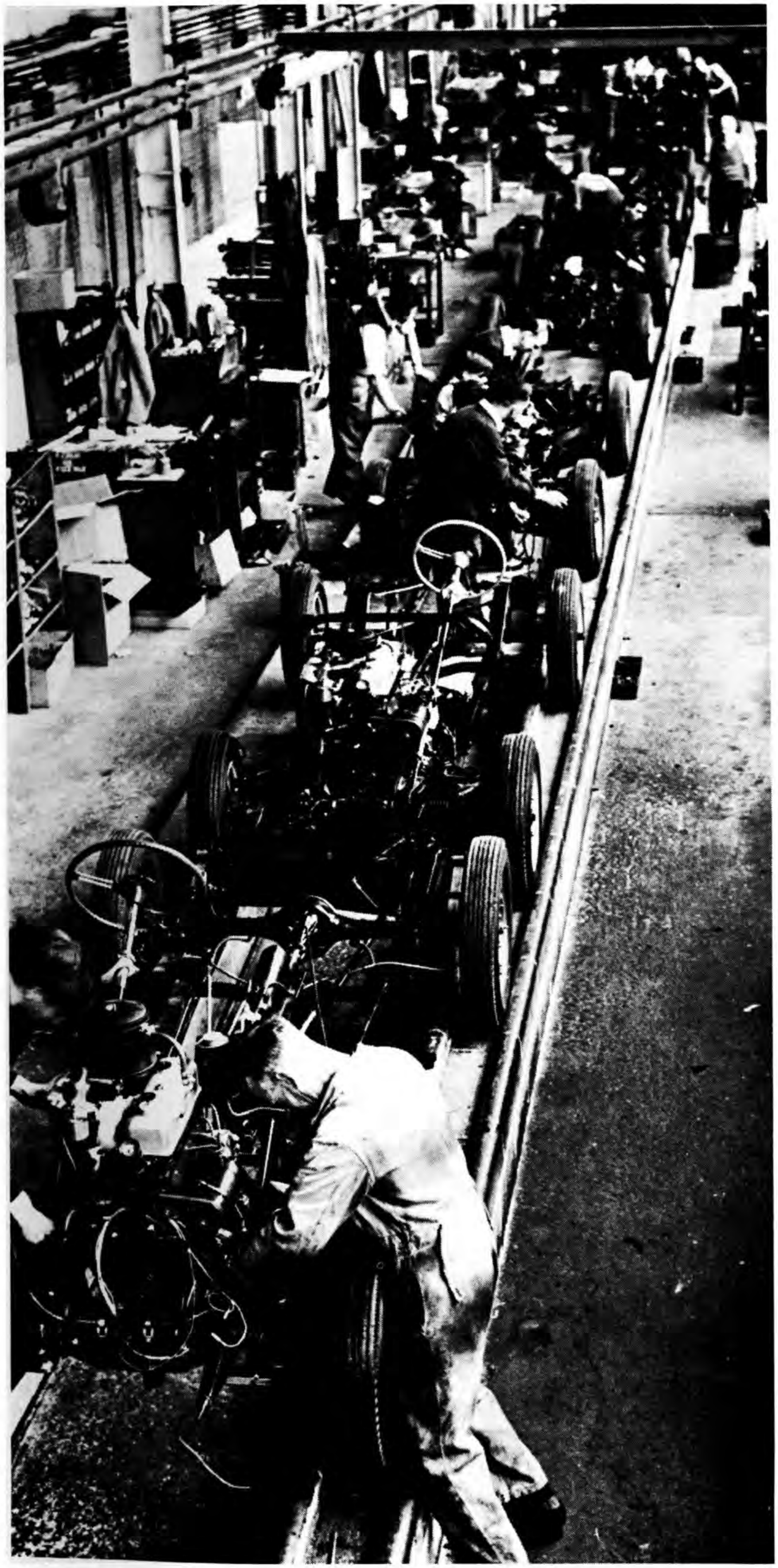
The TD chassis frame was always painted black, as were most of the componants attached to it. An itemized list of parts which should be black would be extremely long, so try this approach: Remove the body, the fenders, the running boards, the splash aprons, and any miscellaneous sheet metal from the chassis. Also remove the radiator shell and grille, the engine and gearbox, the wiring harness, the handbrake lever, the bumpers and the wheels. The chassis and everything still attached to it should be black.

The radiator grille was usually painted to match the upholstery color, but was sometimes painted to match the exterior body color. Which grille color was chosen for any given car may have depended upon the interior/exterior color combination used on the car, but this is by no means certain. With the exception of those on late examples of the TD Mark II, TD grilles were never chromium plated.

## OPTIONAL EQUIPMENT

Concours judges and show-oriented owners love to argue about whether certain accessories are factory options, dealer-installed options or aftermarket accessories, and about which, if any, are acceptable on a concours car. Many owners have written to ask whether or not a certain accessory is "original", but in most cases all I can say is maybe, depending on the owner's interpretation of the word original. When asked whether a part is a factory option, a dealer-installed option, or an aftermarket accessory, my answer becomes even more vague. The dividing lines between these catagories are fuzzy at best, and are sometimes nonexistant.

Section "P" of the *TD Service Parts List* contains two pages of factory-offerred accessories. Included in the list are such goodies as luggage racks, double spare tire carriers, wider wheels, badge bars, foglamps (Lucas SFT 462), a combined oil pressure and water temperature gauge for retrofitting to early TDs, an oil temperature gauge, special soft Girling dampers, Andrex



friction dampers, and alternate rear axle ratios (4.875:1 & 4.555:1).

Section "R", which lists TD Mark II parts differing from standard equipment, also lists many special tuning parts which were not standard on any TD, Mark II or otherwise. Here we find high compression pistons, special carburetors for supercharger installations, a Lucas 4VRA magneto, competition head gaskets, flexible oil pipes, special distributors, sodium-cooled exhaust valves, competition clutches competition cams, a manual ignition advance control, and other bits of exotica.

All of these items were supplied by the factory, but which, if any, could actually be ordered from the factory with a car attached? Almost none of them, as far as I can determine. All of these special parts could be ordered through a dealer and installed by the dealer or the owner. In other words, all the items listed above can be considered factory options, dealer options or aftermarket accessories, depending on how you look at it. Very fuzzy!

By the time the TD was in its ascendancy, there were dozens of manufacturers here and abroad specializing in aftermarket accessories and speed-tuning parts for sports cars. Most of these items could be ordered by the TD owner from mailorder outlets, but many M. G. dealers also carried the same accessories in stock and would install them on a new car before delivery at the request of a customer. Are these dealer-installed or owner-installed accessories? Does it really matter? It is futile to try to make such distinctions. Remember, only pigeons fit in pigeonholes.

There is one piece of so-called optional equipment, however, which needs closer scrutiny: the wire wheel. Many claims have been made to the effect that wire wheels could be had on the TD, either direct from the factory or as factory-supplied add on equipment. There is no evidence that a TD could be ordered with wire wheels. Wire wheels are not mentioned in the *Owner's Manual, the Workshop Manual,* the *Service Parts List,* or any known TD advertising brochure, nor are they mentioned in any contemporary road tests in the motoring journals.

There is also no evidence that wire wheel conversion parts could be ordered from the factory while the TD was still in production. However, this changed after the TF went into production. The TF could be ordered with wire wheels, and since the TD and TF shared most mechanical components it was an easy matter to convert a TD to wire wheels using TF parts. In fact, the factory even issued a service bulletin listing the TF parts needed for the conversion, and supplied a special kit for converting the spare wheel carrier. In the strictest sense, wire wheels are not original equipment on a TD, but they did become a factory-approved modification after the TD went out of production. If that means "original" to you, so be it.

## THE ELUSIVE MARK II

A short time after the TD went into production, the factory answered demands for more power and better handling by introducing a slightly modified version known as the TD Mark II. The Mark II was not radically ;different from the standard TD. In fact, most of the differences could not be seen unless you happened to look under the bonnet or peer around under the fenders. Never the less, those differences plus the low number actually produced make the Mark II the most sought-after of the TDs.

Quite a large body of legend has grown around the Mark II over the years, and as is true of any legend the "facts" contained therein are often contradictory, vague, or outright products of the imagination. Let's look at some of these "facts" and compare them to the car as it really was.

**IDENTIFICATION:** Many a TD owner has been disappointed to learn that the "XPAG/TD2" prefix on his engine number does not mean that the car is a Mark II, but others still are not aware of this fact. The only difference between an XPAG/TD and an XPAG/TD2 is that the latter uses a larger flywheel, clutch and clutch housing than the former. This has nothing to do with whether the car is a standard TD or a Mark II.

Mark II engines follow the same engine numbering sequence as the standard engines. Up until engine number 9408 all TD engines had the small clutch and carried the prefix XPAG/TD in front of the engine number. At engine number 9408 the large clutch was introduced on both models, and the engine number prefix was changed to XPAG/TD2. Then, at engine number 17029 the prefix for Mark II engines was changed to XPAG/TD3 while the standard engine continued as XPAG/TD2. Until that time there was no code in the engine number to set the Mark II engines apart from the others. However, the picture is confused a bit by the fact that some Mark II engines built during the transition period show the TD2 prefix on the engine itself but have TD3 stamped on the maker's plate, with the number itself identical in both places. Thirty years of engine swapping doesn't exactly help, either. The fact that your engine is or is not an XPAG/TD3 does not ncecssarily mean that your car is or is not a Mark II. Clear as mud! In the long run, the engine number is not a safe way to identify a Mark II.

It is also not valid to assume that a car is a Mark II simply because all the Mark II goodies are in evidence on the engine and chassis. Every one of the special Mark II parts could be purchased and installed on a standard TD, and for all practical purposed the resulting car was a Mark II. Purists will claim that such a car is only a Mark II replica, not the real thing. On the other hand, there are a few Mark IIs around from which some or all of the special Mark II equipment has been removed, but I've never heard the purists insist that these cars are standard TD replicas. We'll leave such arguments to those who have nothing better to do.

There is only one foolproof way to tell for sure whether a TD began life as a Mark II or not, and that is to look at the car number. All standard TDs carry the prefix "TD" in the car number. On all Mark IIs the prefix is "TD/C". It's as simple as that.

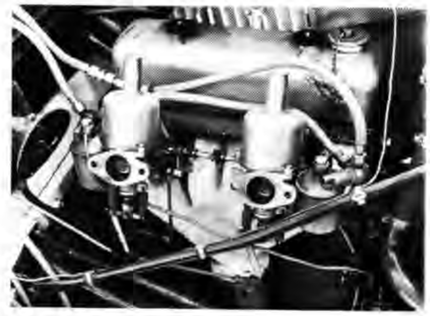
**PRODUCTION STATISTICS:** Several writers have stated that the first Mark II was not produced until some time in 1952, and that only forty to fifty were built in all. One need only look through the Register's membership listings to learn that both claims are incorrect. The 1952 starting date probably arose from the confusion between XPAG/TD2 and TD Mark II, but I cannot imagine where the low total production figures came from.

According to the daily production records, the first Mark II to come off the assembly line was TD/C 1123 EXR, built on May 8, 1950. The last was TD/C 29909 EXL/NA, which left the assembly line on August 17, 1953. At the time of this writing we do not have a confirmed total for Mark II production, but the figure 1022 has been put forth by several authorities and seems to be fairly accurate. Perhaps someone will find the time to go through the daily production records and count them all, but that will be a long, dreary job.

**DESIGN CHANGES:** The Mark II was assembled at Abingdon right along with the standard TD, and underwent the same design changes described earlier in this article. When the standard TD changed, so did the Mark II. Similarly, all earlier comments regarding market variations also apply to the Mark II.

**THE ENGINE:** We often hear it said that the Mark II engine was a race-tuned version of the standard TD engine, and indeed some advertisements and road tests which appeared during the TD era made such claims. In reality the Mark II engine produced 57 h.p. as opposed to the standard 54 h.p., and this hardly qualifies the engine for a "race-tuned" label. By racing standards the Mark II engine was quite mild. Even so, those three extra horses represented a 5 1/2% increase in power, and the effect on the car's performance was quite noticeable.

The methods employed to obtain that increase were entirely orthodox. The compression ratio was raised from the standard 7.25:1 to 8.1:1. This accounts for most of the power increase, especially at lower speeds. The engine's ability to breathe at high speeds was improved by fitting 36mm intake and 34mm exhaust valves in place of the standard 33mm and 31mm valves. The original SU type H2 (1 1/4") carburetors were replaced by H4 (1 1/2") units bolted to an enlarged intake manifold. Incidentally, these were not the same as the H4 carburetors later used on the TF. The first Mark IIs retained the standard TD air cleaner, but later a larger version of the same design was adopted. Most Mark II engines used the standard TD distributor, but late examples had a new unit with a revised advance curve better suited to higher compression ratio.



These were the only major differences between the standard XPAG and the Mark II version, and for the most part they affected only the cylinder head and the induction system. The cylinder block itself and all its component parts were identical to those used on all TD engines. Contrary to what you may have heard, the Mark II engine did not have oversized cylinder bores, a racing camshaft, super-high compression ratio, trick porting and polishing, or special balancing and assembly.

This does not mean that additional speed tuning parts could not be had from the factory, nor does it mean that such goodies were not occasionally installed right on the assembly line. In fact, a notation in the daily production records tells us that TD/C 15098 EXR left the factory equipped with a supercharger, although there is no indication why this was done or for whom. Our examinationof the records has only just begun, so other oddities may come to light as we go along. However, with the exception of isolated examples like this, the normal, everyday TD Mark II engine was equipped as described above.

**THE CHASSIS:** Changes to the chassis were fewer, and happily these changes have only occasionally been the cause of controversy. The normal Luvax Girling hydraulic dampers were retained, but were assisted by an Andrex friction damper at each wheel. This improved the car's cornering ability somewhat, but also stiffened the ride. To ensure adequate fuel supply at high speed an extra pipe carried fuel from the tank to a duplicate fuel pump mounted beside the normal one. These were normal SU type "L" low pressure pumps, not high pressure pumps as has sometimes been claimed. In the rear axle an 8/39 ring and pinion set changed the final drive ratio from the standard 5.125:1 to a longer-legged 4.875:1. In spite of this taller gearing the Mark II could still out-accellerate the standard TD, thanks to the increased power output of the engine.

**THE BODY:** The first Mark II loaned out to the British automotive press for testing seems to have been outfitted with bucket seats and a few other special body parts, and this has led some owners to believe that all Mark IIs were originally so equipped. The truth is that the majority of the Mark IIs sold to the general public were outfitted exactly like the standard TD. There was no external distinction between the two models until fairly late in the game.

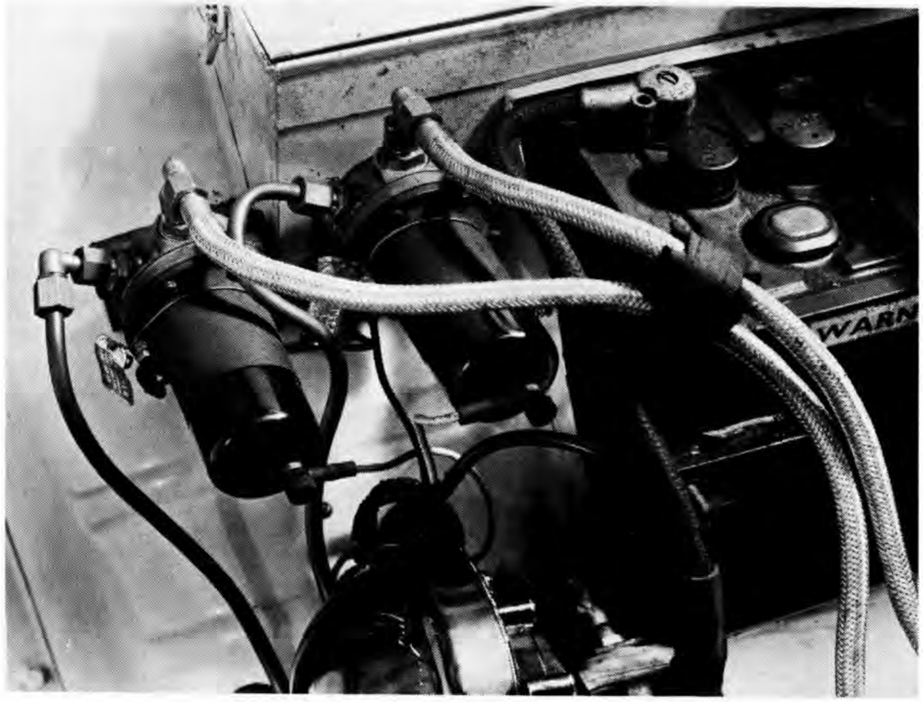
Then, at car number TD/C22613 (Dec. 1, 1952) a special "appearance package" was introduced to set the Mark II apart from the rest. The "new look" Mark II had a small bubble on the right-hand side panel of the bonnet to clear the enlarged air cleaner pipe which appeared at about the same time. A "Mark II" medallion was mounted on each side of the bonnet, and a similar medallion was mounted on the rear bumper. The octagonal radiator and spare wheel medallions, previously a brown "MG" on a cream background, were changed to black on white. The radiator grille, previously painted, was now chromium plated. A curved grab handle was mounted on the passenger's side of the facia. Still no bucket seats, though.

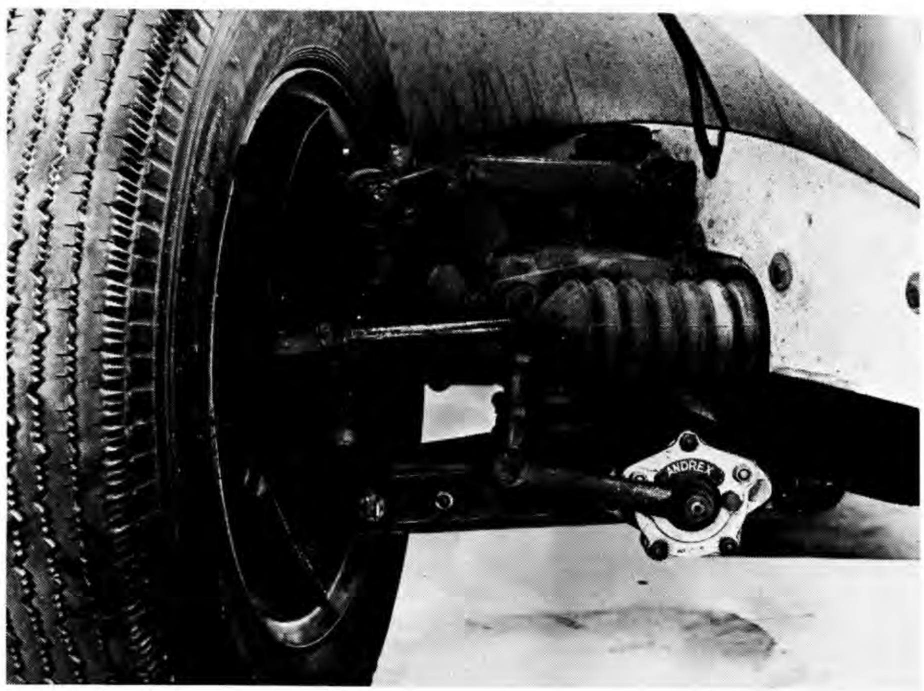
It is unusual to see a late Mark II with all these special items still intact. This is partly because so few Mark IIs were produced in the first place, and partly due to normal attrition. A big factor, however, is that some owners have changed over to standard TD body trim in the belief that the special Mark II trim items were not original. Perhaps this article will help to reverse that trend.

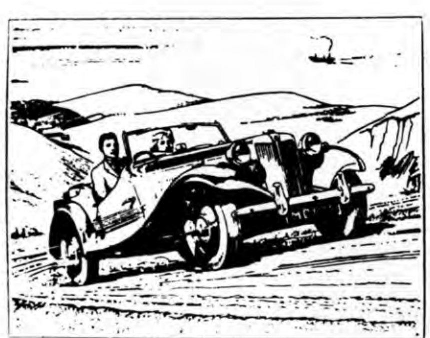
## CONCLUSION

The word "conclusion" is really misleading here, because an article of this sort can never be considered concluded. There are obviously great gaping holes in this article, partly due to lack of space and partly due to ignorance on the part of the author. There may also be mistakes; I would be the last to claim the title of final authority on the subject of originality. Never the less, the information presented here should put the would-be TD restorer on the right track. If additional information comes to light, or if corrections need to be made, this will be taken care of in future editions of "Technically Speaking".

Thanks to the M.G. T-Type Owners of Holland for providing the before and after illustrations which accompany the "Design Changes" section of this article. The illustrations are taken from official factory publications, and were used in an article similar to this one which appeared in the MGTTO's newsletter *Square Front* several years ago. Thanks also to a real enthusiast, who prefers to remain anonymous, for his hard work in digging dates and other useful information out of the daily production records.





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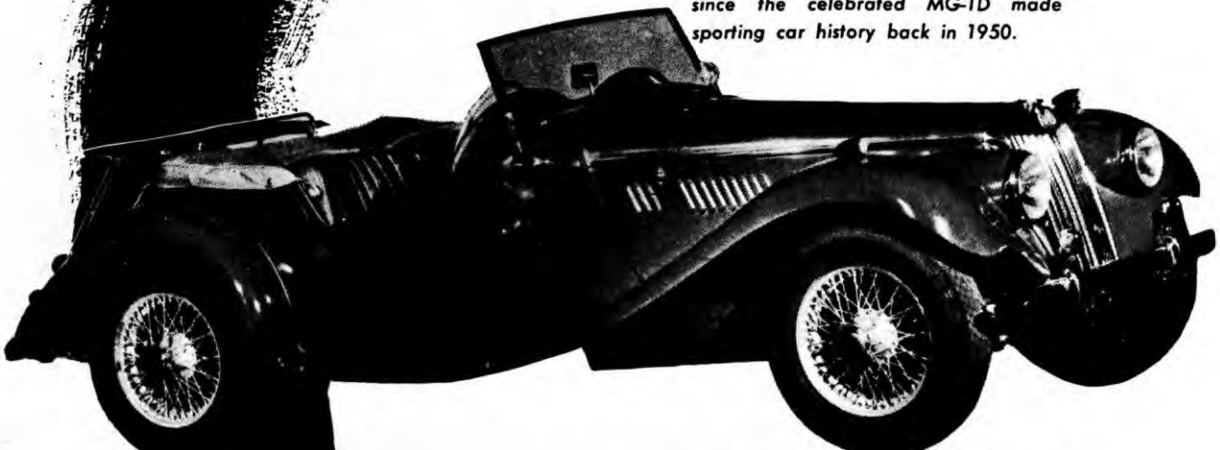

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# THE TF

by
Richard L. Knudson

"It's the best looking M.G. they ever made," says Syd Beer. But what does he know? He just has the world's largest collection of M.G.s that's all.

The TF was an attempt to update the aging TD to keep up with heavy competition in the sports car market from the likes of Morgan, AC, Triumph, Austin-Healey, and Porsche. Often called the last of the square riggers because it still bore a strong family resemblance to the pre-war Midgets, the TF really was not welcomed all that warmly by the American motoring press. One journalist irreverently remarked that it looked like a TD that had been kicked in the face. The late Tom McCahill, dean of road testers, wrote, " . . . the new MG-TF is a dyspeptic Mark II imitation that falls short of being as good as the Mark II." Poor press or not, the TF has endured and has earned a special place on the M.G. family tree.

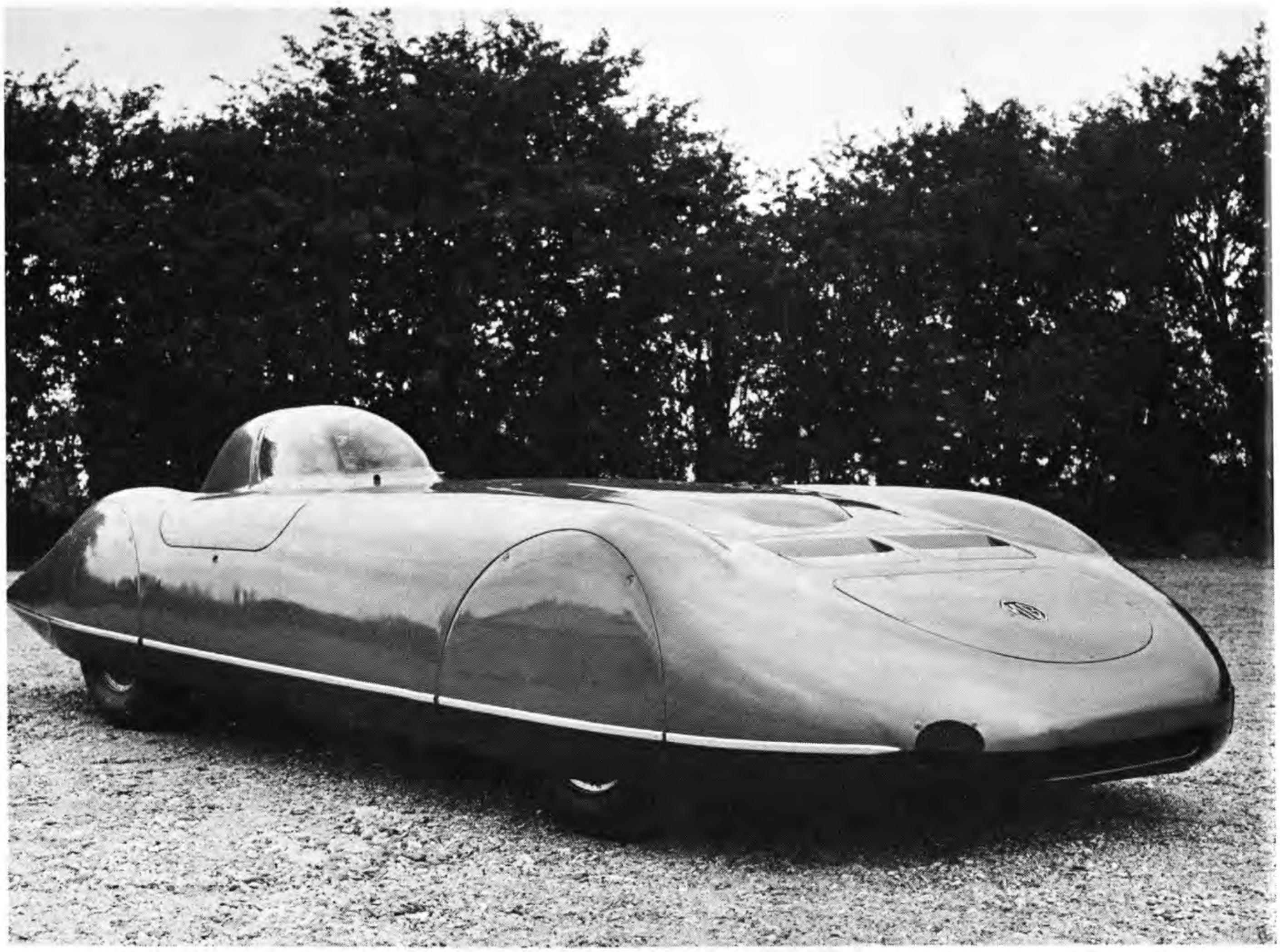
When M.G. was stripped of its racing department in 1935 at the time of the Morris takeover, they also lost another important department; their drawing office was moved to the main Austin plant at Cowley, just outside Oxford. To insure that the M.G. men at Abingdon had sufficient input took considerable diplomatic work. Happily, Cecil Kimber and Syd Enever were able to influence the design office, especially before the war. After the war, however, M.G. had to fight for survival and change.

The TC, of course, was based on the pre-war TB. It sold well. The TD was developed at Abingdon by Cecil Cousins (M.G.'s first employee), Syd Enever, Alex Hounslow, and Billy Wilkins. They took a bare Y-type sedan chassis off the line and put a TC body on it. It wasn't **quite** that simple because modifications had to be made; the important thing was that they had instant independent front suspension. After they had put the prototype together, they showed it to the ADO, got approval, and the TD was on its way. Three years later they got impatient again and took matters, literally, into their own hands.

Cecil Cousins recalled: "The TF was designed by myself and a couple of other foremen and a tin basher (panel beater) in a fortnight. We wanted something more modern because there were these sorts of pretty cars coming. The AC and various other things came along, and they wanted something similar to that. So we got hold of a TD and we said, 'All we got to do is lean the radiator back a bit . . .'

"We got a little chappie by the name of Billy Wilkins over. He was a wonderful panel basher, that chap. He literally handmade the first set of TF wings out of metal to our idea. We made it in a fortnight; there wasn't a drawing or anything. We made it by looking at it, virtually, and saying, 'Now this and that and the other . . . .' and we drove it to Marcham (a nearby town) and back. We had it outside the Managing Director's office when he came back off holiday, and that is how the TF was born. Then it took them six months to draw the blooming thing."

The TF might never have been necessary had Abingdon had its



way in the beginning. John Thornley, the Managing Director at Abingdon in those days, tells the story: "We wanted to get on to the MGA, which had grown out of special vehicles we had built under the counter for George Phillips to race at Le Mans, and we ended up with the vehicle which we have always called HM06, which was really the first prototype MGA — the pre-prototype — in that it was rather larger than the MGA ended up, and this was the way the car that we had to show to Len Lord (BMC chief) to say, 'This is what we want to build.' Unfortunately, we got to Lord three days after Donald Healey had got to him with his Healey 100, and Lord had made a deal with Healey that he would promote the Healey 100. In Lord's eyes the two cars were so similar that the MGA could not go ahead. So it was **that** that really produced the TF; that is, the pressure created by the killing of the MGA. It was going to be two years before we got the MGA drawings out again and really got the thing going."

That George Phillips 1951 Le Mans racer that John Thornley mentions was the famous UMG400. Using a TD chassis, Syd Enever designed a handsome aerodynamic body that proved to be the model for the MGA four years later. The streamlining and a bit of tuning improved performance a great deal, and Phillips could get in excess of 115mph out of the car. Unfortunately, engine trouble forced him out of the race.

While MGA fans may lament the decision that was made to delay the introduction of that model for two years, TF enthusiasts must be pleased that an error in judgment resulted in a facelifted TD that turned out to be one of the prettiest M.G.s ever made.

When the TD was introduced with disc wheels, the complaints from enthusiasts who loved the spidery wire wheels on previous Midgets were loud and pointed. Abingdon answered those cries by making wire wheels an option on the TF. It is possible to purchase the necessary parts to make the changeover, but be prepared to part with about a thousand dollars — beauty is cheap! The first TFs had the same 1250cc engine as was introduced on the TB; performance was less than sparkling. Again the works listened to the press and the enthusiasts and came up with a larger, 1500cc engine for the last 3400 TFs. This bigger engine improved performance greatly, and the relative rarity of the TF 1500 makes it more desirable today.

The engine received its public introduction in the record-breaking EX179 at the hands of Captain George Eyston and Ken Miles. Together they nailed down several American and international class records for M.G. Record breaking, of course, had been a tradition at Abingdon, and George Eyston was the major force behind almost every effort M.G. made over the years. EX179 used the new XPEG block which allowed an increase in bore from the XPAG's 66.5mm to 72mm. To increase the bore required a new block, in order to keep a reasonable cylinder wall thickness. The resultant publicity was helpful in the sales of the TF 1500 and the increased performance was welcomed by everyone.

The TF was almost an instant classic. When it was first introduced, the TC was already regarded with some reverence. The TF, then, was purchased to enjoy and keep. I say "keep" because the majority of buyers consciously or unconsciously realized that this was the last of the line. It is my theory that this preservation instinct resulted in a higher proportion of TFs surviving than any other popular Midget.

Is the TF the prettiest? Beauty, of course, is in the eye of the beholder — at least it has a proper badge.

# TECHNICALLY SPEAKING

F.E. Old III
Technical Editor

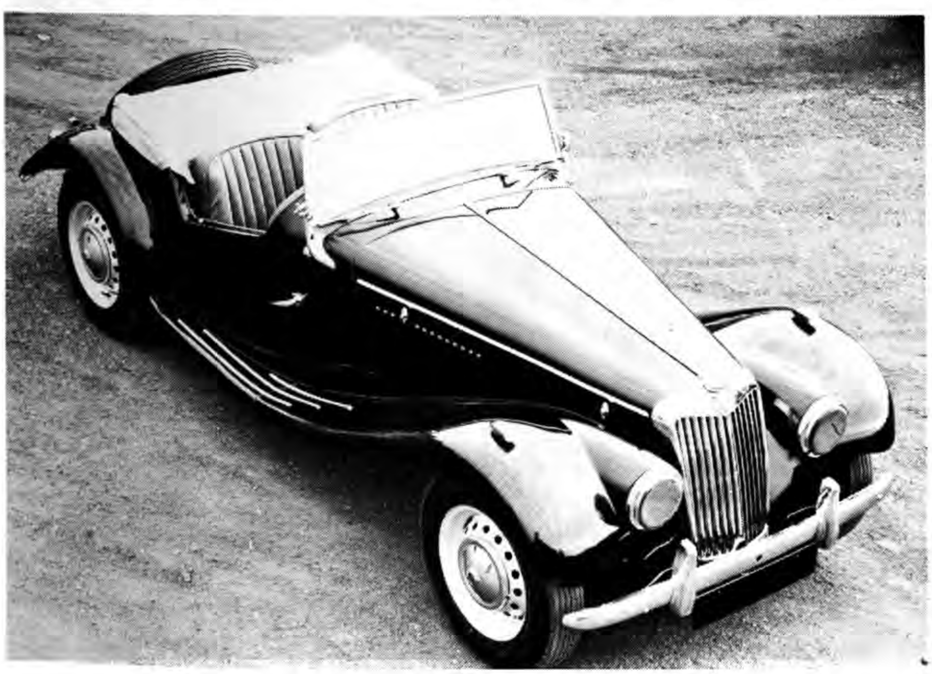
## POINTS OF ORIGINALITY: THE M.G. TF

This is the third in a series of articles dealing with points of originality most often asked about in correspondence received by the Technical Editor. The first, dealing with the TC, appeared in the August 1979 TSO, and a similar article on the TD appeared in the April 1980 issue.

In this article, as in the previous ones, we will not attempt to cover minute details such as which direction each bolt and cotter pin should be inserted through its hole, although I do occasionally receive questions of this nature. To go into such detail would require far more space than is available here, but even if space were available the unhappy fact is that we just don't know much about tiny details like that. If the factory ever bothered to record such things, those records seem to be lost forever. Because these cars were assembled by hand, not by automated machinery, small variations were common even when the cars were new. If someone tried to tell you which way a partiular bolt was inserted, chances are he would be right only fifty percent of the time.

Trustworthy information on originality, especially where the smaller details are concerned, is very hard to come by. From the factory we have the *TD/TF Workshop Manual* (AKD580A), the *TF Service Parts List* (AKD804), the daily production records, several advertising brochures and very little else. We also have numerous articles from the motoring journals of the mid fifties, but these are not much help. The TF did not make much of an impression on the motoring press when it first appeared, so they wasted little time on it. We also have numerous articles which have appeared over the years in club newsletters and other enthusiast publications, but unfortunately an error made by one author was likely to be repeated by others until it became generally accepted as fact.

Just as I did in the TC and TD articles, I want to caution you not to accept what you read here as indisputable fact. Every possible effort has been made to authenticate the information in this article, but I make no guarantees. Neither I nor anyone else I know can claim to know all there is to know on the subject of originality. I cannot tell you how I **know** a TF should be. I can tell you only how I **think** it should be.



### ORIGINS

By the time the TD had been in production for a year or so the management at Abingdon knew the days of the square-rigged M.G. were numbered. Captivated by the streamlined looks of the Jaguar XK120 and the like, postwar enthusiasts were no longer satisfied with a body style which had not changed very much since the early 1930s.

In 1951 M.G. built a special car for George Phillips to race at LeMans. Based on a TD chassis, this car had a very modern streamlined body designed by Sidney Enever. In retrospect we recognize this special body as the forerunner of the MGA body style. Thanks to the much-improved aerodynamics, the Phillips TD was very fast even though the engine was a nearly standard TD unit. However, due to the layout of the TD chassis, the driver was forced to sit with much of his torso above the cowl line. To overcome this problem, Enever designed a new chassis with splayed side rails to allow a lower seating position. To this chassis he fitted a body much like that of the Phillips M.G., but with a full complement of road-going equipment: windscreen, top, side curtains, bumpers, wipers and so forth. Christened EX175, this is now considered the first prototype of what would later become the MGA. In fact, to the uninitiated observer the only external differences between EX175 and a production MGA were a slightly different fender line and a bump in the bonnet to clear the tall XPAG engine.

EX175 was completed toward the end of 1952, and was presented to M.G.'s new masters at the British Motor Corporation as a potential successor to the aging TD. Unfortunately, BMC was about to begin production of the new Austin-Healey 100 and saw no need to introduce two new sports cars at the same time. M.G. was told to keep producing TDs.

By mid 1953 the folly of this decision was apparent even to the upper echelons at BMC. TD sales dropped off rather drastically, especially in the export marketplace. The TD was just too old-fashioned looking to hold its own, even though mechanically it was still equal to most cars in its price class. A more modern-looking M.G. was desperately needed, but BMC still refused to sanction a production version of EX175. Instead, they mandated a facelift of the TD. The result was the TF.

In typical M.G. fashion (typical, at least, of those years) the TF prototype was built in only a few weeks by a small crew in the Development Office. Working without drawings, they created a new body, plopped it on a TD chassis, had it approved by BMC, and only then presented it to the Drawing Office to have proper plans drawn up. This was in May of 1953, and the TF went into production in September of that same year.

**Sketches on these pages are in error as knobs should be octagonal**

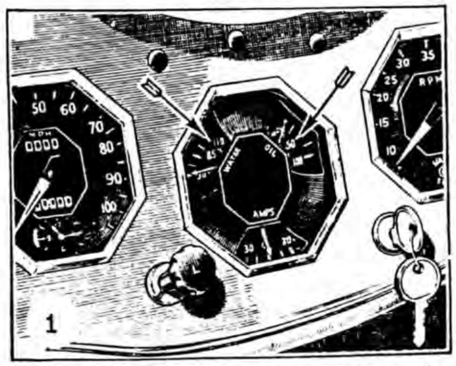
Essentially what was done was to design a new body similar in concept to its predessors, but slightly more modern in appearance. The result was a very pretty car, but one which was still not up to date by the standards of the mid fifties. The radiator shell was redesigned to slope back slightly, and the bonnet line was redrawn to slope down from the cowl. This created a much lower-looking bonnet. To enhance the illusion of streamlining, the headlamps were faired into redesigned front fenders, which in turn were faired into the bonnet sides. The windscreen still folded flat, but the wipers were no longer mounted on it. Instead, they were mounted on the cowl and were driven by a firewall-mounted motor via a push-pull cable arrangement. This wiper system was lifted almost intact from the Y Series saloons.

At the rear of the car the rake of the fuel tank was increased to complement the new radiator shell. The tubular grid spare tire carrier of the TD gave way to a less ungainly type similar to that of the TC and earlier models. The plinth-mounted round tail lamps of the late TD were carried over, as was the TD license plate lamp. However, the license plate holder and lamp were now centrally located on the bumper instead of on the driver's side of the spare tire carrier.

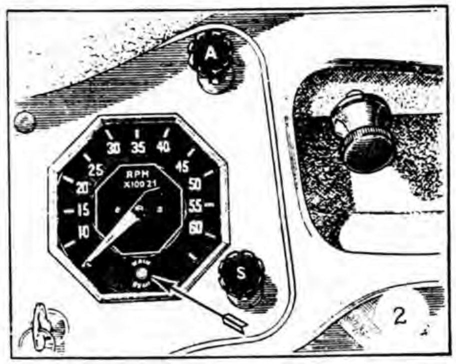
As if to confirm that the old era of M.G. sports cars was nearly at an end, the old familiar brown on cream octagonal radiator emblem was replaced by a black on white one.

The interior of the new model was a mixture of items carried over from the TD, others adapted from the Y and YB saloons, and others original to the TF. Directly in front of the passengers the facia nestled under the familiar twin-humped cowl, but now the edge of the cowl was covered with padded vinyl trim and the facia layout was entirely new. The facia itself was painted metal, not veneered or vinyl-covered plywood as had previously been the case.

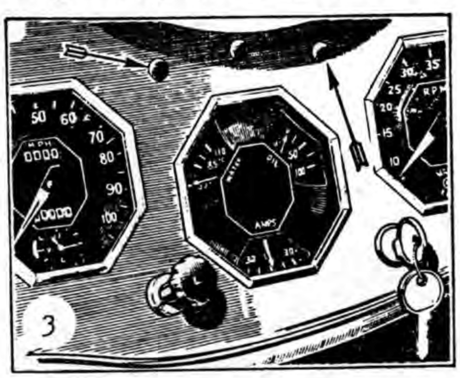
In the center of the facia was an instrument panel containing octagonal speedometer and cluster gauge (oil pressure, water temperature, ammeter) patterned after those used on the Y and YB, and a tachometer following a similar design



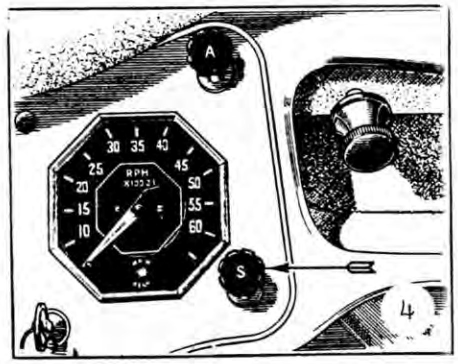

(fig. 1). The clock was mounted in the speedometer, not in the tachometer as on earlier models, and a high beam warning light (fig. 2) was incorporated in the

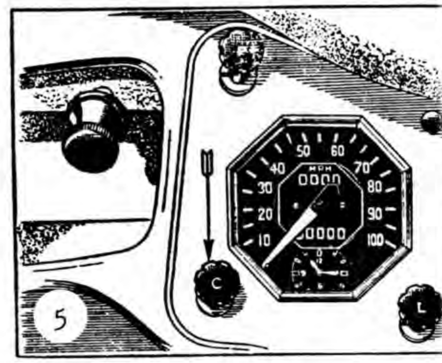


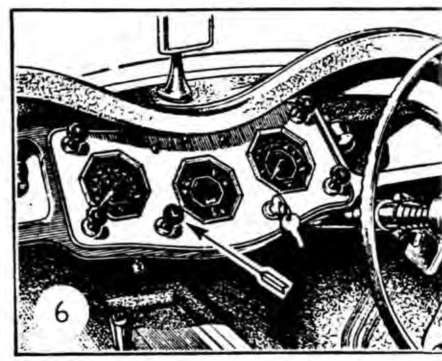

tachometer. Directly above the cluster gauge were three warning lights: blue for turn signals, red for fuel level, and green for ignition (fig. 3). Also mounted in the

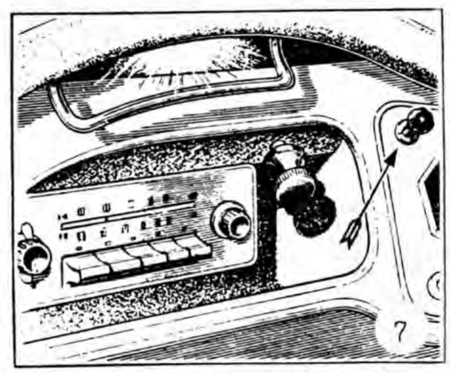



instrument panel were octagonal control knobs (again similar to those on the Y and YB), each lettered to indicate its function: "S" for starter, "C" for choke, "L" for headlamps, "P" for panel lights, and "A" for auxiliary (figs. 4-8). The "A" switch was wired into the harness to operate a fog lamp



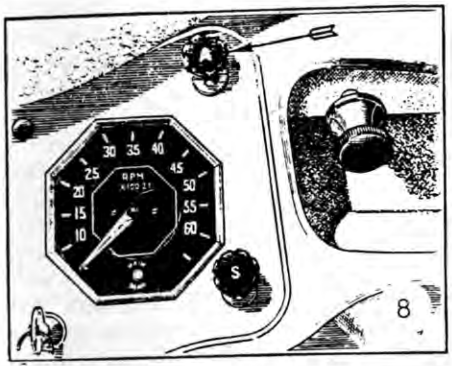




which could be ordered as an option. Unlike earlier T Types, the headlamp "L" switch was a push/pull type. Pulling to the first stop turned on the sidelamps, tail lamps and number plate lamp. The headlamps were switched on by twisting the knob to the right and pulling to the second stop. The panel lighting switch "P" operated the same way, but in this case the twist and second pull switched on map reading lights mounted under the cowl in front of each passenger.

Gone was the old familiar combination ignition and headlamp switch of earlier models. On the TF the key switch for the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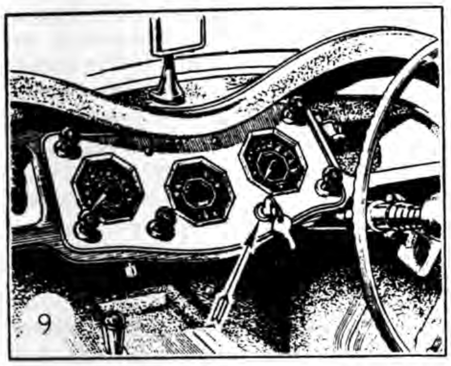
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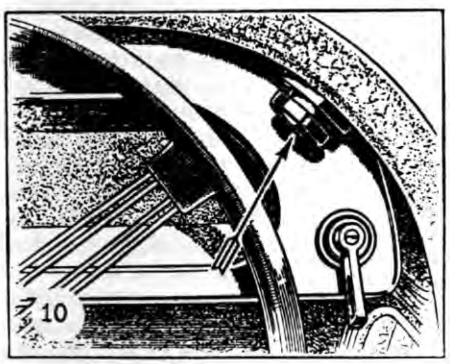
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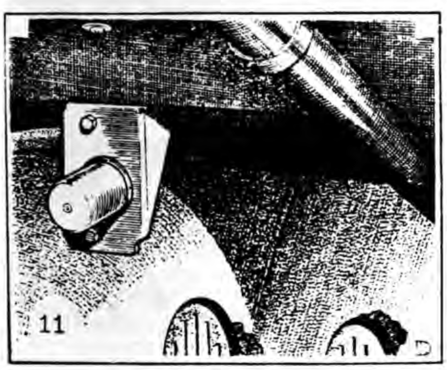
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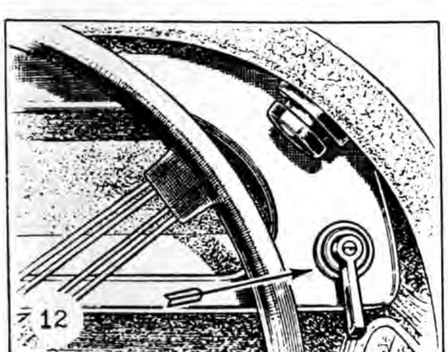
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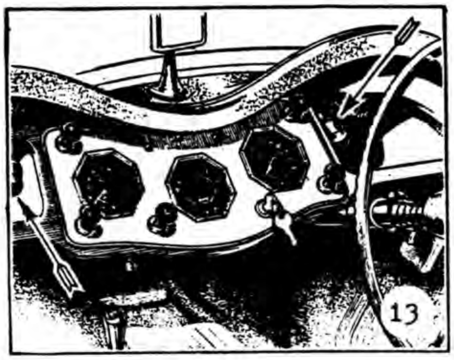
ignition (fig. 9) was mounted directly in the panel. Also gone was the combined horn push and headlamp dip switch, replaced by a horn button (fig. 10) mounted under the rim of the cowl on the driver's side and a floor-mounted dip switch (fig. 11) as on the Y and late TD. The turn signal control switch (fig. 12) was mounted on the drivers side of the facia.

In the facia, to the right and left of the central instrument panel, were two doorless glove boxes. Inside each box was a knob (fig. 13) controlling the windscreen wipers. By pushing in and twisting the knob, the wiper on that side was connected to or disconnected from the drive cable. The knob on the driver's side also operated the switch to turn the wiper motor on or off. Like the wiper motor and cable drive mechanism, this method of control was taken directly from the Y and YB.

The seats were individually adjustable (fig. 14) and had seperate backrests, although they were not true bucket seats. Gone at last was the old familiar and often cursed bench-type backrest of most earlier models. Luggage capacity was increased slightly by placing the side curtain storage locker under the luggage compartment floor (fig. 15), not upright at the rear of the car as it had been on earlier models.

Under the much-revised body was a rolling chassis carried over almost unchanged from the TD. The frame was nearly identical. The rear axle was also identical, but the 4.875:1 gear ratio of the TD Mark II became standard for the TF. The rear springs (fig. 16) used the same number and thickness of leaves, but the camber or arch was reduced by an inch and a quarter to allow for the fact that the TF's weight distribution was more toward the front. The front suspension (fig. 17) was carried over unchanged from the late TD, as was the excellent rack and pinion steering. The gearbox too was unchanged from the TD. Now, however, the purchaser had a choice between disc and wire wheels (figs. 18-19).

Even the engine was the old familiar XPAG, not the larger unit most enthusiasts had hoped for. Now called the XPAG/TF, it was in most respects identical to the XPAG/TD3 used in late examples of the TD Mark II. The cylinder head had all the Mark II modifications: large valves, heavy duty valve springs, and 8.1:1 compression ratio. Like the Mark II, the TF used S.U. type H4 (1½") carburetors, but with shorter body castings and revised venting for the dashpots (fig. 20). Because of the reduced clearance under the bonnet, the TD-type oil bath air cleaner was replaced by individual Vokes pancake cleaners (fig. 21) mounted on each carburetor. The distributor was the low-advance Lucas #40367 unit used on late examples of the TD Mark II, but otherwise the engine block and its componant parts were nearly all identical to earlier versions of the XPAG.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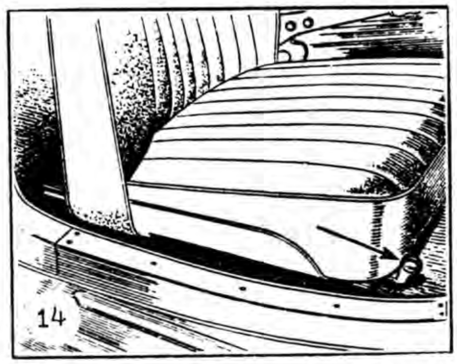
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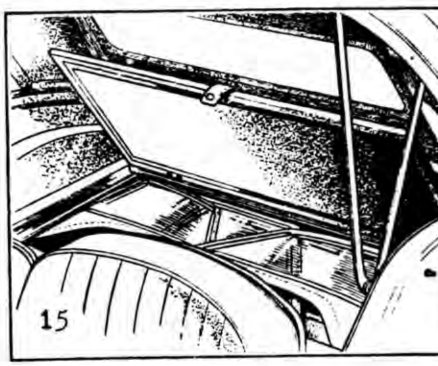
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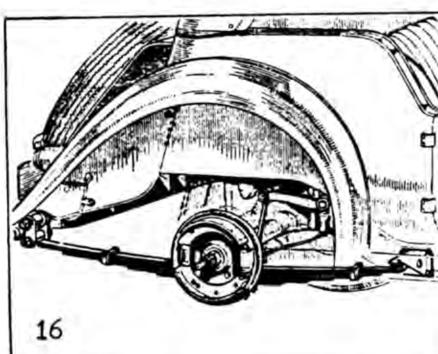
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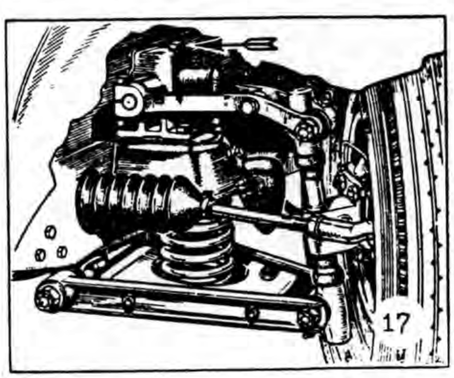
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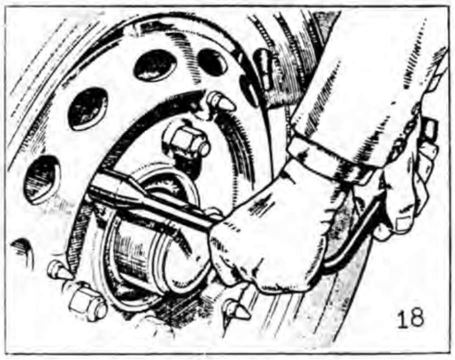
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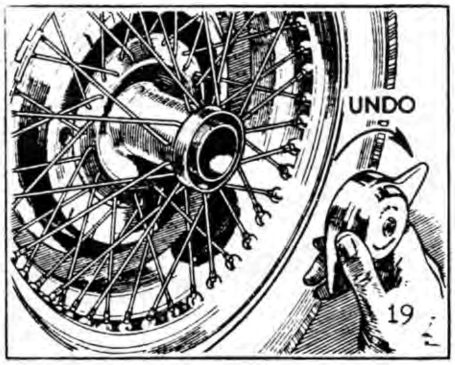

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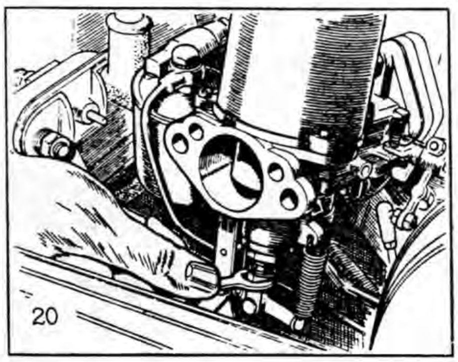
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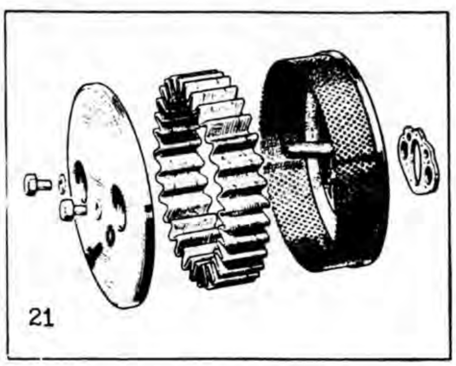
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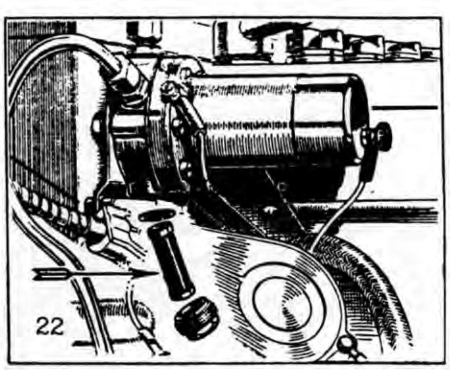
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At 57ph, power output was unchanged from the Mark II, but road tests showed the TF to be a bit slower. The road testers and many long-time M.G. enthusiasts were openly disappointed in the TF's performance, especially since the new ZA saloon which appeared at the same time had an all new 60hp, 1489cc BMC engine based on an Austin design. Why, they asked, didn't the TF also get a larger, more powerful engine?

The XPAG block could, if you were lucky, be bored out as much as .120" oversize, raising the displacement to 1368cc. Removal of any more material from the cylinder walls made them too thin for reliability, and in fact even this .120" overbore was .060" larger than the maximum recommended by M.G. Several engine builders had experimented with XPAG engines enlarged to nearly 1500cc by the rather unorthodox method of boring the cylinders out so drastically that the boring bar broke through into the water jacket in spots. Oversized liners were then pressed in and finish bored to 72mm, for a new displacement of 1466cc. This produced a healthy power increase, but reliability was often less than acceptable, and the process was slow and rather expensive. It was hardly practical as a production line operation.

Unfortunately, the casting techniques needed to create a 1500cc engine within the confines of the XPAG's external dimensions were not perfected until late in the TD's production life, and even then those in the BMC power structure who made such decisions would not allow an enlarged version to go into production. However, demands for more power were such that eventually the decision was reversed and the new 1466cc XPEG engine was introduced into TF production late in the summer of 1954. The XPEG engine was, with only a few exceptions, identical in every respect to the XPAG/TF engine it replaced. The block casting was basically unchanged except that the front and rear pairs of cylinders were siamesed. In other words, unlike the XPAG version, the XPEG had no water space between cylinders one and two, nor between numbers three and four. This allowed larger bores without altering the bore center spacing. Larger pistons were required, of course, and the connecting rods were made stronger by increasing their thickness slightly. These were the only major differences between the XPAG/TF and the XPEG. With an 8.3:1 compression ratio, the new 1466cc engine produced 63hp, a healthy 10½% increase.

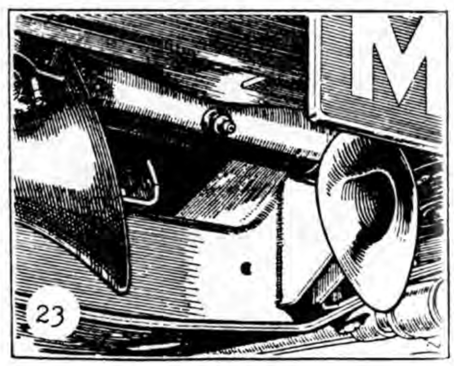
When this new engine was introduced, the car's name was changed to TF 1500. Aside from the enlarged displacement, the only other changes were the addition of two reflectors on the rear of the body and TF 1500 medallions on the bonnet sides. Of the 9600 TFs built, 6200 were XPAG/TF powered and 3400 were XPEG powered.

The underbonnet layout of the TF was very similar to that of the TD. Originally a single firewall-mounted S.U. type AUA25 low pressure fuel pump (fig. 22) supplied fuel to the carburetors, but early in TF production this was replaced by a high pressure AUA54 pump mounted near the fuel tank. The turn signal relay, voltage regulator, fuse block, starter switch and so forth were right off the TD and were mounted in approximately the same positions. The Lucas Windtone horns were also taken from the TD, but were now mounted down under the radiator shell (fig. 23) instead of on the firewall.

Access to all this under-bonnet paraphernalia was limited. Because the front fenders were faired into the bonnet sides, only the top panels of the bonnet could be opened. The new bonnet could easily have been designed to hinge at the rear, giving much better access, but instead the hinge remained at the centerline and each half opened separately.

Although the new radiator shell was re-shaped and tilted back, and although the grille slats were now chrome plated, it still looked very much like a typical M.G. radiator. Under the shell, however, it was very different. The lower bonnet necessitated a smaller radiator core, so to prevent the possibility of overheating the cooling system was pressurized. The pressure cap was (fig. 24) located on the header tank of the radiator, hidden under the bonnet. A revised water outlet on the engine allowed the use of a more modern insert type thermostat. The familiar octagonal filler cap still perched on top of the radiator shell, but it was a non-functional dummy.

When the TF first appeared it drew little praise from the motoring press, who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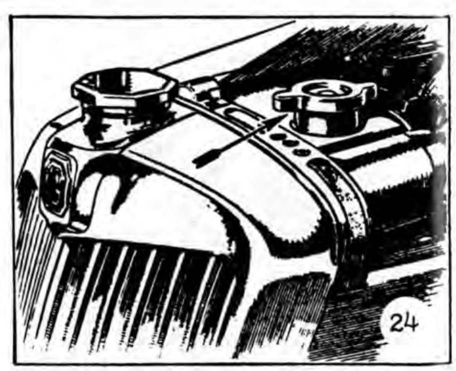
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recognized it for what it was: a warmed over version of the TD. It never achieved the popularity of the TD, and remained in production only nineteen months, from mid September 1953 through early April 1955. M.G.'s masters at BMC finally realized that something more modern looking was needed if M.G. was to recapture its share of the low-priced sports car market, so the last of the T Series was replaced by the MGA in the fall of 1955.

## PRODUCTION STATISTICS

Most of us are so accustomed to that American automotive ritual known as the annual model change that we automatically try to identify all cars by model year. However, M.G. did not produce a new model every year, and when a new model did appear its introduction did not necessarily coincide with an artifically contrived model year. The 1954 or 1955 label you probably attach to your TF really has no meaning to anyone but the Department of Motor Vehicles, who will continue to insist that model year is the only way to identify a car. In fact, if your local DMV if typical of most, the year shown on your TF's registration card may well be incorrect. In many states, if an import's papers did not show a specific model year then the car was registered under the year in which it was first sold. Thus most TFs built in 1953 are registered as 1954 models in this country, and some built in 1955 are actually registered as 1956 models even though production ended in April of 1955. Refer to the table of annual production statistics below to determine the year in which your TF was built. The table is derived from the daily production records, so it is safe to assume that it is correct even though it may disagree with statistics you have seen elsewhere.

Almost all earlier M.G. models had begun their chassis numbering sequence with 251, which was also the factory's telephone number (Abingdon 251). Which came first, the phone number or the tradition of using 251 as the first chassis number, is a matter of some dispute among those who have nothing better to discuss, but at any rate Abingdon broke with tradition by assigning the number 501 to the first production line TF. For those who insist on statistical precision, the complete car number was HDA13/0501, which identifies the car as a Home Model, painted black lacquer.

### M.G. TF ANNUAL PRODUCTION STATISTICS

| Production Year | Commencing Chassis No. & Date | Ceasing Chassis No. & Date | Yearly Totals |
|---|---|---|---|
| 1953 | TF 0501, Sep 17 | TF 2177, Dec 31 | 1677 |
| 1954 | TF 2178, Jan 4 | TF 8643, Dec 30 | 6466 |
| 1955 | TF 8644, Jan 4 | TF 10100, Apr 4 | 1457 |
| Grand Total | | | 9600 |

There was a TF 0251, and in fact there was also a TF 0250, but both of these cars were prototypes built in the development shop. The first, TF 0250, was completed on May 12, 1953, and was fitted with engine number XPAG/TD3/26849. The second prototype, TF 0251, was completed three months later on August 8, and the engine was XPAG/TD2/29748. We do not know what became of these two prototypes, nor do we know why the numbers between 0251 and 0501 were not used.

## DECODING THE TF

Until the appearance in 1953 of the TF Midget and ZA Magnette, M.G. car numbers always followed an easily deciphered pattern. The letters identifying the series (TD or whatever) were followed by the serial number of the chassis. This in turn was sometimes followed by more letters identifying the market for which the car was built. Thus TD 28929 EXL/NA is easily identified as a **TD** Midget, serial number **28929**, **EX**port **L**eft Hand Drive, **N**orth **A**merican market.

By the time the TF and ZA appeared on the scene the new British Motor Corporation had devised a standardized vehicle identification scheme which was applied to all new BMC products, and it was very different from the earlier M.G. system. A typical TF car number might look like this: HDP46/1843. Decoding it is easily done, if you have the proper key.

The first two letters (HD) are common to all TFs, and identify the car as an M.G. two seater, Series TF. Similar letter codes were used to identify other BMC makes and models.

The third letter identifies the original paint color of the car. The complete BMC listing for this time period follows, but of the sixteen possibilities only the five followed by asterisks (*) are applicable to the TF.

| | |
|---|---|
| A = Black* | J = Dark Grey |
| B = Light Grey* | K = Light Red |
| C = Dark Red* | L = Light Blue |
| D = Dark Blue | P = Ivory* |
| E = Mid Green* | R = White |
| F = Beige | S = Mid Grey |
| G = Brown | T = Light Green |
| H = CKD Finish | U = Dark Green |

The first numeral following the letters identifies the class, or the market for which the car was built. Only the first four are normally found in TF car numbers.

1 = Home Market, RHD*
2 = General Export, RHD*
3 = General Export, LHD*
4 = North America, LHD*
5 = CKD, RHD
6 = CKD, LHD

The second numeral, or the one immediately preceding the slash (/), identifies the type of paint used on the car. Of the six possibilities listed below, only the three indicated by asterisks are found in TF car numbers.

1 = Synthetic
2 = Synobel
3 = Cellulose*
4 = Metallic
5 = Primed*
6 = Cellulose Body, Synthetic Wings*

The series of numerals following the slash is simply the serial number of the chassis. The chassis number is stamped on the left front frame extension, where it is preceded by the letters TF. However, on the vehicle identification plate or "maker's plate" the TF prefix is dropped and is replaced by the alphanumeric prefix described above. Thus when chassis number TF 1843 went down the assembly line to become a complete car, its offical identification became HDP46/1843. This tells us that the car is an M.G. two seater, Series TF, chassis number TF 1843, left hand drive, built for the North American market. The original color was Ivory, and the paint on the body was cellulose while the paint on the wings was synthetic.

The TF numbering system may look very wrong compared to earlier M.G. numbering systems, but it does give the restorer two pieces of information not available for earlier types: original color and original paint type. Note, however, that there is nothing in the car number to distinguish the TF 1250 from the TF 1500. This can be determined only by looking at the engine number, where an XPAG/TF prefix indentifies the 1250cc engine and an XPEG prefix identifies the 1466cc engine of the TF 1500.

You will have noticed that the initials "CKD" appear in the paint color chart as the code letter "H", and also in the market code chart as the numerals "5" and "6". CKD stands for **C**ompletely **K**nocked **D**own, and identifies a car which has sent out in disassembled form, usually to an assembly plant in a Commonwealth country.

The notation "CKD" was used to identify CKD cars in the TF production records, but the corresponding BMC codes (H, 5 or 6) do not seem to appear in the records. For some reason Abingdon chose not to use that part of the BMC code. In fact, the record keepers were not at all consistant about coding CKD cars. Some show the full alphanumeric prefix, some show the prefix with the paint code letter omitted, but most show only the chassis number in the records, with no prefix at all. For example, the first CKD TF listed in the records is HDA36/2910, but the last one is listed simply as 9994.

Just how complete a CKD car was when it was shipped out is not certain, but some sources say the chassis, power unit and body were each shipped separately. This is confirmed in part by the fact that there are no engine numbers listed for CKD cars in the production records. It is also not certain what kind of finish was applied to the sheet metal. Some say the bodies were fully painted, some say they were only primed, and others say a preservative coating was applied over bare metal. Certainly the first CKD TF mentioned above seems to have been fully painted, but what about those with no paint code in the prefix and those with no prefix at all?

## MARKET VARIATIONS

When M.G. resumed production immediately following the Second World War they embarked upon an export campaign which would eventually dwarf all previous efforts. About sixty-six percent of all TCs built were exported, and over ninety percent of the TDs. Actually, Abingdon had no choice, for the size of their steel allocation during the lean postwar years was in direct proportion to the number of cars exported. No exports, no steel. The situation had eased somewhat by the time the TF went into production, but by this time M.G.'s masters recognized an even more powerful reason to export: money. The export markets, particularly the United States, represented a sales potential undreamed of during the prewar years, and consequently the building of cars for export became standard operating procedure at Abingdon. Indeed, of the thirty-eight TFs built during the first day of production, no less than thirty-six were built for the U.S. market.

Even though a large proportion of the TCs had been exported, the TC was still very much a British sports car which made no concessions to the tastes or legal requirements of the rest of the world. It was not until the introduction of the TC/EXU (**EX**port **U**nited States) late in 1948 that this policy changed, but then it changed in a big way. Those of you who read the first article in this series will know that the TC/EXU was very different from the Home and General Export models.

With the advent of the TD late in 1949 the factory tried a slightly different approach, one which must have been much more cost effective in view of the enormous number of TDs sent abroad. Instead of manufacturing a starkly British Home model, then modifying it extensively for specific export markets, Abingdon designed the TD to incorporate many of the features demanded by foreign markets. Thus the differences between the various export versions and the Home model were small, simplifying parts inventory and assembly line procedure. We often hear that the result was an Americanized M.G., not at all the proper vehicle for a self-respecting British sporting driver, but one can't help but wonder if most British drivers weren't glad to have some of the creature comforts provided by the TD.

This policy of standardization was carried a step farther with the coming of the TF. With only a few exceptions, all TFs were alike regardless of the intended destination. All TFs had turn signals, for example, while only late TDs meant for North America had been so equipped. Some design features helped to minimize the extra parts formerly needed to cope with the differences between RHD and LHD cars. For example, two different facia panels were needed for the TD: one for right-handed cars and one for lefties. The TF facia was suitable for either type because all the instruments were placed in the center of the panel. Similarly, the TF rear license plate holder was centrally mounted, whereas on the TD it was always mounted on the driver's side of the car, necessitating two different brackets. The TF's electrical equipment was standardized to the point where one wiring harness could be used on all versions. Several different harnesses were required for the TD, depending on what electrical equipment was fitted and whether the car was right hand drive or left. There are numerous other examples of this policy of standardiztion, and as a result I imagne the TF must have been somewhat easier to manufacture than its predecessors.

Of course, some duplication of parts was unavoidable. The steering gear and control pedal assembly from a RHD car would not work on a LHD version, so two types of each had to be carried in stock. There were minor differences in fuel pipe and brake pipe layout between RHD and LHD cars, so two different sets of each were required. Also, regulations regarding headlamp intensity and direction of dipping varied from one country to another, so several different types of light units were necessary. Aside from these few items, a search through the *TF Service Parts List* uncovers remarkably few differences dictated by the market for which the car was intended.

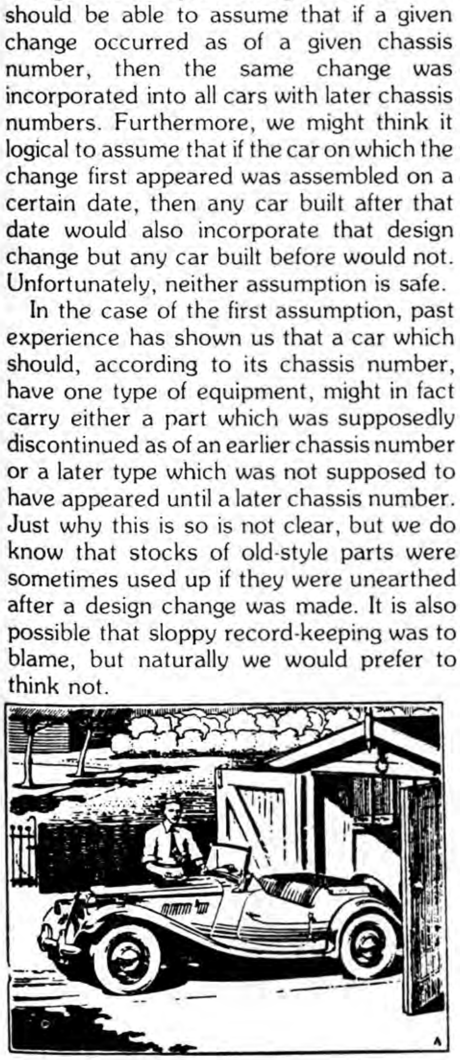
Those of you who are statistically oriented might be interested in knowing that the first Home model (also the first production TF) was HDA13/0501 (Sep 17, 1953), and the last was HDC16/10037 (Mar 18, 1955). The first General Export RHD TF was HDP26/0692 (Oct 16, 1953), and the last (also the last TF) was HDE23/10100 (Apr 4, 1955). The first and last General Export LHD cars were HDC36/0603 (Oct 5, 1953) and HDB36/9907 (Mar 16, 1955. The first and last of the North American Export models were HDP43/0502 (Sep 17, 1953) and HDC46/10075 (Mar 21, 1955).

## DESIGN CHANGES

Like its predecessors, the TF did not undergo a major redesign with the coming of each new year. Instead, improvements were made more or less continuously as production proceeded. Each change was documented by the factory according to the chassis number of the car on which it first appeared. In a short while we will list all the major changes to the TF chassis and body. There were also a few minor changes, most of which were necessitated by the major changes, but even a complete listing of **all** TF changes is rather short compared to the long list of TD changes in the preceeding article in this series. The TF remained relatively unchanged throughout its nineteen-month production life. Improvements made to the XPAG/TF and XPEG engines will not be covered here, as they are the topic for a future article.

The chassis numbers listed here are those given for each change in the *TF Service Parts List* the *TD/TF Workshop Manual* and other official documents. The date appearing beside each chassis number is the date on which that TF was assembled, according to the production records. On the surface the relationship between car number, production date, and design change seems quite straightforward. We should be able to assume that if a given change occurred as of a given chassis number, then the same change was incorporated into all cars with later chassis numbers. Furthermore, we might think it logical to assume that if the car on which the change first appeared was assembled on a certain date, then any car built after that date would also incorporate that design change but any car built before would not. Unfortunately, neither assumption is safe.

In the case of the first assumption, past experience has shown us that a car which should, according to its chassis number, have one type of equipment, might in fact carry either a part which was supposedly discontinued as of an earlier chassis number or a later type which was not supposed to have appeared until a later chassis number. Just why this is so is not clear, but we do know that stocks of old-style parts were sometimes used up if they were unearthed after a design change was made. It is also possible that sloppy record-keeping was to blame, but naturally we would prefer to think not.



In the case of the second assumption, we can see in the production records that TFs did not always roll down the assembly line in strict numerical order. This is demonstrated by the fact that although the records list the cars in numerical order, the dates corresponding to each car number do not always fall in strict chronological order. For example, TF 6950 was assembled on September 20, 1954. We would logically assume that TF 6951, which falls next in numerical sequence, was built on that day or the next, but it wasn't. In fact, TF 6951 was built on September 8, twelve days **before** TF 6950. Similar numerical and chronological oddities appear throughout the production records.

This poses a problem to the amateur marque historians among us who like to pin things down to exact dates and car numbers. On a more practical level it poses a problem to the restorer who simply wants to determine whether his car should have one type of equipment or another. Should we accept a given date as the correct/dividing line between so-called early and late equipment, or should we accept only a given chassis number as the dividing line? For example, suppose you are restoring TF 1502 and the fuel pump and its mounting brackets and pipes are missing. The *TF Service Parts List* tells us that as of TF 1501 the fuel pump was moved from the firewall to the chassis near the fuel tank. The production records tells us that TF 1501 was built on December 4, 1953, but let's suppose for sake of illustration that TF 1502 was actually built several days earlier. Where should you mount the fuel pump? If the change applies only to cars actually **built** after TF 1501, then TF 1502's pump should be on the firewall. If it applies only to cars **numbered** after TF 1501, then TF 1502's pump should be near the tank. I cannot say with 100% certainty, but my guess is that it is safest to go strictly by chassis number. My reasons will be more easily explained after we look at the various design changes made during TF production.

The changes described below are listed in numerical order by chassis number. The production date for each of these cars is also given, but should be considered only as a rough chronological reference point.

**TF1501** (Dec 4, 1953): The fuel pump was changed from an S.U. type AUA25 low pressure unit mounted on the firewall to a type AUA54 high pressure unit mounted on the righthand frame rail in front of the rear wheel arch. The main wiring harness was altered to suit. This removed the pump from the high temperatures in the crowded TF engine compartment, lessening the possibility of vapor lock.

**TF 3495** (Feb 24, 1954): Piston dampers were added to the carburetor dashpots to retard piston movement when the throttle was snapped open. This provided a richer mixture under such conditions, improving acceleration. The factory recommended that earlier TFs be retrofitted with piston dampers, so non-dampered TF carbs are rare.

**TF 3811** (Mar 5, 1954): The front wheel grease retainers were improved on wire-wheel equipped cars.

**TF 4760** (Apr 9, 1954): On RHD cars, the tie rod and ball stud threads were changed from British Standard Fine (BSF) to Unified National Fine (UNF). The grease fillings in the tie rod ends also changed from BSF to UNF. However, the threads on the tie rods and in the bores of the tie rod ends remained BSF. Oddly, the production records show TF 4760 to be a LHD car. This change was not officially made on LHD cars until TF 4910 (Apr 20, 1954).

**TF 6501** (Jul 13, 1954): First TF 1500. The engine type was changed from XPAG/TF (1250cc) to XPEG (1466 cc). TF 1500 medallions were added to the bonnet sides and reflectors were added to the rear of the body.

**TF 6651** (Aug 9, 1954): Engine type changed from XPEG back to XPAG/TF.

**TF 6751** (Aug 24, 1954): Engine type changed from XPAG/TF back to XPEG.

**TF 6851** (Aug 25, 1954): Engine type changed from XPEG back to XPAG/TF.

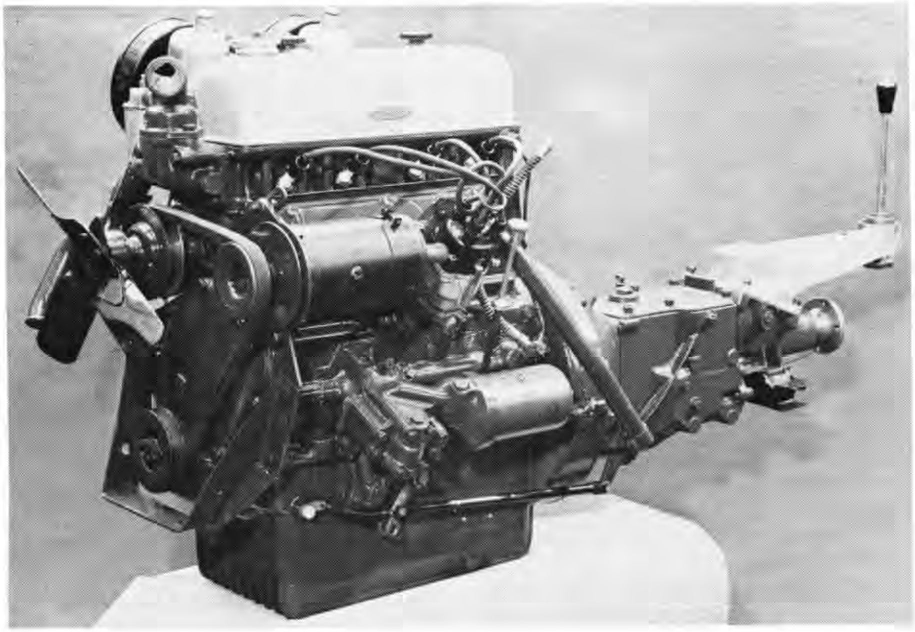
**TF 6887** (Aug 31, 1954): The design of the wire wheel center changed from the early type with a shallow-dished inner flange to a new type with a deeper-dished flange. Wheel size (4J × 15) and number of spokes (48) remained unchanged.

**TF 6951** (Sep 8, 1954): The engine type changed from XPAG/TF back to XPEG for the last time. All cars with subsequent chassis numbers were TF 1500s.

**TF 8146** (Nov 23, 1954): The configuration of the cast portion of the horns changed slightly, although they remained Lucas WT614 Windtone units.

Now let's go back to the chassis number versus production date argument. If you look at the engine type changes listed above you will see that they occurred in a nice neat numerical sequence. They also appear to have occurred in a sensible chronological sequence, so we might logically assume that as of TF 6501 the factory switched over exclusively to TF 1500 production, then switched back to the earlier version, then back to the TF 1500, then back to the standard TF and so forth until the TF 1500 took over for good as of chassis number TF 6951 on September 8, 1954. Unfortunately, it wasn't quite that straightforward. Let's look at it in a slightly different way by listing the last car in each group as well as the first (see table of engine applications).

The production records confirm that the engine changeover points listed in the table are correct: chassis numbers 6501 through 6650 really were XPEG powered, numbers 6651 through 6750 really were XPAG/TF powered, and so on down the list. Again, if we look only at the chassis numbers and the starting dates we see what appears to be a very orderly sequence. But look at those last dates for each group! In almost every case there is a chronological overlap between the last car in one group and the first car in the following group, and in some cases there are rather large chronological gaps between groups. What's going on here? Well, if you take all the cars between chassis numbers 6500 and 6951 and put them in order by production date rather than by chassis number, you will quickly discover that the standard TF and the TF 1500 were being produced more or less simultaneously from mid July through mid September of 1954. So much for the validity of production dates as indicators of the points at which design changes were made. Chassis numbers may not be 100% accurate either, but they seem to be the most reliable guides available to us.



### M.G. TF ENGINE APPLICATIONS

| Engine Type | Commencing Chassis No. & Date | Ceasing Chassis No. & Date |
|---|---|---|
| XPAG TF | TF 0501, Sep 17, 1953 | TF 6500, Jul 13, 1954 |
| XPEG | TF 6501, Jul 22, 1954 | TF 6650, Aug 24, 1954 |
| XPAG/TF | TF 6651, Aug 9, 1954 | TF 6750, Aug 20, 1954 |
| XPEG | TF 6751, Aug 24, 1954 | TF 6850, Sep 8, 1954 |
| XPAG/TF | TF 6851, Aug 25, 1954 | TF 6950, Sep 20, 1954 |
| XPEG | TF 6951, Sep 8, 1954 | TF 10100, Apr 4, 1955 |

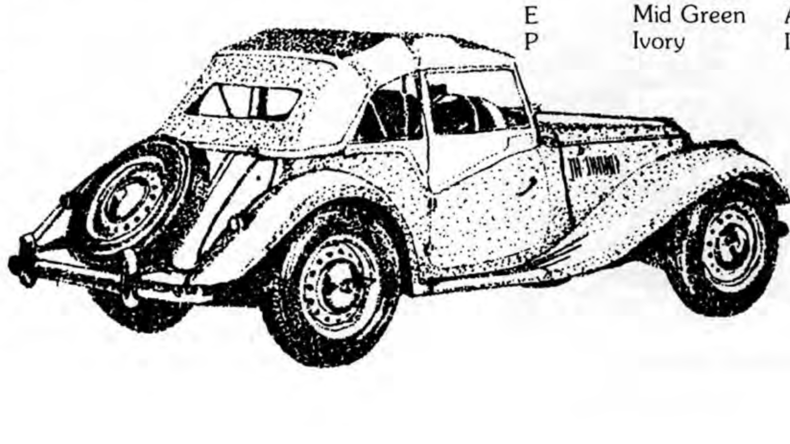
### PAINT & UPHOLSTERY COLORS

The TD had been available in no less than nine different exterior colors at one time or another during its production life, but for the TF the choices were narrowed down to five. As before, the upholstery color choices were red, green or biscuit, but not all upholstery colors could be had with all exterior colors. The combinations offered were as follows:

| BODY | UPHOLSTERY |
|---|---|
| Black | Red, Green or Biscuit |
| M.G. Red | Red or Biscuit |
| Almond Green | Green or Biscuit |
| Ivory | Red or Green |
| Birch Grey | Red |

As you see, the specific color names listed above do not necessarily match the generic color names used in the BMC coding system described earlier. This is because one color was often used on two or more different BMC products, but that same color might be called a different name on each make. For example, M.G. Red would for obvious reasons be called something else if used on a Morris or an Austin. To clarify matters, let's list the BMC color codes and generic names along with the corresponding M.G. color names.

| BMC CODE | BMC GENERIC | M.G. COLOR |
|---|---|---|
| A | Black | Black |
| B | Light Grey | Birch Grey |
| C | Dark Red | M.G. Red |
| E | Mid Green | Almond Green |
| P | Ivory | Ivory |



If you examine the new member listings in TSO you will occasionally find TFs listed with color codes other than those listed above, but in every case where the owner has responded to my query the code shown in the listing has been either a misprint or a case of misreading the identification plate. The official policy at Abingdon was to supply cars only in the advertised colors. However, there are those who claim that non-standard colors could be had if the purchaser knew the right people. Whether or not this is true is open to debate, but I do know of a former TF owner who claims to have special-ordered his car painted Woodland Green, a TD color. If so, the color code on his car must have been "U" (dark green), but unfortunately the car has long since vanished and the original owner has no record of the car number.

Birch Grey is a bit of a puzzle in that it is not listed as a color choice in any TF advertising brochure I know of. Never the less, the fact that it was a choice is verified by the production records, where we can see many numbers bearing the "N" (light grey) color code. In the past, some writers have expressed the opinion that Birch Grey was strictly a TF 1500 color, while others have maintained that this color could be had on the 1250cc TF, but not until some time after production began. In the strictest sense this second theory is correct, but only just barely. The first Birch Grey TF was HDB46/0570, which was built on September 28, 1953. This was, in fact, only the second day of TF production, as no cars were built from September 18 through September 27. For all practical purposes, Birch Grey was available right from the start.

All the other TF colors made their appearance on September 17, 1953, the very first day of production. The first Black TF was HDA13/0501, the first Ivory was HDP43/0502, the first M.G. Red was HDC13/0513, and the first Almond Green was HDE43/0518.

The paint types listed in the BMC code and in most factory literature are confusing to many American owners, and with good reason. The term cellulose or cellulose enamel often leads restorers to believe that what we in this country call enamel is the only correct paint type for an authentic restoration, but such is not the case. The British term "cellulose enamel" refers to the type of paint we know as nitrocellulose lacquer, sometimes called "straight lacquer" or "nitro". The other type of paint used on the TF, called Synthetic in the BMC code, is what we know as alkyd enamel. Nitrocellulose lacquer and alkyd enamel were the standard automotive finishes for many years both here and abroad, but have been largely superceded in the past twenty years or so by acrylic lacquer and acrylic enamel. To avoid confusion, I will try to use the American terms throughout the rest of this article. Thus, the paint type code "3" refers to a car which was painted lacquer all over, while the code "6" refers to one with a lacquer body and enamel fenders, running boards, splash aprons and so forth.

Normally we find only the paint type codes "3" and "6" in TF car numbers, with the lacquer/enamel combination outnumbering the all-lacquer type by a very wide margin. Most cars painted Black, Birch Grey, Ivory and M.G. Red used the combination, while the majority of Almond Green TFs were all lacquer. There were, however, many exceptions. Among the black, grey, ivory and red cars, as a general rule of thumb all-lacquer examples were most likely to appear during the early part of TF production, while the lacquer/enamel combination dominated later production. However, there seems to have been no clean breaking point between the two in terms of car number or date, and there are many exceptions to the rule. At any rate, the point in time at which one stopped and the other started is totally unimportant. The purist restorer can tell which type of paint scheme was original for his car simply by decoding the car number. The sensible restorer will use either acrylic lacquer or acrylic enamel, but not both.

This practice of using two different types of paint on the same car may seem odd to most of us, but apparently it was common practice at one time, as I have read of other vintage British cars which used the lacquer/enamel combination. The reasoning behind it was sound, especially for a car which was likely to receive rough use. Nitrocellulose lacquer dries by the evaporation of its thinners, forming a paint film which is hard all the way through. It can be compounded and polished to a very high gloss when new, and this gloss can be maintained by subsequent polishing and/or compounding until the paint film is literally worn away. Unfortunately, this hard, brittle film is easily damaged by flying pebbles and other road debris.

Alkyd enamel, on the other hand, reaches full hardness only on the surface of the film, leaving the majority of the film relatively soft. If it is applied properly the initial gloss of the film is good, but when it weathers it cannot be rejuvenated by compounding because this would wear through the hard surface to expose the softer, duller underlayer. However, because of this soft underlayer the film is somewhat flexible. It tends to give a bit when struck by flying stones, so it is more resistant to chipping. Because of this, M.G. and others often used alkyd enamel on fenders, running boards, front and rear aprons, and other areas which were most likely to be attacked by road debris. Nitrocellulose lacquer was reserved for the relatively protected main body panels where high gloss was more important than durability.

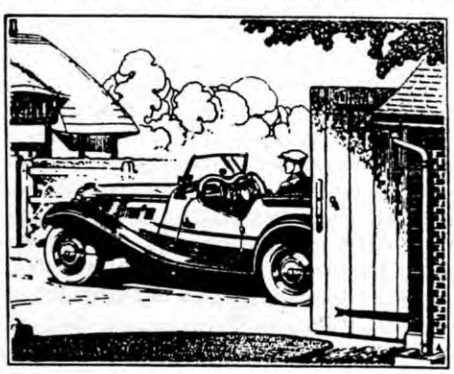
We often hear claims to the effect that most earlier models were also painted this way, but we have no way of knowing which models and which colors were affected. For the TF, thanks to the BMC coding system, we can see not only which colors received the lacquer/enamel combination treatment, but also which specific cars. Why Almond Green TFs were usually painted entirely in lacquer is not clear, but I suspect it may have had something to do with difficulty in obtaining a good match between the lacquer and the enamel in that particular color.

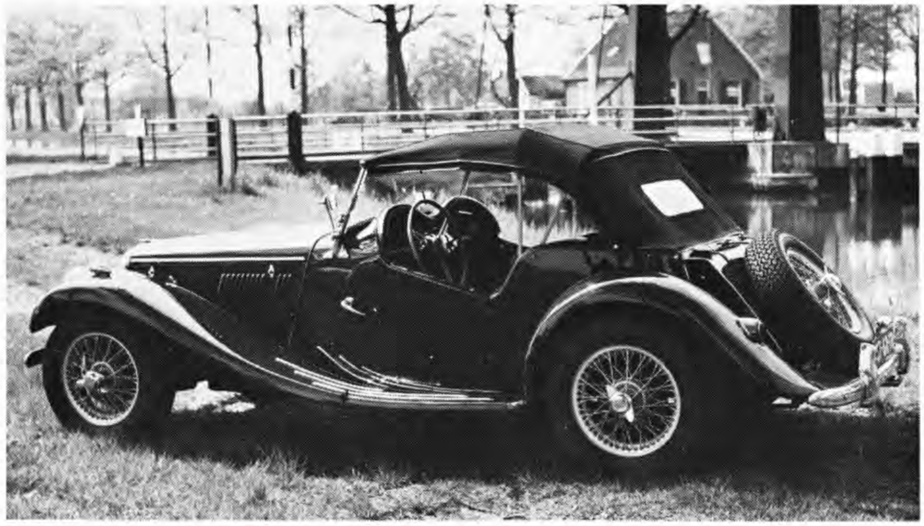
On rare occasions we see the paint type code "5", indicating that the car left the factory in primer. One example is HD 15/10036, a primered Home Model built on March 18, 1955. Note that the paint color code is omitted from the car number in this case. We must assume that this car and others like it were ordered by dealers or individuals who preferred to devise their own paint schemes, possibly using non-standard colors. This poses a problem for the purist who finds himself restoring a "5" coded TF. What color should he paint the car? He certainly cannot prime the car and just leave it like that, no matter how important so-called "factory originality" may be to him. If he is looking for the highest possible concours score, then he will probably choose one of the standard TF colors. If not, then any color appropriate to the mid 1950s will do.

The paint originally used on these cars was I.C.I. Belco, manufactured by Imperial Chemical Industries Ltd. I.C.I. was then and still is the major supplier of automotive finishes to Great Britain's automobile industry. If you insist on having only the original and cannot find I.C.I. Belco paint locally, contact the importer: East Coast Specialties Company, 35 Koehl Avenue, Union, New Jersey 07083.

Jack Smolik, Register Member #78, has been working with the importers to find current I.C.I. paint codes for the original T Series colors. Of the colors appropriate to the TF, he has established that I.C.I. can still supply M.G. Red (P030-3000) and Ivory (P030-3482). Look for additional I.C.I. Belco codes in future editions of Technically Speaking.

Most of us will find it more convenient to use American-made paint because it is more widely distributed. Of the many brands available, Rinshed-Mason and Ditzler seem to be most popular among T Type restorers. Ditzler in particular has been very helpful in tracking down their old codes and formulas for M.G. colors and transposing them into modern formulas. The Ditzler and Rinshed-Mason codes in the table below are for modern acrylic lacquer, not nitrocullulose, but they are as close to the original as possible. Black is not shown in the table because it is available from all manufacturers, and in every type of paint.





**M.G. TF PAINT CODES**

| COLOR | DITZLER | R—M |
|---|---|---|
| M.G. Red | DDL 71993 | BM 121R |
| Almond Green | DDL 44159 | BM 076 |
| Ivory | DDL 81271 | BM 127 |
| Birch Grey | DDL 31918 | BM 002 |

If the paint type code in your car number is "6", and if you feel compelled to duplicate the original lacquer/enamel combination paint scheme, Ditzler makes selection of the appropriate paint code very simple. Simply change the letter prefix from DDL (acrylic lacquer) to DQE (alkyd enamel) or DAR (acrylic enamel). The numberic code stays the same for any given color regardless of the paint type. Thus M.G. Red is DDL 71993 in Duracryl acrylic lacquer, DQE 71993 in Ditzco alkyd enamel, and DAR 71993 in Delstar acrylic enamel. Your local Ditzler dealer may not have all these codes in his formula book, but this is no cause for alarm. Contact L.S. Cullen, Ditzler Automotive Finishes, 20755 Greenfield Rd., Southfield, Michigan 48075 for the appropriate mixing formula. Be sure to tell him the Ditzler code as listed below, the name of the color, the type of paint you want, and the make and model of the car.

## INTERIOR DETAILS

The seats and interior trim panels were covered in a combination of leather and matching leathercloth, which was a thin vinyl-coated material. The seats are often described as being leather, but only the front of the seat back, the top of the seat bottom, and the front and outboard side panels of the seat bottom were real leather. The rest of the seat covering was leathercloth. With the exception of the top edges of the map pockets, which were leather, the rest of the interior trim was leathercloth.

The floor of the car was covered with black, short-piled carpet, laid over rubberized felt padding and secured by lift-the-dot fasteners. The toeboard, driveshaft tunnel, brake cable cover and gearbox cover were also carpeted, but the floor of the luggage compartment was not.

Most of its predecessors had plywood facia panels, sometimes veneered, sometimes leathercloth covered, but the TF facia was painted metal. Any four "experts" will offer four different opinions on how the panel should be finished, but the most reliable information is that it should be painted the same color as the car's interior. The instrument panel in the center of the facia was painted a bronzish tan, surrounded by a chromium plated bead. The area under the facia was covered by a black-flocked masking board. Most of these have disappeared over the years, discarded by owners who wanted quick access to the wiring and control cables.

The top and side curtains were of tan duck or canvas, mounted on metal frames painted a matching tan. The tonneau cover was sometimes black vinyl, but was usually tan canvas. The standard cover covered only the area behind the seats, but a full-length cover could be ordered as optional equipment.

Other interior details have already been covered under the "Origins" heading, and will not be repeated here.

## CHASSIS DETAILS

The chassis frame was always painted black, as were most of the components bolted to it to make up a bodyless rolling chassis. I have always found it easiest to remember it this way: remove the body, bonnet, fenders, running boards, splash aprons and all other sheet metal body parts. Also remove the radiator shell and grille, engine, gearbox, wiring harness, handbrake lever, bumpers, wheels, spare tire carrier, fuel pump, wheel cylinders, brake hoses (not the metal pipes), and shock absorbers. The chassis frame and pretty much everything still attached to it were originally basic black.

The alloy Armstrong shock absorbers were generally left unpainted, but the shock arms were black. Also black were the gearbox and driveshaft covers. You may think it odd that such things as the brake pipes, brake cables, fuel lines and numerous non-ferrous items will end up being black if my "take it apart and paint what's left" suggestion is followed. However, several people who have talked to M.G. production line workers from the T Series era say that the normal procedure was to assemble the rolling chassis, then spray it black. Most restorers prefer to leave brass, copper and aluminum parts unpainted, and I will admit that the chassis looks better that way.

## ENGINE COMPARTMENT DETAILS

Most of the sheet metal inside the engine compartment was painted to match the car's exterior color, although in some cases the toeboard or footramp at the bottom of the firewall was painted black regardless of body color. The radiator and most of the pipe clips, wiring clips and miscellaneous small brackets under the bonnet were also black.

The predominant color on the engine itself was the deep red which had become standard on all XPAG engines back in 1948. Several of the T Series parts suppliers offer spray cans of engine paint in approximately the right color. If you prefer to use your own spray equipment or even a paintbrush, try Ditzler's Ditzco Enamel DQE 50782Y, Dupont's Dulux Enamel 5321DH, Sherwin Williams' Kem Enamel J31261-R, or Acme AC419. Each of these paints is claimed by its proponants to be very close to the original deep red. Although they are not true engine enamels, they will hold up very well on any engine part except the exhaust manifold, which in any case is not supposed to be painted.

Most of the small parts attached to the engine were also painted deep red, but occasionally black was used instead. The Morris engines plant, where the XPAG and XPEG were made, seems not to have been very consistant about the coloring of small parts, so on one engine a small bracket might be red while the same part on another engine might be black. The following is offered as a general guide to engine colors, but should not be considered infallible:

**Deep Red:** Cylinder block, cylinder head, cylinder head rear cover, water outlet, thermostat housing, tappet cover, intake manifold, sump, timing chain cover, breather pipe and clamp, engine bearer plate, front motor mount bracket, clutch housing and inspection plate, water pump and pulley, oil pump, water branch pipe, gearbox and gearbox cover.

**Black:** Air cleaners, generator, starter motor, fan blades, clutch operating rods and levers, throttle return spring bracket, driveshaft flange on gearbox, engine stabilizer link and brackets, exhaust pipe bracket on gearbox, exhaust pipe, steering column, pipe connecting rocker cover to air cleaner.

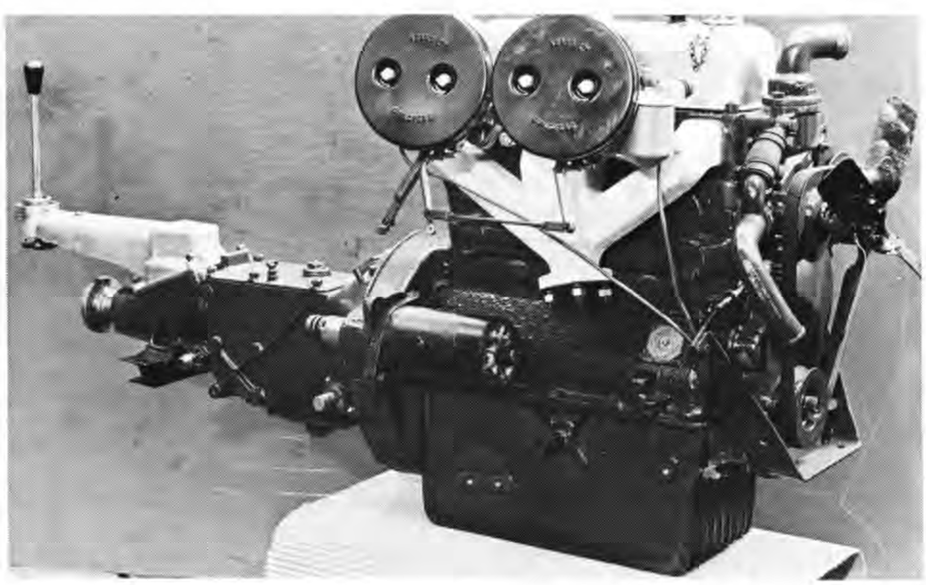
**Crinkle Black:** Windshield wiper motor body, except the alloy parts.

**Red Or Black:** Generator pulley and fan, generator mounting brackets and adjusting link, breather pipe support bracket on clutch housing, crankshaft pulley, fan blade spacer.

**Grey-Green:** Rocker cover. Some say silver green is correct, while others swear by grey or deep red.

**Natural Aluminum:** The gearbox remote control housing was the only aluminum part of the power unit originally left unpainted. It is customary these days to leave the aluminum sump, clutch housing and timing chain cover unpainted, but originally these were deep red like the rest of the engine.

**Natural Brass & Copper:** The drain plugs, priming plugs, oil line from block to cylinder head and other brass and copper parts are usually left unpainted, but originally they were sprayed deep red with the rest of the engine.



**Aluminized:** The exhaust manifold and manifold clamps were metal sprayed with an aluminum coating.
**Cadmium Plated:** Oil filler cap, gearbox dipstick, stabilizer link locknuts and cupped washers, hose clamps, bonnet catch assemblies, turn signal relay cover, windshield wiper motor gearbox cover and drive cable.
**Chromium Plated:** Engine dipstick, gearshift lever.
**Miscellaneous:** A few items of engine equipment were produced outside the BMC empire, and the manufacturers could not be depended upon to stay with any single color scheme. Most TF oil filter assemblies were supplied by Purolator, and this filter is easily identified by the large cupped washer under the head of the cannister attachment bolt. Purolator cannisters were usually metallic green with a decal outlining maintenance procedures. Some TF filter assemblies came from Tecalemit, and in such cases the cannister was a coppery brown with an instruction plate riveted or soldered on.

## OPTIONAL EQUIPMENT

I am often asked whether or not a certain accessory is original, but all I can say in most cases is maybe, depending on how you prefer to interpret the word "Original". When asked whether an item is a factory option, a dealer option, or an aftermarket accessory, my answer becomes even more vague. The dividing lines between these catagories are fuzzy at best and often non-existant, causing endless arguments among concours judges and show-oriented owners.

Section "P" of the *TF Service Parts List* contains several pages of optional extras and alternative equipment: wire wheels, Andrex friction shock absorbers, 5.125:1 and 4.555:1 rear axle ratios, a luggage carrier, an external rear view mirror, a badge bar, and a full-length tonneau cover.

In addition, although they are not shown in the *TF Service Parts List*, the factory could provide many special parts for the speed-oriented owner: high-compression pistons, special carburetors, magneto ignition systems, competition-quality head gaskets, special distributors, sodium-cooled exhaust valves, competition clutches, competition camshafts. One could even buy special competition cylinder blocks and cylinder heads. These were identical in most respects to the standard items, but had no water transfer holes on the head gasket surface. Water was carried from the block to the head via an external pipe at the rear of the engine.

Any of these items could be supplied by the factory, but which, if any, could be ordered from the factory actually installed in or on a TF? As far as I can determine, most could not be. All could be ordered through an M.G. dealer and installed by the dealer on a new car before delivery. They could also be installed either by the dealer or by the owner at a later date. In other words, these can be considered either factory options, dealer-installed options, or aftermarket accessories or all three, depending on how you prefer to look at it.

The picture is clouded additionally by the fact that there were dozens of manufacturers here and abroad specializing in aftermarket accessories and speed-tuning parts for sports cars. The variety of products available to the TF owner was staggering. Most could be ordered from mailorder outlets, but many M.G. dealers carried the same accessories in stock and would install them on a new TF before delivery at the request of a customer. Are these dealer-installed options or aftermarket accessories? Does it really matter?

Apparently it does matter to some purists, who assign an arbitrary order of acceptibility to accessories and optional equipment. To them, options available from the factory are "better" than those installed by a dealer, which are in turn preferred over those added later by the owner. When these cars were new no self-respecting owner left his car as delivered from the factory any longer than he had to. It is only recently that emphasis has been placed on so-called "factory originality". Perhaps after all the T Types are restored to factory original condition we can start adding accessories again.

## CONCLUSION

An article of this type is never really concluded. Those of you who know the TF inside and out will realize that there are great gaping holes in its content, and this is due in part to lack of space and in part to the author's ignorance. There may also be mistakes, for I can hardly lay claim to the title "expert" on these matters. Even so, I believe the information presented here should put the would-be TF restorer on the right track. If additional information comes to light, or if corrections need to be made, this will be taken care of in future editions of Technically Speaking.

My thanks to my friend and sometimes critic Jack Jackson, who cast his critical eye upon the first draft and suggested several worthwhile changes and additions. Thanks also to an anonymous (by his choice) enthusiast who was most cooperative in digging dates and other useful information out of the production records.

The majority of the drawings used to illustrate points made in the text were reproduced from *The M.G. Midget (Series TF and TF 1500) Operation Manual*, second edition (AKD 658A).

# TECHNICALLY SPEAKING

**By F. E. Old, III**
**Technical Editor**

For the August 1975 edition of Technically Speaking I wrote an article dealing with original T-Series color schemes, noting in my opening remarks that interest in the subject seemed to be growing. Little did I realize the extent of that increased interest in authenticity. I had hoped that the stream of requests for color information would stop after the article, but the result was just the opposite. The article generated more interest than ever before, and letters poured in asking for (and offering) additional information. To make matters worse, about two thousand new members have joined the Register since that article appeared, and quite a few of them are now writing for color information.

The result is that over two years later the questions are pouring in faster than ever, and again I find myself unable to answer them all. In many cases I have simply referred enquirers to the original article and to the additional information and corrections which appeared in subsequent issues of TSO, but this is not entirely satisfactory since new information has been unearthed and some of the old information has turned out to be incomplete or incorrect. I dislike having to cover the same topic over again in these pages, at the expense of other interesting topics, but the demand makes it necessary to do so. It's largely a matter of self defense; at least three quarters of the requests I receive for technical information are concerned in one way or another with T-Series color schemes.

What follows is basically a revised and corrected version of the August 1975 article. New information has been added, and I have tried to clarify several points which confused readers of the original version. For obvious reasons it is impossible to cover every minute detail in these few pages, but the areas of concern to most members will be dealt with as thoroughly as possible. I have tried to limit myself as much as possible to recorded facts, because very few of the many personal opinions and vague, twenty year old recollections which one hears on this subject can be relied upon for any degree of accuracy. My information is based largely upon specifications found in publicity brochures issued by M.G., road test articles in British motoring journals, close inspection of unrestored cars, and color information supplied by several paint manufacturers. Also referred to was an article by Martin Brent entitled "A Question Of Colour", which appeared in the October 1968 issue of **Safety Fast.** Every attempt has been made to ensure accuracy, but I am under no illusion that this is the definitive article on the subject. There are, in fact, several gaping holes which remain to be filled, and I will gladly accept any additions or corrections which are sent my way.

The majority of our members are concerned only with the T-Series, so to save space I will omit earlier models and the Y-Series. I do have a little bit of information on these other models which I will pass along upon request. We will begin with a model-by-model rundown of the original body and upholstery colors, then deal with smaller components, and finish with a listing of currently available paints which provide accurate reproductions of the original colors.

## TA

Production of the TA began in June 1936, and according to a brochure issued that same month the following color combinations were available on the early examples of this model:

| BODY | UPHOLSTERY |
|---|---|
| Saxe Blue | Blue |
| Racing Green | Green |
| Carmine Red | Red |
| Black | Blue, Green or Red |

TA production continued until April 1939, but I have not been able to locate a TA brochure dated later than June 1936. However, articles in British motoring journals of the time suggest that for 1938 and 1939 the TA could be had in the full range of colors common to all contemporary M.G. models: Emgee Green, Dublin Green, Apple Green, Duo Green (two-tone), Maroon, Abingdon Blue, Saxe Blue, Peacock Blue, Emgee Red, Coral Red, Metallic Grey and Light Grey. Upholstery choices were Biscuit, Brown, Green, Maroon, Grey, Red and Blue, but which upholstery colors went with which body colors is not clear.

Several reliable sources have claimed that these colors were not all available as standard on the TA, but this should not trouble the restorer. It was the policy of the Company during most of the pre-war years to offer several colors as standard for each model, but to provide other colors at the request of the purchaser. Colors from other M.G. models could be had free of charge, but for a bit extra the customer could specify any color at all. This is a real boon to the TA restorer, for it means that literally any color appropriate to the late thirties might legitimately be used without offending anyone.

The TA Drophead Coupe, more commonly known as the TA Tickford, appeared in late 1938. I have not seen a factory brochure for this model, but a report in the August 19, 1938 issue of **The Autocar** states that the full range of M.G. colors was available. The standard upholstery colors, however, were limited to Biscuit, Brown, Maroon or Grey.

## TB

Production of the TB began in May 1939 and continued until September of the same year, when the war effort put a stop to civilian automobile production. According to a brochure dated June 1939, the TB was available in a wide range of colors:

| BODY | UPHOLSTERY |
|---|---|
| Saxe Blue | Blue |
| Coral Red | Red |
| Apple Green | Green |
| Duo Green | Biscuit |
| Maroon | Maroon |
| Metallic Grey | Grey |
| Black | Any of the above |

According to the same brochure, the TB Tickford could be had in the same range of colors, with the addition of Light Grey. Upholstery color choices were Biscuit, Brown, Red or Grey with any of the body colors.

The TB brochure goes on to say that duo-tone color schemes could be ordered at no extra charge, provided standard M.G. colors were specified and provided the body was to be all one color and the wings and running boards all the other color. As with the TA, non-standard colors could be ordered at extra cost.

The standard TB normally came with upholstery to match the color of the body, but the brochure also states that contrasting upholstery could be ordered provided the customer limited his choice to one of the standard M.G. leather colors.

## TC

The TC was introduced in October 1945, and according to most sources the earliest examples were available only with black bodies and a choice of red, green or beige upholstery. No other colors were available until September 1946, when red and green exterior colors were added. Blue and cream were added still later, but the exact date is not known. A brochure dated January 1948 does not mention the two new colors, but they do appear in a brochure dated August 1948, so we must assume that blue and cream were added at some time between those dates. From then on, the TC color choices were as follows:

| BODY | UPHOLSTERY |
|---|---|
| Red | Red or Beige |
| Green | Green or Beige |
| Cream | Red or Green |
| Blue | Beige |
| Black | Red, Green or Beige |

Some TC brochures refer to these colors simply as red, green, cream, blue and black, as I have in the above listing. However, in other TC brochures the red becomes Regency Red or M.G. Red; green becomes either Shires Green, M.G. Green or Almond Green; cream becomes Sequoia Cream or Ivory; and blue becomes Clipper Blue. All these different color names are the root of a controversy which remains unresolved as of this writing. Some people claim that each of these color names actually identifies a different color; that there were, in other words, two different reds, three greens and two creams available at various times during TC production. Others claim that there was, in fact, only one shade of each basic color, but that the color names were changed from time to time as an advertising gimmick.

I have not been able to find conclusive evidence one way or the other, but most evidence seems to support the idea that only one shade of each color was used. It was and still is common practice among auto manufacturers to offer the same range of colors for several years in a row, but to use different names for those colors during different years or even for different models during the same year. M.G. has done this at various times in the past, and there is no reason to believe that the TC era was any exception. Furthermore, the paint manufacturers' listings for TC colors do not show codes for different shades of red, green and cream. This adds some credibility to the claim that only one shade of each color was used. Can anyone supply evidence to the contrary?

The same advertising ploy was sometimes used to describe the upholstery colors. In some TC brochures red upholstery becomes Regency Red, green becomes Shires Green, and beige becomes Vellium Beige.

## TD

The earliest TD brochures and contemporary road tests list color choices identical to those offered on the later TCs, but we now find the names assigned to these colors standardized as Black, M.G. Red, Almond Green, Ivory and Clipper Blue. Several of these colors were dropped as time went on and others were added, for a total of nine different TD colors. Exactly when one color ceased and another commenced is not clear, but as of late 1950 the following color combinations were available:

| BODY | UPHOLSTERY |
|---|---|
| Black | Red, Green or Beige |
| M.G. Red | Red or Beige |
| Autumn Red | Red or Beige |
| Almond Green | Beige |
| Ivory | Red or Green |
| Clipper Blue | Beige |
| Sun Bronze | Red or Green |

By 1953 the TD color choices had been narrowed down considerably:

| BODY | UPHOLSTERY |
|---|---|
| Black | Red or Green |
| M.G. Red | Red |
| Woodland Green | Green |
| Ivory | Red or Green |
| Silver Streak Grey | Red |

## TF

According to all TF brochures I have seen, this model was available in Black, M.G. Red, Green and Ivory. The brochures do not specify which green was used, but other contemporary sources identify it as Almond Green. None of the TF brochures list grey as an available color, but at some point during TF production Birch Grey was added to the list. The complete TF color list is as follows:

| BODY | UPHOLSTERY |
|---|---|
| Black | Red, Green or Biscuit |
| M.G. Red | Red or Biscuit |
| Almond Green | Green or Biscuit |
| Ivory | Red or Green |
| Birch Grey | Red |

You TF owners who wish to restore your cars to original color have a slight advantage over the rest of us. By referring to the third letter of the car number you can determine what color your TF was when it left the factory: A = Black, B = Grey, C = Red, E = Green, and P = Ivory. Thus, TF number HDA46/3894 was originally black, while HDC46/4807 was red. One will occasionally see other letters in the Register's new members listings, but these almost always turn out to be mistakes. The letter "F" is ofter seen, but in every case this has turned out to be either a typographical error or a partially obliterated E. There were sixteen color code letters used by the British Motor Corporation during that period, but only A, B, C, E and P designated TF colors. The letter "H" is occasionally found on a TF, indicating "completely knocked down" finish. These were cars which were shipped in partially disassembled form to assembly plants in Commonwealth countries, where they were assembled, painted and sold.

## MISCELLANEOUS DETAILS

Color information for the smaller details of the body, chassis and running gear is not as reliably documented as the upholstery and body color information we have just covered, and this unfortunate fact has been the cause of much confusion and controversy. Adding to the confusion is the fact that much of what has been accepted as truth in recent years has been based on vague recollections, and we all know how unreliable memory can be. To complicate matters even more, it has become apparent that different colors were used at various times on some parts, but when the changes were made and often exactly what changes were made is not always known. The following will serve as a general guide, but it is obviously incomplete and is not to be considered unshakable truth.

**Chassis:** The frame, axles, driveshaft and most of the brackets and other small bits and pieces attached to the frame were painted black on all models. It is sometimes said that the frame ends and brake drums were painted body color on later examples of the TC, but according to Cecil Cousins this was done only on a few special show cars and not in regular TC production.

**Wheels:** All T-Series wheels were originally painted silver, regardless of whether they were wire or disc type.

**Engine:** Engine color is difficult to pin down for the earlier cars. According to reasonably reliable sources, MPJG engines for the TA were painted either black or dark green; opinion is equally divided as to which is correct. The correct color for the early XPAG engines used in the TB is also unknown. The very earliest TC examples of the XPAG seem to have been dark green, but fairly early on this was changed to grey, sometimes described as greenish-grey. At some point in 1948, probably fairly early in the year, a change was made to a very dark red (not quite maroon) similar to M.G. Red. This color was continued through the TD and TF models.

**Gearbox:** TC, TD and TF gearboxes were painted the same color as the engine. This is probably also true of TA and TB gearboxes, but is not certain.

**Engine Compartment:** At about the time engine color was changed to red, TC firewalls were painted body color, and this was continued on the TD and TF. Reliable information for earlier cars is hard to come by, but it seems fairly certain that earlier TC firewalls were painted grey to match the engine. TA and TB Tickford firewalls were all black, but the correct color for the standard roadster is uncertain; some say black, others say body color. The bottom part of the firewall (toeboard) was sometimes painted to match the firewall, and sometimes painted black regardless of firewall or body color. This seems to be true throughout the T-Series range, and no logical pattern is discernable.

**Radiator Grille:** On all models except the TF, the grille slats seem usually to have been painted to match the upholstery color. In some cases, however, they were painted to match the body color. Which color was used on a given car probably depended upon the interior/exterior color combination used on that particular car, but no ironclad rule has been discovered. TF grille slats were always chrome plated, and it is possible (but by no means certain) that this also applies to a few of the very late examples of the TD Mk. II.

**Facia:** On all cars through late 1947 or early 1948 the facia was walnut veneer over plywood, and on later cars leathercloth colord to match the upholstery was used. The exact date of the changeover is unknown, but there is some evidence that the two types overlapped for a short time.

**Instrument Panel:** The metal instrument panel mounted in the center of the facia followed the same basic design from the TA through the TD. It was chrome plated, but the flat center section was painted so that only a chrome bead remained visible around the outer edge of the panel. Black paint was used through the early TC, but this was changed to bronze at about the time of the change from walnut to leathercloth on the facia. As with the facia, the two types seem to have overlapped for a short time. The painted bases of the map lights and 30 m.p.h. warning lights matched the instrument panel color.

**Carpets:** Black carpet with a fairly short cut pile was used on all models. The floor behind the seats was not carpeted; it was usually painted to match the upholstery.

**Fender Piping:** The piping, welting, beading or whatever you prefer to call it was always painted to match the color of the body.

**Weather Equipment:** According to all brochures and old photographs I have seen, tops and side curtains were beige or tan canvas. Several old hands claim to have seen a few cars with black tops and side curtains, but I have been unable to find written or photographic confirmation of this color. The metal top and side curtain frames were painted tan to match the material.

**Proprietary Parts:** Many of the smaller parts used on these cars were not made by M.G., but were purchased from outside manufacturers. The colors of these items seem to have depended on the whim of the manufacturers. Lucas generators and starters, for example, were usually black, but grey or green were sometimes found on earlier models. Throwaway oil filters used on the TC and early TD came from several different manufacturers, and in a variety of colors. TD headlamps (Lucas) were sometimes chrome plated and sometimes painted body color; most had the Lucas "King of the Road" emblem, but some did not. It has often been said that early TD headlamps were plated and later ones painted. This seems to be true in most cases, but is not a hard and fast rule. There were many other proprietary parts used on these cars, but none are as visible as the few described above, and their coloring is relatively unimportant. When in doubt, paint it black; you'll be right more often than not.

## CHOOSING YOUR PAINT

The most frustrating part of restoring a car to original specification is often the search for paint which is a perfect match for the original Clipper Blue, M.G. Red or whatever. To be perfectly honest, it is an almost impossible undertaking. At one time you could walk into almost any automobile paint dealership and get exactly what you needed, but those happy days are gone forever. With very few exceptions, none of the paint manufacturers still carry these old colors on their books, for the simple reason that it is not economically feasible to do so.

This unfortunate situation has given rise to several different approaches to the problem of finding a suitable modern paint for the T-Series. For several years the most popular approach has been to choose a color from some modern car. This has produced many very attractive cars, quite a few of which have been prize winners. These modern colors are seldom anything like the original colors, but there's nothing wrong with that as long as you like the finished product and are not concerned about flawless authenticity.

Custom mixing is another approach, but is resorted to mainly by those who absolutely must have the one and only authentic Woodland Green (or whatever) on their cars. Paint can be custom mixed to any color in the rainbow, and because of this it might seem to guarantee authenticity. This is not necessarily so. The paint dealer needs a sample of the original paint to work from, and this is where the trouble begins. After all these years even paint samples taken from protected parts of the car will have changed with age. Exterior paint exposed to the elements and engine compartment paint exposed to oil, gas and fumes are useless as accurate samples. Original paint excavated from under later layers of paint is not much help either, because the newer layers almost always penetrate and alter the original paint to some extent.

Custom mixing from such samples does not guarantee that your new paint will be an exact duplicate of the original, if that's what you are after. At almost any GOF you will see several cars nominally the same "original" color, all of them sprayed with paint custom mixed from old paint samples. They almost never look the same. Custom mixed paint will often be very pretty, but the person who claims to have duplicated an original color by this process is probably wrong.

On the other hand, custom mixing is often the only way to go if you need to respray a small portion of the car to match the existing color. This ensures that the newly sprayed panel will match the rest of the car, but has no bearing whatsoever on the authenticity of the color.

Recent developments make it again possible to get authentic colors directly from the dealer or distributor, but without the agony, expense and uncertainty associated with custom mixing. Several of the major paint manufacturers have gone through their books and have sent me lists of codes for the colors which they can still supply for our old M.G.s. These codes are shown in a table elsewhere in this article. Thanks are due to E. W. Rowe of Dupont, E. J. Borst of Martin-Senour, and especially to J. S. Wilson III and L. S. Cullens of Ditzler for their cooperation in this research.

Rinshed-Mason codes are also shown in the table, and these are taken from an article entitled "Colour Me Original" by Gord Whatley, which appeared in the Ontario Chapter's **Trillium News** several years ago. Rinshed-Mason has not responded to requests for confirmation of these codes, but the few cars I know to be painted using these R-M codes look reasonably authentic to me.

It is only fair to warn you that none of these paints are guaranteed to be absolutely perfect duplicates of the original colors. Most of these cars were painted with nitrocellulose lacquer (the British called it cellulose enamel), but the paints now being supplied are usually acrylic lacquer. The two types seldom look exactly alike when seen side by side, even if the color is nominally the same.

Furthermore, samples of the same nominal color obtained from different manufacturers seldom match each other perfectly. For example, I recently heard from Register member Dallas Woodall, who purchased small quantities of Clipper Blue from Rinshed-Mason, Dupont, Martin-Senour and Ditzler. Each was sprayed on a panel for comparison, and there were slight differences noticeable. This is no great cause for alarm; it even happens occasionally with colors for modern cars. Once you have decided what color you want to use, you might want to buy a pint of each brand, spray each on a panel, and decide which you like the best. Once you have chosen a brand, stay with that brand for any future touchup or repair work.

All four of these manufacturers are highly respected in the trade and can be depended upon to supply quality products, so I am slightly uneasy about recommending one over the others. Nevertheless, it should be said here that Ditzler has always been very cooperative in digging out and reactivating obsolete colors for people in the antique car hobby, and their colors for older cars are considered by many to be the most authentic available. Unfortunately, a few of the codes shown in the table are not carried in Ditzler's current books of mixing formulas, so you may find that your local Ditzler distributor cannot mix the color you want. If you encounter this difficulty, write to L. S. Cullens, Ditzler Paint, 20755 Greenfield Rd., Southfield, Mich. 48075. Tell him the make, year and model of your car, the name of the color you want, the code for that color as shown in the table, and the type of paint (enamel, lacquer, etc.) you want to use, and request a mixing formula for that color.

Conspicuously absent from the table are paint codes for the bronze instrument panels, tan side curtain and top frames, and the red, green and grey used on the engines. As this is being written I do not have suitable codes for these colors, nor do I know of anyone who does have them. Quite a few different paints have been tried in efforts to duplicate the red used on most T-Series engines, but none that I know of have been entirely satisfactory. There are almost no original examples left, because the caustic bath used to clean engines prior to rebuilding them strips off the paint along with all the sludge. Because of this, most custom-mixed engine paints are formulated to match someone's memory of the correct color or to suit the car owner's personal taste, and it is unusual these days to see two engines painted the same shade of red. A color which has gained some degree of popularity in recent years is Ditzler DQE 50782Y, an alkyd enamel, although many people feel that it is a bit too dark, more like a maroon than the original dark red.

This should fend off most questions on colors, at least until we add another two thousand or so to the membership roles. If you need color information which I have not included here, please don't hesitate to write or call. Please note, however, that I do not have any reliable paint codes other than those in the table. Others will be published in this column if and when they come to my attention, as will information on the subject of color.

# MGT PAINTS

| Color Name | Ditzler | Rinshed-Mason | Dupont | Martin-Senour |
|---|---|---|---|---|
| Abingdon Blue<br>Saxe Blue | 14475 | BM 071 | | |
| Peacock Blue | 44806 | BM 083 or 084 | | |
| Clipper Blue | 12297 | BM 042 | Dulux 93-25888 | 25286 |
| Cream (TA/TB) | 80203 | BM 126 | | |
| Sequoia Cream<br>Ivory | 81271 | BM 127 | | 25235 |
| Dublin Green<br>Apple Green | 43342 | BM 079 | Lucite 8193LH<br>Dulux 93-97230H | 20561 |
| Duo Green (light half) | 44705 | BM 106 | | |
| Duo Green (dark half) | 40495 | | | |
| Racing Green (?)<br>Emgee Green<br>Shires Green<br>M.G. Green<br>Almond Green | 44159 | BM 076 | Lucite 8195LH<br>Dulux 93-96233H | 20214 |
| Woodland Green | 2246 | BM 078 | Lucite 8194L<br>Dulux 93-98249 | |
| Metallic Grey | | BM 024 | | |
| Light Grey | 32714 | BM 013 | | |
| Silver Streak Grey | 72030 | | | 25280 |
| Birch Grey | 31918 | BM 002 | | |
| Maroon | 2150 | BM 114M | | |
| Carmine Red (?)<br>Emgee Red<br>Coral Red<br>Regency Red<br>M.G. Red | 71993 | BM 121R | | 25011 |
| Autumn Red | 50930 | BM 108R | Dulux 93-83450H | |
| Sun Bronze | 23662 | | | |

*Colors grouped in boxes (i.e. Abingdon Blue & Saxe Blue) are believed to be identical. Codes to right of each box are to be used for all color names in that box. Colors provided by these codes are as authentic as currently available information can provide, but are not guaranteed to be perfect. Codes are not currently known for colors mentioned in text but not shown in this table, except for black which is available from all manufacturers. Additions and corrections will be published as they become known.*

# Pretty as a picture

## and character that goes deep

To watch hard-boiled sporting motorists becoming starry-eyed at their first sight of the T.F. Midget is quite a touching experience! And undoubtedly she is a car to fall in love with. Her line is enhanced by a slightly longer and lower bonnet and a new bow-fronted radiator adds a touch of contemporary elegance. Headlamps are now gracefully streamlined into the wings. But, of course, it is in performance that the M.G. shows her breeding. Here in the T.F. you have all the vivid power and verve you expect, plus a new, more vigorous acceleration that will surprise even the most knowledgeable of M.G. enthusiasts. This T.F. model is clearly going to maintain and enhance the M.G. reputation for unique and exciting motoring in safety . . . fast!

*Safety-glass is a standard M.G feature.*

T.F. SERIES

MIDGET

*Safety fast!*

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Qualified M.G. owners planning a Continental Tour are invited to see their M.G. dealer for details of a free service to save foreign currency.

THE M.G. CAR COMPANY LIMITED, SALES DIVISION, COWLEY, OXFORD

*London Showrooms: Stratton House, 80 Piccadilly, London, W.1*

*Overseas Business: Nuffield Exports Limited, Cowley, Oxford, and at 41 Piccadilly, London, W.1*

# Back To Basics

By F. E. "Chip" Old
Technical Editor

The majority of our members do all or most of their own T-Series maintenance and tune-up work, so it comes as something of a surprise each time we meet an owner who pays a professional mechanic to carry out even the simplest job. Naturally, some of you prefer to do it that way. However, it's a safe bet that a lot of you who pay someone else do so only because you don't know how to do the work yourself. This new TSO column is designed for this group. It is not our intention to turn you all into expert mechanics. However, we believe that we can teach you how to do enough of your own basic maintenance and tune-up work so that you will have to visit a professional only when major repairs are needed.

Why should you bother to learn? For one thing, professional mechanics have never worked for bargain basement prices, and in these times of tight money the maintenance costs of a non-essential hobby car can be hard for some owners to bear. By doing your own basic work, you will save a lot of money.

More importantly, there's a good possibility that the job will be done better if you do it yourself. This isn't meant as a slur against the profession, but it is an unfortunate fact that some of the gas pump jockies who pass themselves off as mechanics really don't know much more about automobiles than you do. Even large dealerships have trouble finding enough good mechanics these days. The number of cars on the road is growing much faster than the number of trained mechanics available to service them, so garages and dealerships must either hire improperly trained mechanics or must push their trained mechanics to put out more work.

Either way, the quality of work has suffered as a result. The well informed amateur can often do a better job himself, if he is willing to work carefully and keep trying until he gets it right.

Last, but not least, is the satisfaction you will get from having a car that runs right because **you** made it run right. This may sound a bit corny to some of you, but most of us who do our own work really get quite a kick out of it.

Regardless of your motives, "Back To Basics" is designed for you. We will probably cover a lot of material which is included in the owner's manuals and workshop manuals, but only because these manuals are not always easy for the novice to understand. We will try to explain each operation in simple language. In addition, we will try to explain why these things must be done, and this is something the manuals don't do. It's all very well to know what step-by-step procedures you should follow in any given operation, but you can do a much better job of it if you understand why you are doing what you are doing.

It would be nice if we could cover everything at one time, but that would fill up this whole issue of TSO. We'll have to cover it one step at a time, one issue at a time. This means that you won't be able to do a complete tune-up for several months yet.

For openers, we will discuss the various tools you will need. Future installments will cover workshop manuals, oil change and lubrication, valve adjustment, ignition tune-up, carburetter and fuel pump tune-up, cooling system care, and other appropriate topics. Where we go from there will be largely up to you. If you don't like the column, we'll drop it at that point. If you do like it, we'll branch off into frequently needed minor repairs. Let's begin.

### THE BASIC TOOL KIT

If you visit your friendly local mechanic, you will probably find the walls of his shop lined with a bewildering array of tools, few of which will provide any clue regarding their intended purposes. This is one thing which has contributed to the layman's reluctance to try it on his own, by don't let it worry you. Many of those tools are special items designed to make often-repeated operations easier for the mechanic. You can do quite well without them. For the types of jobs we will be discussing in this column, all you will need are the few basic tools described below. We won't try to explain how to use basic hand tools like screwdrivers, wrenches, pliers and the like. If you don't already know, then go to your local library and ask for a book on the use of basic hand tools. There are many such books available, and they will teach you all you will ever need to know about the finer points of wielding a wrench or whatever. The use of more spêcialized tools will be explained in full when we get to the point where we need them.

*Photo #1 left to right, (front) phillips screwdriver, stubby standard screwdriver, standard screwdriver. (Rear) fin-nosed pliers, slip-joint pliers.*

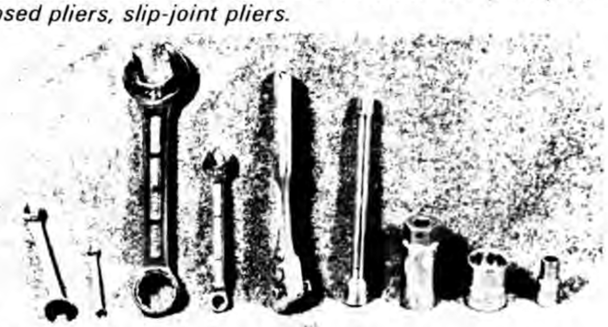

*Photo #2 left to right, two open end wrenches in BA sizes, two combination wrenches in Whitworth sizes, ratchet handle, 6 inch ratchet handle extension, spark plug socket, two whitworth sockets.*

*Photo #3 clockwise from front center, compression gauge, pencil type tire pressure gauge, PSW carb tool kit, Uni-Syn carb synchronizing tool, feeler gauges, spark plug gapping tool.*

Here's what you will need in your basic took kit:

**Screwdrivers:** A standard hardware store pre-packaged assortment will do, but make sure it contains at least two standard screwdrivers (medium and small) and a #2 Phillips

# # 1 --- TOOLS

screwdriver. A "stubby" screwdriver with a standard tip will also be useful. Others can be purchased as the need arises. Stay away from the extra large sizes. They're great for levering boulders out of the roadway, but not much else. (See photo #1)

**Pliers:** One standard slip-joint type and one thin-nose type. Again, avoid the giant-sized ones. (See photo #1.)

**Wrenches:** A set of "combination" wrenches in sizes 3/16BS through 9/16BS (or 1/8W through 1/2W) and a set of open-end "ignition wrenches" in sizes 0-BA through 8-BA will be the most useful ones to get. If your last paycheck included a bonus, also get a set of socket wrenches in the same sizes as the combination wrenches, and a ratchet handle to turn them. You can manage without the socket wrenches, but they do make life easier. Wrench sizes will be explained in more detail later on. (See photo #2.)

**Spark Plug Wrench:** For removing and replacing spark plugs. A cheap stamped steel one will do, but if you have a ratchet handle, get a spark plug socket to fit it. It's a lot easier to use. (See photo #2.)

**Spark Plug Gapping Tool:** For adjusting the spark gap, which will be covered in a future installment. The type with the wire-type feeler gauges is best. (See photos #3 & 4.)

**Timing Light:** For setting **static** ignition timing, which will be explained in a future installment. At that time I'll explain how to make one out of a bulb, a socket, some wire, and two alligator clips. It's easy. If you prefer to buy one, be sure the salesman understands that you want a light suitable for **static** timing. Don't let him talk you into buying a neon or strobe power timing light.

**Tire Pressure Gauge:** For checking the air pressure in your tires. You can spend a bundle for a dial-type gauge, or buy a cheaper pencil-type. The latter is sufficient, but make sure its scale starts at fifteen pounds or lower. Some start higher. (See photo #3.)

**Compression Gauge:** A basic tune-up tool used to test for leaking valves, piston rings and head gaskets, all of which will be explained in the future. The type which screws into the spark plug hole is the most foolproof, but they also tend to be the most expensive. Next best is one with a rubber tip which pushes into the spark plug hole and stays there until you pull it out. The cheapest ones usually have a cone-shaped rubber tip which must be held against the spark plug hole during the test. This ties up one hand, and unless you are an anatomical oddity you won't have enough free hands to do the other things required during a compression test. (See photo #3.)

*Photo #4 close up of typical spark plug gapping tool. L-shaped wire things are used to measure spark gap. T-shaped thing at right used for adjusting gap.*

*Photo #5 clockwise from front center, midget grease gun, grease cartridge for gun, pump type oil can, standard oil can, pouring spout for motor oil cans.*

**Feeler Gauges:** Used for measuring valve clearance and ignition point clearance. Consists of a number of metal blades of different thicknesses, usually ranging from .001 inch to about .025 inch, in .001 inch increments. (See photo #3.)

**PSW Carburetor Tool:** Useful for tuning S.U. carburetors. You can do without it, but you'll curse a lot less if you have one. (See photo #3.)

**Uni-Syn Carburetor Tool:** Will not perform as many different operations as the PSW tool, but allows more accurate synchronization of the dual carburetors than the PSW tool. An optional extra if your budget permits (See photo #3.)

**Grease Gun:** For lubricating all the chassis and running gear componants which require grease. The lever-operated cartridge-load type is easiest to use. The midget version shown in photo #5 will fit in the toolbox very neatly, and it's cartridges each hold enough grease for one complete lube job.

**Pouring Spout:** For opening and pouring 1 qt., 4 qt., and 5 qt. cans of motor oil. You can survive without this, but it makes the job of filling the sump a lot less messy. (See photo #5). New plastic containers are best.

**Oil Drain Pan:** For catching and holding the old oil when you drain it out during an oil change. Should hold at least two gallons, and must be low enough to fit under the engine.

**Oil Cans:** For squirting oil on parts which require periodic oiling. The trigger or lever operated pump type is easiest to use. Fill with clean SAE 20 motor oil. (See photo #5.)

**Wiping Rags:** Any type of lint-free material will do. Old baby diapers are fantastic!

This basic collection of tools will carry you through the basic tune-up and maintenance operations we will be discussing here. With the exception of the wrenches and the carburetor tools, you can find these tools in almost any hardware or auto supply store. Try your local Sears store before you go anywhere else; their "Craftsman" line of tools is hard to beat in terms of good quality at a low price. The PSW and Uni-Syn carburetor tools are usually available only at auto supply houses catering to the foreign car market. If you have a lot of money to spend and want nothing but the best, get your tools from Snap-On Tools Corp., Kenosha, Wis. 53104. Snap-On has outlets in many of the larger cities, so consult your telephone directory.

Finding suitable wrenches for your T-Series toolbox is a bit more difficult. Even the most basic household toolbox will usually contain a few wrenches in sizes to fit standard American bolts and nuts. Some of you who own European or Japanese cars might even have wrenches to fit metric bolts and nuts. Sorry to disappoint you, but neither will do. The bolts and nuts you will be dealing with on your T-Series M.G. are neither American or metric. They are generally known by the terms "Whitworth" or "British Standard," but even that isn't strictly correct. If you want to learn more about the various types of bolts and nuts used in your M.G., refer back to the July/August 1973 TSO, pages 105-106. For the purposes of this article it will be sufficient to say that American and metric wrenches will not work.

# Back to Basics . . .

Some people will disagree, and will tell you that by using some American sizes and some metric sizes you can come up with a wrench to fit almost any nut or bolt on your car. This is true, but it is **not** to be recommended. None of the American or metric wrenches will fit the British bolts and nuts really well, and the result will be rounded-off bolt heads and sprung wrench jaws. To turn British bolts, you need British wrenches.

For most of the bolts and nuts you will need either British Standard (BS) or Whitworth (W) wrenches. These two types actually cover the same sizes, but the size markings on the wrenches are different. For example, a 1/4BS wrench and a 3/16W wrench both turn the same size bolt. The reason for this is obscure and isn't worth going into here. Some manufactureres mark their wrenches in "BS" sizes, while others prefer to mark theirs in "W" sizes. In actual practice it doesn't matter which type you get. A set of wrenches ranging from 3/16BS (1/8W) through 9/16BS (1/2W) will handle most of the bolts and nuts on your car.

Most of the very small bolts and nuts go by a completely different size system known as "British Association" or "BA", and to turn these you need wrenches in BA sizes. These range from O-BA (the largest) to 8-BA (smaller) in most wrench sets. Some catalogs refer to these as British "ignition wrenches", since bolts in these sizes are used mainly in the ignition and electrical systems. However, you will find British Association fittings (especially 2-BA) all over your car.

You won't find British Standard, Whitworth, or British Association wrenches in your local hardware or auto supply store. Most all British cars switched over to the American Standard (also called "Unified") form in the mid to late 1950's, so the demand in this country for tools to fit the earlier form is not high. However, most British motorcycles didn't make the switch until the late 1960's, so many motorcycle shops still carry appropriate wrenches. Moss Motors, Abingdon Spares, and most of the other T-Series parts houses can supply quality wrenches, as can the Snap-On Tools Corporation mentioned earlier. In face, many people consider Snap-On's British Standard and British Association wrenches the best available in this country. The Metric & Multistandard Componants Corporation, 198 Saw Mill River Rd., Elmsford, N.Y. 10523 can also supply quality wrenches, and thay can also supply BS and BA bolts and nuts at lower prices than I've come across elsewhere. There are many other sources for BS, W, and BA wrenches, but these are the most prominent.

One last word about tools in general before we move on to other things. You can buy all these tools for very little money if you really want to economize, but as a general rule you will find that you can get much better tools if you are willing to spend a bit more. Also generally speaking, you will find that the more expensive tool will be easier to use and will last longer than the less expensive one. Before you decide to buy the cheapies from the 88¢ tool counter at the supermarket, please consider the fact that the money you spend now on good tools will be paid back many times over by the garage bills you won't be paying when you learn to do your own maintenance and tune-up work.

In the next installment of "Back To Basics" we will discuss all the workshop manuals which are available for the T-Series M.G., and will recommend those which we feel are best for the beginner. We'll also spend some time on an English lesson. Beleive it or not, British English and American English are **not** the same language, especially when it comes to automotive terminology. The manuals are all written in British English, which can confuse the beginner. It's fun! Tune in next issue.

# Back to Basic

**By F. E. "Chip" Old**
**Technical Editor**

In part one of this "Back To Basics" series we discussed the various tools needed for basic maintenance and tune-up work. Now that you've gone out and bought those tools, you're probably champing at the bit and ready to get down to work on your car, aren't you? So am I, believe me, but we're not quite ready for that yet. So put the cover back over your car, put all those shiny new tools away, pour yourself a tall glass of your favorite brew, and let's sit down and talk about shop manuals.

Every now and then someone will sidle up to me and announce very proudly that he has always done his own maintenance and tune-up work, or even his own engine rebuild, and all without ever having looked at a shop manual. I can only assume that these people like to live dangerously, because not even the most experienced mechanic will try to get by without a manual of some sort for the car he is working on. The manual provides numerous specifications and procedures which are needed for even the most basic work. Without those specifications and procedures, you cannot possibly expect to keep your car running properly. It is senseless to try to commit all the necessary specifications to memory, because sooner or later your memory is going to fail you. Would you entrust your life to a surgeon who memorized his textbooks several years ago and never looked at them since? I wouldn't. Even if you never progress beyond the simple operations which will be covered in this series, you will find a workshop manual indispensable.

There are a number of good workshop manuals available for the T-Series M.G., but the manuals published by the factory are by far the best:

*Instruction Manual For The M.G. Midget (Series TA & TB)*: An excellent manual for owners of prewar T Series cars. Provides details on the MPJG and early XPAG engines.

*Instruction Manual For The M.G. Midget (Series TC)*: Not as comprehensive as the TA/TB manual, but covers most basic maintenance operations.

*M.G. Midget (Series TD) Operation Manual* and *M.G. Misget (Series TF & TF 1500) Operation Manual*: These owner's manuals are similar in content and provide a handy guide to most maintenance operations.

*M.G. Midget (Series TD & TF) Workshop Manual*: This excellent factory manual covers the TD and TF in great detail, and is recommended reading for beginner and expert alike.

*Maintenance Manual And Instruction Book For The M.G. 1¼ Litre (Series Y)* and *M.G. 1¼ Litre (Series YB) Workshop Manual*: Each of these is a combined owner's manual and workshop manual, even more detailed than the TD/TF Workshop Manual. The first covers the Y and YT, while the second covers only the YB.

These factory manuals are available from most T Series parts suppliers in reprint form, and may sometimes be obtained from Classic Motorbooks, 3106 West Lake Street, Minneapolis, Minnesota 55416. This firm can occasionally supply reprints of owner's manuals and parts manuals for earlier models as well.

There are also several independently published manuals worth mentioning here:

***The M.G. Workshop Manual***: by W. E. Blower. Often referred to as "Blower's Bible", this manual covers all M.G. models from the M-Type through the TF. Although it is comprised mainly of extracts from the factory manuals, additional bits of wisdom are thrown in here and there. All the necessary information is there, but is is sometimes hard to find since so many different models are covered.

*Tuning And Maintenance of M.G.s*, by Philip H. Smith. Concerned mainly with PA, PB, TA, TB, TC, TD and TF engine overhaul procedures. Contains many bits of wisdom not found in other manuals, and will be useful to the owner who might want to go beyond the basics.

*M.G. Midget TA-TF 1936-1955 Autobook*, by Kenneth Ball. Mostly a rehash of the factory manuals, but much less detailed.

All three of these independently published manuals are available from Classic Motorbooks and from T-Series parts suppliers. The Autobook can be found at many parts and accessories stores which cater to the foreign car trade.

Which one should you buy? If at all possible, buy the factory shop manual for your particular model, as the factory manuals are by far the most comprehensive. If you would rather use one of the independent manuals (and they are somewhat less expensive), then the Autobook is probably best for the novice.

Once you get your manual, sit down and look through it. If you are really a novice there won't be much point in reading it cover to cover at this time, since much of what you read won't make any sense to you. Familiarize yourself with the manual's arrangement, though, and find the table of contents and the index so that you can find the appropriate sections when you need them.

Reading the manual will present difficulties not only because you lack basic automotive knowledge, but also because these manuals are all very British. They are written in British English, not American English, and the two varieties of the language are quite different in many respects. A glance down the following comparative dictionary of automotive terminology should prove the point. Many novice T-Type mechanics have no trouble at all with this strange terminology, but many others are completely stymied by it. The following is included here as an aid to the latter group.

| BRITISH TERM | AMERICAN EQUIVALENT |
|---|---|
| **Engine** | |
| Cam Follower | Valve Lifter, Tappet |
| Choke Tube | Carburetor Venturi |
| Contact Breaker | Ignition Points |
| Float Chamber | Carburetor Float Bowl |
| Gudgeon Pin | Piston Pin, Wrist Pin |
| H.T. Cables | Spark Plug Wires |
| Inlet Valve | Intake Valve |
| Micro Adjuster | Octane Selector |
| Mixture Control | Choke |
| Slow Running Control | Hand Throttle |
| Sparking Plug | Spark Plug |
| Sump | Oil Pan |
| Valve Cotter | Split Valve Lock, Valve Key |
| Valve Crash | Valve Float |
| Welch Plug | Core Plug, Freeze Plug |
| **Drive Train** | |
| Balk Ring | Synchronizing Ring or Cone |
| Clutch Housing | Bell Housing |
| Clutch Release Bearing | Throwout Bearing |
| Clutch Withdrawal Fork | Throwout Arm |
| Crown Wheel & Pinion | Ring & Pinion Gears |
| First Motion Shaft | Input Shaft |
| Gearbox | Transmission |

# No. 2 — Manuals

| | |
|---|---|
| Gearchange | Gearshift Lever |
| Laygear | Cluster Gear, Countergear |
| Layshaft | Countershaft |
| Propeller Shaft | Driveshaft |
| Remote Control | Remote Shifting Mechanism |
| Second Motion Shaft | Cluster Gear, Countergear |
| Third Motion Shaft | Output Shaft |
| **Body** | |
| Bonnet | Hood |
| Boot | Trunk, Luggage Compartment |
| Bulkhead | Firewall |
| Dashboard | Firewall |
| Fascia or Facia | Dashboard |
| Hood | Convertible Top |
| Hood Sticks | Top Frame |
| Mudguard | Fender |
| Over Rider | Bumperette |
| Screenwiper | Windshield Wiper |
| Seat Squab | Seat Back |
| Seat Cushion | Seat Bottom |
| Windscreen | Windshield |
| Wing | Fender |
| **Miscellaneous** | |
| Bush | Bushing |
| Circlip | Snap Ring, Spring Clip |
| Control Box | Voltage Regulator |
| Damper | Shock Absorber |
| Dial | Instrument Face |
| Distance Piece | Spacer |
| Dynamo | Generator |
| Earth | Electrical Ground |
| End Float | End Clearance |
| Extractor | Gear or Bearing Puller |
| Fraze | Burr from cutting, drilling, etc. |
| Grub Screw | Dog Screw, Set Screw |
| Joint Washer | Gasket |
| Jointing Compound | Gasket Cement |
| L.H.D. | Left Hand Drive |
| L.H.S. | Left Hand Side |
| Laden | Loaded |
| Methylated Spirits | Denatured Alcohol |
| Near Side | Left Side |
| Off Side | Right Side |
| Paraffin | Kerosene |
| Perished | Rotted |
| Petrol | Gasoline |
| R.H.D. | Right Hand Drive |
| R.H.S. | Right Hand Side |
| Rectify | Repair |
| Renew | Replace |
| Revolution Counter | Tachometer |
| Road Springs | Suspension Springs |
| Running In | Breaking In |
| Set Screw | Bolt or Machine Screw (sometimes) |
| Silencer | Muffler |
| Spanner | Wrench |
| Spigot Bearing | Pilot Bearing |
| Split Pin | Cotter Pin |
| Spring Washer | Lock Washer |
| Swarf | Chips from cutting, drilling, etc. |
| Swivel Axle | Spindle, Stub Axle |
| Swivel Pin | King Pin, Pivot Pin |

Not only will familiarity with the British terminology help you to read and understand your shop manual, it will help you understand TSO as well. As you have probably noticed, some of our contributors are died in the wool Anglophiles who use the British terminology exclusively. Other, the Anglophobes, shun it at all cost. Still others of us can't make up our minds and jump back and forth between the two languages, often within the same sentence. I regret to say that I fall into this last category, although I'm trying very hard to stick to American terminology in this "Back To Basics" series

If any of you wish to pursue the matter of British English versus American English further, I suggest you ask for a copy of *British Self-Taught, With Comments In American*, by Norman W. Schur, at your local library. This delightful book contains thousands of British words and their American equivalents. It's a real eye opener, and often quite amusing.

Our dictionary of automotive terminology alone could take up several more pages, were we to list every single term. However, for the sake of your sanity and my typing finger (singular intended), I'll leave it for the time being and start working on the next installment. Tune in next issue for a discussion of lubricants, lubrication and the basic oil change.

# BACK TO BASICS, NO

By F. E. "Chip" Old
Technical Editor

Now that we have the necessary tools and manuals (see parts 1 & 2 of this series) we are ready to go to work. It's time to get your hands dirty.

Lubrication is the easiest of the maintenance operations for the novice to perform, but by coincidence it is also one of the most important to the well-being of the car. There are hundreds of places on every car where one piece of metal moves against another. Without adequate lubrication these parts will wear out or sieze tight, neither condition being especially benefical to anyone except the parts suppliers.

Lubrication is simply the act of applying something slippery (lubricant) to the spaces between these moving parts. The lubricant (oil, grease, or whatever) forms a film which holds the rubbing surfaces apart, thereby eliminating or at least minimizing friction. This reduction in friction helps the parts work smoothly together and decreases wear dramatically. Our more knowledgeable readers will recognize this as an oversimplified explanation of the "why" of lubrication, but it is adequate for our purposes. Lubrication is necessary; without it your car would be reduced to rubble in short order.

As you read through what follows you will notice that we spend very little time on what to lubricate and how to lubricate it. This is covered in detail in the owner's manuals and workshop manuals published by the factory. There would be little point in repeating all that information here, especially since it would take up far more room than is available. As I said in part two, you will need a manual if you expect to do your own work. There's no way around it. Some manuals are not as well illustrated as others, and so that you won't have to spend hours looking for parts without knowing what they look like, some of the illustrations from the *TD/TF Workshop Manual* will be reproduced to ease identication problems.

The components requiring lubrication fall into three distinct categories. First comes the engine and all its accessories (generator, water pump, etc.). Second is the drive train (gearbox, driveshaft, rear axle). The third includes the chassis, body and everything else not included elsewhere.

Engine lubrication requires the most explanation, so we will deal with that first. The rest will be dealt with in part four.

**ENGINE LUBRICATION**: A large percentage of the moving parts in a car are concentrated within the relatively small confines of the engine, and these parts work harder than any others in the car. At a relatively sedate 3000 rpm (about 50 mph) the crankshaft revolves in its bearings fifty times each second. The pistons travel up their bores and back fifty times each second. The camshaft opens each valve (there are eight) twenty-five times per second, and all the related valve gear (tappets, pushrods, rocker arms) operate at that same speed. Dozens of other parts spin, slide, wobble, oscillate or thrash around at equally frantic speeds. No other parts in the car are asked to move so far, so fast, or under as heavy a load. More than any other component in the car, it is imperative that the engine receive a constant supply of clean high-quality lubricant. If that supply fails the engine will reduce itself to junk in a few seconds.

The monumental task of lubricating the engine is handled by a system which has been almost universally used since the early days of the automobile. The oil supply for the engine is contained in the bottomost part of the engine, called the sump by the British but more descriptively named the "oil pan" by us Yanks. An oil pump, located on the left side of the engine, sucks oil up from the sump through a wire mesh screen which removes particles of junk large enough to damage the pump. It then forces the oil under pressure through an external oil filter which removes particles large enough to damage the engine. Once it clears the filter, the oil is forced through pipes and drilled passageways to all the engine parts requiring lubrication. The oil then drains back down into the sump, where the cycle begins again. This is another oversimplification, but the system is fully described in the manuals if you are interested.

This is a remarkably reliable system; very little can go wrong with it except as the result of gross neglect on the part of the owner and/or mechanic. There is, however, one weak link in the system, and that is the oil itself. Contrary to popular belief, oil never loses its oiliness, slipperyness, lubricosity, or whatever you prefer to call it. However, it eventually becomes contaminated by acids, combustion by-products, and particles of junk too small to be trapped in the filter. Also, the additives found in every modern oil eventually break down and fail to do their jobs. The resulting mess is hardly fit to be called a lubricant. For this reason it is necessary to drain out the old oil at regular intervals and replace it with fresh new oil. We will discuss this simple operation a bit later, but first we must decide what type of oil to use.

The biggest problem facing the amateur oil changer is that of choosing the right oil for his engine. There are a bewildering number of brands and types of oil available, enough to make the experts cry and the beginners go back to bicycles. To make matters worse, every backyard mechanic seems to be a self-proclaimed expert on the subject of oil, resulting in the dissemination of a huge body of misinformation in general, and in particular the perpetuation of theories which were out of date even before the days of the T-Series M.G. Let's try to cut through some of the fog.

**ENGINE OIL TYPES**: Any motor oil will lubricate an engine, but some will do a better job of it than others. Modern motor oils almost all contain additives designed to fight certain conditions which "straight" oils cannot cope with: sludge, varnish, acids, bearing corrosion, scuffing, frothing, and a number of other problems. The American Petroleum Institute grades motor oils according to the types and quantities of additives they contain.

**SA** oils are non-detergent additive-free oils which are not required to meet any performance requirements. This classification includes everything from good additive-free oils to the dregs from the local tar pit. SA oils are manufactured only to supply special needs and to cater to those who are thirty years behind the times.

**SB** oils contain a few additives to protect against scuffing, bearing corrosion and oil oxidation, but they provide only minimum protection.

**SC** oils are slightly better, containing the additives listed above plus a few others which protect against high and low temperature deposits, rust, and wear.

**SD** oils protect against all the conditions the other oils do, but more so. Until 1971 this was the best grade available.

**SE** grade oils appeared in 1971, and offer even more protection for the engine.

Every can of motor oil will carry one of these grade designations somewhere on it, usually on the lid. You will also find other markings on most cans: ML, MM, MS (an older grading system); DG, DM, DS (an old diesel grading system) and CA, CB, CC, CD (the modern diesel system). These are unimportant for our purposes, so don't let them confuse you. The best oils will also display the statement "Meets or exceeds all manufacturers' warranty requirements" or something to that effect.

Which type is best for your M.G. engine? Some owners refuse to use anything except old fashioned non-detergent additive-free (grade SA) oils. The usual lines of reasoning are that this was the type of oil the engine was designed to use, that modern detergent oils will clog up old dirty engines, that modern oils don't lubricate as well, and so on *ad nauseum.*

These ideas represent fuzzy reasoning at best, and are not born out by the facts.

Only one of these arguments deserves further comment. When detergent oils first became available there was much concern that they would dislodge the deposits which used to build up inside old engines, clogging up the oil lines and ruining the engine. This proved not to be a problem, and now the possibility no longer exists since virtually every quality oil sold in the past fifteen or twenty years has contained detergents. Any deposits which might once have existed will have been washed away long ago, unless the owner has gone to a lot of trouble to search out sources of non-detergent oil. Even if he has, there is no cause for concern. Detergent oil will clean the deposits out quite safely, and the engine will be better off because of it.

It will pay you to use the best oil you can get. Look for oil cans bearing the "SE" designation and the statement "Meets or exceeds all manufacturers' warranty requirements". Such oils will provide the best possible protection for your engine. The best oil need not be the most expensive. Grade SE oil is available at a wide variety of prices. Top quality oil from major manufacturers can often be found in discount stores at prices far lower than the normal retail price. It pays to shop around, and it also pays to buy in quantity. A ten quart can, for example, will usually cost considerably less than ten one quart cans. Similarly, a case of twenty-four one quart cans will often cost less than the same number of cans bought individually.

**VISCOSITY:** Every motor oil is assigned an SAE (Society of Automotive Engineers) viscosity index number. In simple terms, the lower the number the thinner the oil. SAE 5W and 10W oils are very thin, providing easy starting and instant oil circulation under cold start conditions. The "W" indicates that the oil contains additives which enhance cold flow characteristics. The higher numbers, such as SAE 30, 40 and 50 are heavier oils which provide good lubrication under high operating temperature conditions.

When our cars were new, these single-viscosity oils were all that were widely available. The factory recommended viscosity ranges which were more or less standard in those days: SAE 30 for temperatures consistantly above 32°F, SAE 20 or 20W for temperatures between 32°F and 0°F, and SAE 10 or 10W for temperatures consistantly below 0°F. If you insist upon using single-visocity oil, these recommendations should be adhered to.

Unfortunately, single-viscosity oil is a compromise at best. Let's assume that your engine has been running for a while and is thoroughly hot. Under these conditions an SAE 40 or 50 oil will be required to provide the best possible lubrication. But before the engine warms up this heavy oil will be as thick as molasses. When you first start the engine this thick goo will not flow freely, so the bearings will not receive enough oil, resulting in tremendous wear. To provide the best lubrication under cold start conditions we need an SAE 10W or 20W oil which will flow freely into the bearings while it is still cold. But, this thin oil gets even thinner when it gets really hot, and will not provide adequate lubrication at normal running temperatures. If a single-viscosity oil is to be used it must fall between the extremes of SAE 10W and SAE 50, so SAE 30 is specified. This provides reasonably free flow when cold, but not as free as the thinner SAE 10W. It also provides reasonably good performance at running temperatures, but not as good as the heavier SAE 50. It is, as I have stated, a compromise.

Lubrication technology has taken great strides since the late forties and early fifties, providing multi-viscosity oils which do a better job over a wider range of temperatures. In light of this, it makes little sense to use the old single-viscosity oils. Multi-viscosity oils have been available since the early 1950s, but for many years they were almost universally mistrusted among enthusiasts. This mistrust has largely evaporated, and multi-viscosity oils are now almost universally accepted, even in some racing circles.

These oils are engineered to provide the best possible lubrication both under cold start conditions and hot running conditions. For example, an oil rated as SAE 10W-40 will perform like an SAE 10W oil when it is cold, providing instant lubrication when the engine is first started up. It performs like an SAE 40 oil when it gets hot, providing good lubrication at running temperatures. In between those extremes, it performs like an SAE 20 or SAE 30 oil, depending upon the temperatures encountered.

Another advantage of multi-viscosity oil is that it eliminates the need for different viscosities to suit different seasonal temperatures. The ability to cope with temperature changes both inside and outside the engine is built into the oil.

Nobody claims that multi-viscosity oil is the final solution to the lubrication problem. Lubrication technology is constantly advancing, so in a few years there will probably be something much better. Right now, however, multi-viscosity oils bearing the SE rating are the best available. They will lubricate and protect your engine far better than the old single-viscosity non-detergent oils. Use them.

A number of viscosity ranges are available: 10W-30, 10W-40, 10W-50, 20W-40, 20W-50, and so on. SAE 10W-30 and 10W-40 are the most easily obtained in the States, and either of these will work fine in your M.G. (with preference for the SAE 10W-40). SAE 10W-50 and 20W-50 oils are just becoming available here, but they have been in use in Europe and Great Britain for several years. If you can find them, these seem to be the best choice. All reports seem to indicate that engine wear is significantly reduced when 10W-50 or 20W-50 is used in the T-Series.

**SYNTHETIC OIL:** Man-made synthetic lubricating oils have been used for many years in applications where running speeds and temperatures remain more or less constant. Several companies are now marketing synthetics for automotive use, but they haven't really caught on yet. At first glance the synthetics seem to offer many advantages over the mineral-based oils we are accustomed to, but there are still many questions left unanswered. I don't really know enough about the synthetics to form an opinion, but since they are so much more expensive than normal oils I prefer to wait and see whether or not they really prove to be superior.

**BRANDS:** Sooner or later at any gathering of automotive enthusiasts an argument will start over the merits or lack thereof of this or that brand of oil. You will also see advertising claims to the effect that Castrol is best, Shell is best, Kendall is best, and so on from Valvoline to Grandma Gerber's Goober Goo. The truth of the matter is that there is very little real difference between one brand and the next, assuming that they are grade SE and are the same viscosity. They may use slightly different additive packages, but the net result will be the same.

**SNAKE OIL:** There are dozens of motor oil additives on the market which are supposed to do wonderful things for your engine if you add them to the oil. Some of the claims made by the manufacturers sound very much like those made for patent medicines in years past, hence the nickname "snake oil". We've all seen the ads, but it has always struck me as odd that none of the snake oil brewers publish hard facts to support the claims made in these ads. Any good motor oil will already contain all the additives your engine needs, all blended together into a compatible package. Until such time as Andy Granatelli (STP) and the others prove that they know more about oil than the oil companies, I strongly suggest that you save your money.

**CHANGING OIL:** Once you have decided what oil to use, the actual job of changing the oil is quite simple. The procedure is fully described in the manuals, so we won't go through it in detail here. However, there are several useful tips which are not included in the manuals.

Use the correct wrench to loosen the drain plug (fig. 1). It is made of brass, so anything besides the correct 9/16 BS or ½ W wrench will chew it up, making future oil changes difficult. Let the oil drain completely; unless you are in a big hurry, let it drip a while. Before you screw the plug back in, make sure the threads are clean and the sealing washer is in good condition. Tighten the plug firmly and decisively, but don't use extra-long wrenches or super-human effort as this will only make it hard to remove next time.

Now you are ready to pour in the new oil. Do not just keep pouring it in until it reaches the "full" mark on the dipstick (fig. 2). It takes a while for all the oil to drain down into the sump, so the dipstick may lead you to believe you have added the right amount when in fact you may have overfilled it. This is a no-no! Instead, pour in only the correct amount for your car, as follows:

| | |
|---|---|
| TA | 11 Imp. pints (6.5 U.S. quarts) |
| TB, TC, early TD | 9 Imp. pints (5 U.S. quarts) |
| late TD, TF | 10.5 Imp. pints (6 U.S. quarts) |

Those of you who are mathematically adept will notice that my conversions from Imperial pints to U.S. quarts are not exact. For example, the TA sump really holds 6.6 quarts, but it's rather difficult to measure out oil that exactly. Use the figures shown above, then after the oil has had time to run down into the sump check the level with the dipstick and add more if necessary, bringing it up to the full mark.

TD owners reading this might be wondering how to tell whether they have the five quart sump or the six quart sump. The change was made at engine number XPAG/TD2/14948, but due to numerous engine swaps and modifications this is no longer an accurate guide. It's not unusual to find a TB with the large sump or a TF with the smaller one. The external appearance of the two types is quite different if you know what to look for. Profile drawings of the two types are included elsewhere (fig. 3) and should make identification quite simple.

**OIL FILTER:** The oil filter should be changed every 6000 miles, just like it says in the manual. For the most part this presents no particular problem and is adequately explained in the manual, but there are several things to look out for.

Owners of TCs and early TDs with the "throw-away" type of filter (fig. 4) must take care not to damage the

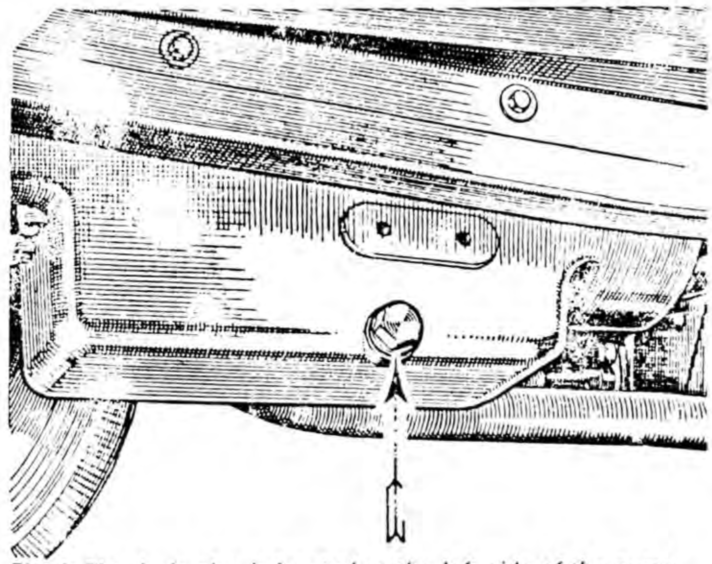

*Fig. 1: The drain plug is located on the left side of the sump.*

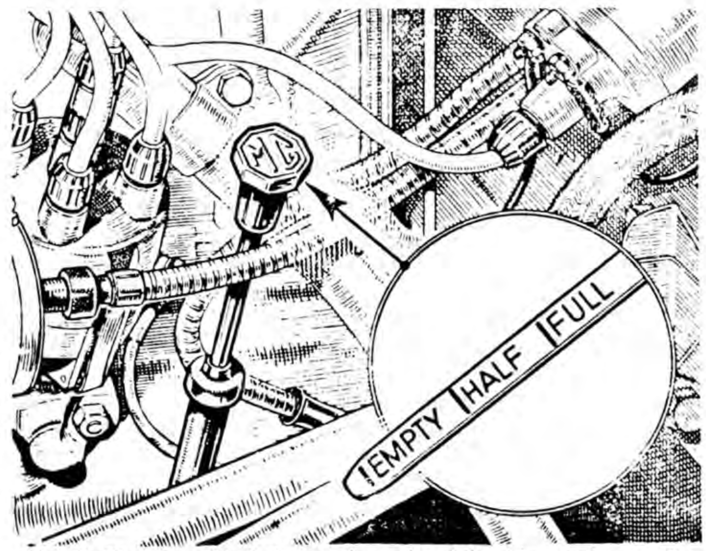


*Fig. 2: The dipstick is located on the left side of the engine. Inset shows the oil level markings.*

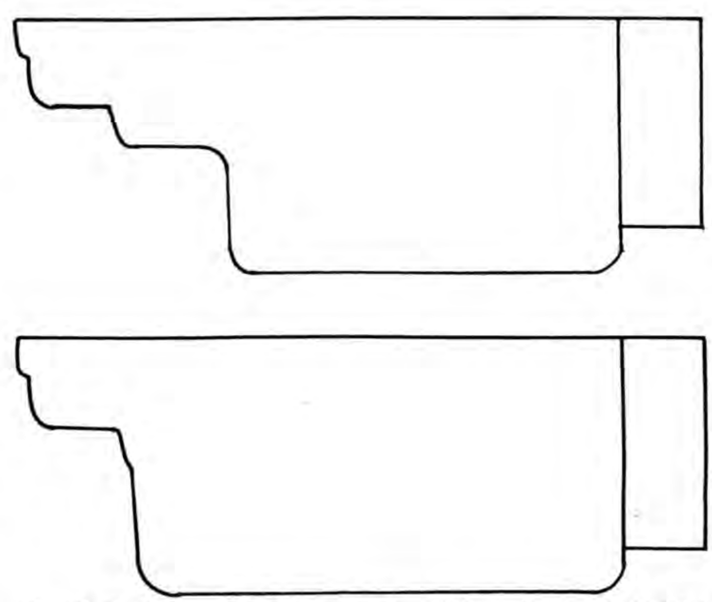

*Fig. 3: Profiles of the 5 qt. (top) and 6 qt. (bottom) XPAG/XPEG sumps, as seen from the left side.*

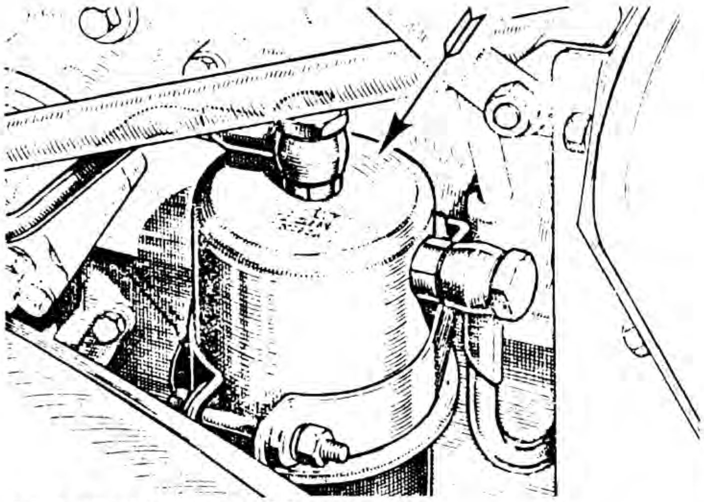

*Fig. 4: The TC and early TD oil filter.*

external oil pipes attached to the filter. The correct procedure is not fully explained in the manual. The filter is secured to the left side of the engine by a clamp, and the oil pipes are attached to the filter by banjo bolts. Unscrew the banjo bolts first, then loosen the clamp. **Do not** bend the pipes away from the filter. Slide the filter downwards out of the clamp and throw it away. Slide the new filter up into the clamp, but leave it loose for the time being. Screw the banjo bolts in finger tight, making sure that the copper washers (two per bolt) are in place. Now tighten the clamp firmly, then tighten the banjo bolts. Never loosen or tighten the banjo bolts with the clamp loose, or you will quite likely bend the pipes out of position. If this happens you will have to bend them around quite a bit to get them to match up again, and eventually all that bending will cause cracks in the pipes. If this happens you will lose all your oil, and if that happens you will also lose the engine.

You may find that a previous owner has done away with the throw-away filter and fitted a cannister type with a replaceable element. If so, you are on your own. There are too many different types to cover here. Most of the replacement types are fairly simple to take apart and renew, but you may have to search quite a while to find a suitable replacement element. Even so, don't neglect it. If the filter becomes clogged, the filter bypass valve will open and allow unfiltered oil into the engine.

The later cars which came with replaceable element filters as standard equipment (fig. 5) pose no problem except for the rubber ring which seals the joint between the cannister and the oil pump. Your new filter may come with a new ring, and if this is the case then you should use it. You will have to dig the old ring out of its recess in the oil pump, and this can be difficult. A knife blade, thin screwdriver or ice pick will usually do the job. Make sure the recess is absolutely free of dirt or fragments of the old ring. Before you push the new ring into the recess, smear it lightly with oil.

**STARTING UP:** When you first start the engine after an oil or filter change, do not run it any faster than slow idle until pressure begins to show on the oil pressure gauge. This is especially important after a filter change, since the oil pump will have to fill the empty new filter before any oil is pumped into the engine itself. The engine receives no oil for that short period of time, and high rpms with no oil pressure will ruin the bearings.

If after a few seconds the gauge continues to register zero pressure, then the oil pump has probably lost its prime. This does not happen often during an oil change, but it is not unknown. Shut off the engine immediately to prevent bearing damage, then prime the pump. The procedure varies

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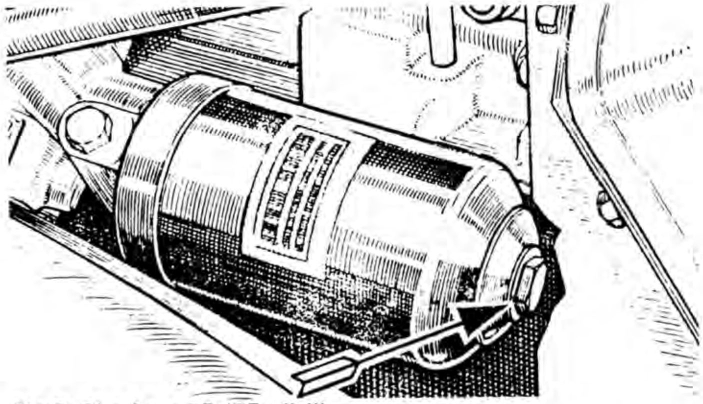

*Fig 5: The Late TD/TF oil filter.*

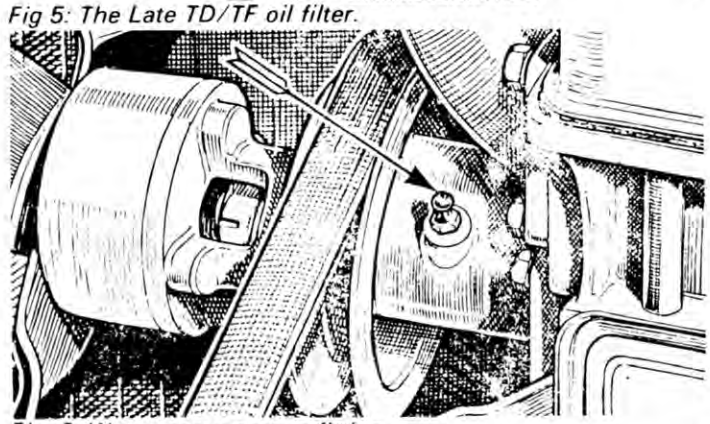

*Fig. 6: Water pump grease fitting.*

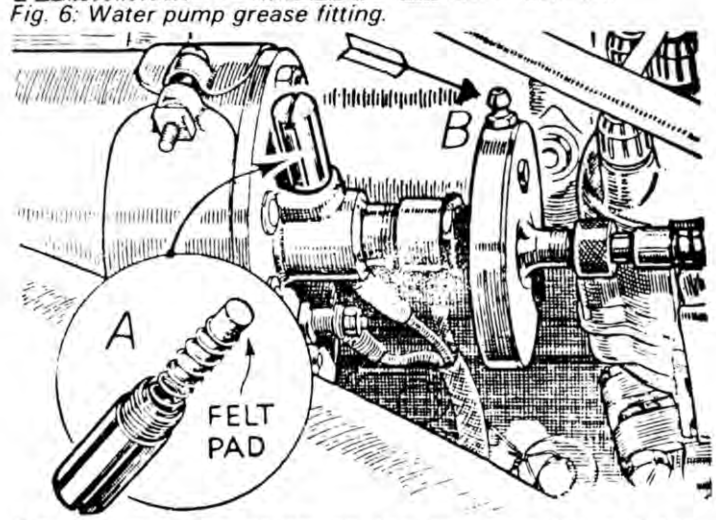


*Fig. 7: Lubrication points on the generator (A) and the tachometer drive (B).*

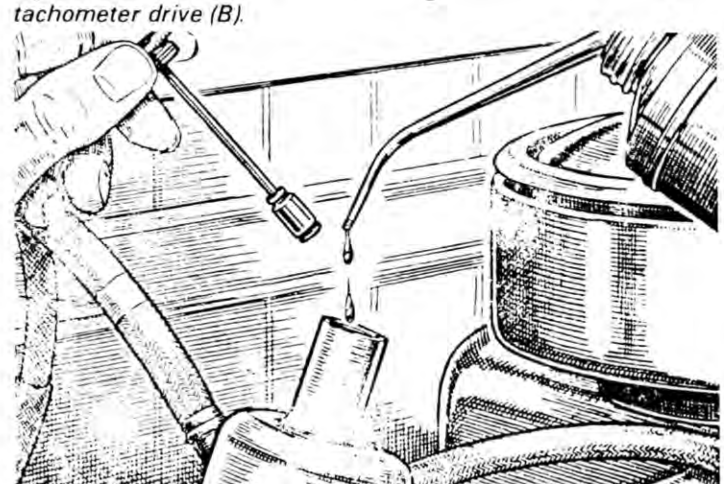

*Fig. 8: Adding Oil to the carburetter dashpots.*

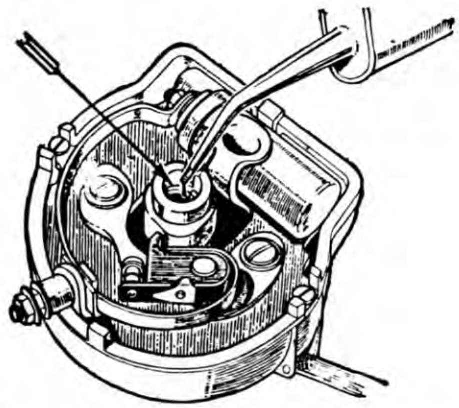

*Fig. 9: Lubricating the distributor cam bearing.*

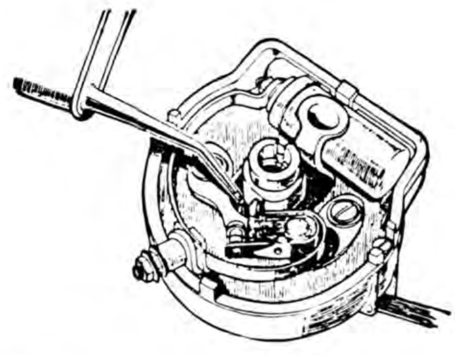

*Fig. 10: Lubricating the distributor advance mechanism.*

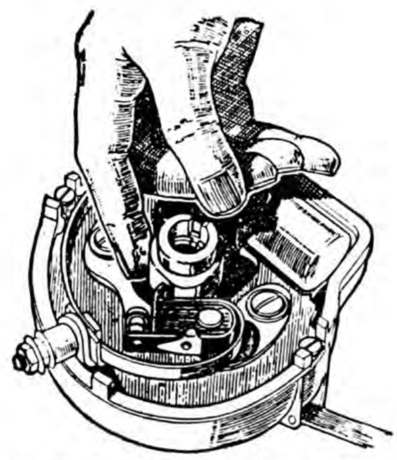

*Fig. 11: Lubricating the distributor cam.*

**BASICS ___**

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depending on the model, but is fully explained in the manuals.

**MISCELLANEOUS:** There are other parts of the engine which require attention: water pump (fig. 6), generator and tachometer drive (fig. 7), carburetter dashpots (fig. 8), distributor (figs. 9, 10, 11), air cleaners, and so on. These operations are fully explained in the manuals and require no further comment.

That about covers engine lubrication, and it took a lot longer to write about it than it takes to actually do it. Lube everything at the intervals recommended in the manual and you will help your engine live a long happy life. Always use high quality lubricants; the use of cheaper low quality lubricants is a false economy. Work slowly and carefully and you will have no difficulty performing the jobs outlined here. Above all, be clean! To paraphrase the immortal words of Woody Wood, cleanliness is next to Godliness, and this is probably as close as most of us will ever come. Wipe all the grit, grime and goo off the area you are working on before you do anything else. There's little point in changing the oil filter, for example, if in the process of bolting the new one on you knock a hunk of dirt into it.

Tune in next time for a discussion of chasses and body lubrication.

# Back to Basics #4 --- LUBRICATION

By F. E. Old III

The workshop manuals and owner's manuals published by the factory provide a pretty thorough explanation of what to lubricate and how to lubricate it. An entire chapter in each manual is devoted to lubrication, and in the back you will find diagrams showing the location of each point requiring attention. Assuming that you have a manual for your car, we will not attempt to duplicate all the information it provides. If you don't have a manual, then you should either get one or forget about doing your own maintenance work.

There are, however, several areas where the information in the manuals may be added to and improved upon. For example, several of the original recommendations concerning types of lubricant and frequency of lubrication (particularly for the pre-war models) have become obsolete as the result of new and improved products. Also, there are a few places requiring lubrication which are not mentioned in the manuals or not discussed in enough detail. These are the things we will deal with here, and it is hoped that this information combined with the information in the manuals will enable the novice to do a proper job of lubricating his car.

### CHOOSING THE CORRECT LUBRICANT

Lists of recommended lubricants are provided in the manuals, but they are not very useful now that they are twenty to forty years old. First, the brand names listed are not generally available in the United States. Second, lubricant grades are not clearly specified, at least not in terms we are accustomed to using. Third, some of the lubricants recommended are decidely old-fashioned and have been superceded in general automotive use by newer and better products. Under these circumstances, we will have to devise a whole new list of recommendations.

### BRANDS

The manuals list specific brands which the M.G. Car Company apparently felt were best for use in their cars. This may have been worth worrying about twenty to forty years ago, when lubricant quality was likely to vary greatly from one brand to the next. Now, however, quality is strictly controlled by a number of governmental and industrial regulatory agencies, so it is hard to go wrong. Nevertheless, lubricants can still be bought whose super-low prices are equalled only by their super-low quality. To play it safe, use only lubricants bearing nationally-known brand names.

### MOTOR OIL

The correct type of oil for use in your engine was discussed in part three of this series (Oct. 1975 TSO), so we won't go into it again. However, metal-to-metal rubbing contact occurs in scores of other places on the car, many of which require lubrication with clean SAE 20 or SAE 30 motor oil. The old-fashioned non-detergent additive-free cheap stuff will do fine for these applications, but please don't use it in your engine. I find it most convenient to keep two pump-type oil cans on hand, one filled with SAE 20 and the other with SAE 30.

### GEAR LUBRICANT

Also known as transmission grease, axle grease, or gear oil, gear lubricant is intended primarily for lubricating the transmission and rear axle, although it is sometimes used in other components as well. It is a special thick oil with sufficient body to resist oil film puncture, thereby preventing most actual metal-to-metal contact between the meshing gear teeth. On the other hand, it must not be so thick that it "channels" when it is very cold. Channeling occurs when the oil is so thick that the gears cut channels through it, and the oil does not flow freely into the spaces between the gear teeth.

Gear lubricants may be divided into two basic types according to the type of service required of them. The first and older of the two is usually referred to as "straight" or "mineral" gear oil. This type is suitable for use in rear axles using spiral bevel gears, such as the M.G. TA, TB, TC, YA and YT models, and in transmissions.

The second type is required for use in hypoid gear rear axles, such as are found in the TD, TF and YB models. Hypoid gear teeth not only roll over one another, they also slide over each other. Lubricant intended for use in hypoid axles contains additives which enable it to withstand much greater pressure than "straight" gear oil alone can stand. Such lubricants are known as "hypoid" or "EP" (extreme pressure) gear oils. This type **must** be used in TD, TF and YB rear axles, and it may also be used in transmissions and earlier spiral bevel rear axles. In fact, hypoid oil is the only type of automotive gear lube widely available today, so owners of the earlier models really have no choice but to use it.

The thickness or fluidity of gear oil is measured in terms of a viscosity index, just like motor oil, with the lower viscosity numbers indicating thinner oils and the higher numbers indicating thicker ones. The manuals call for the use of SAE 140 (TA, TB, TC, YA, YT) or SAE 90 (TD, TF, YB) at temperatures above 10°F, and SAE 80 (all models) at temperatures consistantly below 10°F. It is probably best to stick with the manufacturer's original specifications, although many owners have used the wrong grade (i.e. SAE 90 in a TC or SAE 140 in a TD) with no apparent ill effects over short periods of time. Several multi-viscosity gear oils have been introduced in recent years, the most common being SAE 80-90 and SAE 90-140. I cannot speak from experience since I have never used multi-viscosity gear oil, but it would seem that it offers the same advantages as multi-viscosity motor oil: good flow characteristics at low temperatures and good film puncture resistance at high temperatures. If you want to try it, then I would suggest the use of SAE 90-140 in all models. The low cold temperature viscosity **might** cure the cold morning transmission howl often experienced in the TA, TB, TC, YA and YT, and the higher hot-temperature viscosity **might** help to cure the fast wear encountered in TD, TF and YB transmissions. No guarantees, though; there isn't enough data available on the use of multi-viscosity gear oil in these particular cars, so I can't make an ironclad recommendation.

Gear oil is usually sold in plastic quart bottles and in larger cans. The larger sizes will cost less in the long run, but the quart bottles are easier to store and pour.

### CHASSIS GREASE

Grease is essentially oil to which certain thickening agents have been added. The oil does the actual lubricating, and the thickening agents simply hold the oil in place so it doesn't run off the parts being lubricated. These thickening agents are usually referred to as "soap", but they are not the kind we use for washing. The "soap" can be one of (or a combination of) several metallic compounds, the type used depending upon the service required of the grease. The viscosity of the oil used in the grease will also vary depending on service requirements.

Today grease is used at all chassis lubrication points where reservoirs of oil are either unnecessary or impractical. This was not always true. For some older cars (like the TA & TB) SAE 140 gear oil was the recommended lubricant for most chassis lube points. The theory seems to have been that heavy oil provided better lubrication than grease, even though the oil ran out of the joints easily and had to be renewed often.

By the time the TC went into production, grease had become the accepted lubricant for almost all chassis lube points, even though the items requiring lubricants were almost identical to their earlier counterparts. Even so, you will notice in the TC lubrication chart that two types of grease were called for: wheel bearing grease (hub grease) for wheel bearings, and chassis grease for most other points.

By the time the TD came along, the recommended grease for all points requiring grease (including wheel bearings) was what is usually called "multi-purpose" grease, and this type (in improved form) is still used today. Multi-purpose grease is almost always lithium-based, although some types are now available which also contain molybdenum disulphide. Multi-purpose grease will provide excellent service at almost all lubrication points on **all** T-Series and Y-Series chassis, regardless of what type of lubricant was originally called for. There are a few exceptions, but these will be pointed out later.

Multi-purpose grease is available in cartridges to fit cartridge-load grease guns, and in cans for use in bulk-load guns. Get which ever suits the requirements of your grease gun, but make sure it is multi-purpose lithium or moly grease.

### STICK LUBRICANT

There are many places on the body which require lubrication, but some of them (like door lock strikers) are in locations where they will be brushed against by the passengers. Grease or oil will do a fine job of lubricating these points, but they do an equally fine job of staining the clothing. Other body lube points may be in exposed locations where an obvious gob of grease or runny oil will detract from the appearance of the car. For such applications a stainless stick lubricant is ideal, as it provides an almost invisible film of lubricant and will not stain the clothing.

The most widely distributed brand is called "Door-Ease", although I am sure there must be other brands on the market. Door-Ease comes in a container which might best be described as a giant-sized red, white and blue chapstick tube. Like chapstick, it is applied by pushing the stick of lubricant up out of the tube and rubbing it over the surface requiring lubrication.

### SILICONE LUBRICANT

At several points on the body, rubber moldings are fitted between metal panels to keep them from rubbing together, rattling, and losing their paint. Trouble is, friction eventually causes these rubber buffers to wear down, and they often squeak quite a bit in the process. Lubrication will stop the squeaking and minimize the wear, but conventional mineral-based lubricants (oil & grease) will destroy the rubber. Silicone lubricant will not harm the rubber, and is available in easy-to-apply aerosol spray form.

### HYDRAULIC OIL

Strictly speaking, this is not a lubricant, but you will need some to service your shock absorbers. The manual will tell you to use genuine Girling or Armstrong hydraulic damper fluid, depending on which type of shocks are used on your car. Armstrong fluid may sometimes be obtained from M.G. dealers, and I see that Abingdon Spares lists it in their catalog. If your car is a TF or one of the later TDs with Armstrongs, then by all means get a can of the genuine Armstrong fluid and use it.

If your car is an earlier model with Girling shocks, then you have a problem. Girling fluid is very hard to come by, so you'll probably have to use a substitute. It may be all right to use Armstrong fluid in your Girlings, but I've never tried it so I can't be sure. Luckily, a perfectly acceptable substitute is available at the nearest motorcycle shop. Motorcycle front forks have built-in hydraulic dampers, and the fluid ("fork oil") made for them will work very well in your Girlings. What's more, motorcycle fork oil is available in several different thicknesses, identified by the same SAE viscosity ratings used for motor oil. SAE 20 fork oil seems to work best in Girling piston-type shocks (TC, TD & Y), although SAE 30 might be more satisfactory if the shocks are badly worn. The vane-type Girling or Luvax used on the TA and TB requires a thicker fluid, so SAE 40 seems to be best.

Many TAs and TBs have been retrofitted with Girling piston-type shocks, and many TDs originally fitted with Girlings have been retrofitted with Armstrongs, so you might want to make sure which type you have before you start pouring the fluid. The Girling vane-types and piston-types are easily told apart by the fact the the piston-type has two horizontally opposed cylinders which are readily visible, while the vane-type has no cylinders. The Armstrongs can easily be told from the Girlings by the fact that the Girling's pistons stick out of opposite sides of the shock body (horizontally opposed), while the Armstrong's pistons both stick out of the same side of the shock body.

Armstrong fluid and motorcycle fork oil come in pint cans and bottles, and unless you are dismantling your shocks one pint will last you nearly forever.

### BRAKE FLUID

The hydraulic brake components in all T and Y-Series cars are manufactured by Lockheed, and the older manuals warn that only Lockheed Genuine Brake Fluid should be used in the system. A lot of people will tell you that the use of other brands will lead to the destruction of the rubber cups in the brake cylinders. This may have been true years ago when brake fluid quality was not strictly controlled and unethical operators sold mineral-based fluids under the guise of brake fluid. Mineral-based fluids **will** destroy the rubber cups, rendering the brake system inoperative, so there was real cause for concern in the days when such substandard fluids were on the market.

You may have noticed that boxes of British-made Lockheed parts still bear a warning against the use of any fluid other than the genuine Lockheed stuff. However, you will also notice that many British-published manuals for non-British cars also recommend the use of Lockheed fluid, regardless of who manufactured the brake parts. It may be that in Great Britain it is still possible to purchase mineral-based fluids disguised as brake fluid. Maybe one of our overseas readers can tell us. In the United States there is no real reason to worry about it. For many years the Society of Automotive Engineers has set standards for brake fluid quality, and recently even the Federal Government has gotten into the act. It is now illegal in this country to sell any brand of brake fluid which is incompatible with any other brand of brake fluid or with the components of any automotive hydraulic brake system.

If you need further proof, turn to section M.16 of the TD/TF Workshop Manual, which says: "In cases of difficulty in obtaining Lockheed Genuine Brake Fluid, use must be made of a fluid conforming to S.A.E. specification 70.R2." That old 70.R2 specification has long since been superceded by S.A.E. specification J1073, and even more recently by DOT-3. Thanks to technological advances and increasingly tough standards, modern DOT-3 brake fluid is a considerably better product than any brake fluid (Lockheed or otherwise) which was available when our cars were new. It **will not** harm your Lockheed brake parts. Furthermore, it is available from every auto dealer, auto supply store, service station and discount store in the country, so you don't have to try very hard to find it. Use it!

Brake fluid is packaged in pint cans and also in larger sizes. You will be using only small amounts, so buy the pint cans. Larger cans will take a long time to use up, and while the container is sitting around half full the fluid will absorb small amounts of moisture from the air, even if the top is screwed down tight. Moisture is not good for your hydraulic system!

## LUBRICATION INTERVALS

The lubrication intervals (frequency of lubrication) recommended by the manuals varies greatly from one model to the next, and in fact two different lubrication charts for the same model will sometimes be found to disagree. In addition, the types and quality of lubricants have improved greatly since these cars were new, so in some cases it is not necessary to lubricate as often as was originally specified. On the other hand, time has taught us that some components require lubrication more often than was originally specified if undue wear is to be prevented.

A lubrication interval table suitable for all T and Y-Series cars is provided elsewhere in this article. The recommended intervals are based on the assumption that the car is in more or less constant use. Owners who use their cars very little should lubricate at the recommended intervals or at least once a year, whichever comes first.

You will notice that some parts are to be lubricated as often as every 500 or 1,000 miles. This may seem ridiculous in these days of the modern extended-lube and no-lube car, but do it anyway. Those expensive parts will wear out very quickly if you don't.

## USING THE GREASE GUN

A grease gun is nothing more than a pump made to handle thick grease, with a built-in reservoir for holding the grease supply. The basic idea is to stick the business end of the grease gun onto the grease fittings found all over the car and pump in the grease. Everyone knows that.

What many people don't know is that there is a right way (and several wrong ways) to use the grease gun. The idea is to shoot **clean** grease into the joints serviced by each grease fitting. Always wipe the fitting clean before applying the gun, and never put the gun down nozzle-first in the dirt. If the grease gun has been sitting around for a while, wipe the nozzle off and squeeze off a shot or two of grease to clear away any dirt which may be in or on the nozzle. Forcing dirty grease into the fittings is almost as bad as not greasing the car at all.

Be careful to push the nozzle straight onto the fitting, and pull it straight off again. The nozzle will go on and come off a lot more easily if it is twisted to the side, but resist the temptation to do this. It's an easy way to break off the fitting, especially some of the replacement fittings now being sold which are not as sturdy as the originals.

Each grease fitting has a ball-check valve built in which opens when pressure is applied from the grease gun. The valve is closed the rest of the time, and is supposed to keep the grease in and dirt and water out. Unfortunately, the check valve is not always very clever in this respect. In addition, the joints lubricated by the fittings are not especially well sealed on these cars, so the grease in the joints becomes contaminated rather quickly by dirt and water. To get rid of the contaminated grease it is necessary to keep pumping fresh grease in until the old grease is forced out. This should be done at all joints except a few where excess grease will get into the wrong places. The lubrication interval chart elsewhere in this article specifies the correct number of grease gun strokes for places where the flushing technique should not be used.

When lubricating load-bearing components such as the front end, it is necessary to take the load off the components by jacking up the chassis. Otherwise the grease won't be forced well into the joints.

After you have finished lubing each joint, wipe any excess grease off the joint and the grease fitting so it will not collect dirt.

## SPECIFIC INSTRUCTIONS

In most cases you can depend upon the manual to tell you all you need to know about lubricating each specific component. However, the following additional information will be invaluable to the novice grease monkey.

## GROUPED FITTING LUBRICATION

The late TA and TB models have two groups of grease fittings mounted on the firewall, from which tubes connect to the spring trunnions and handbrake cables. It is not uncommon for the small-diameter tubing to become clogged with hardened grease, especially if old fashioned stiff grease has been used in the past. If you can't force the new grease through, dismantle the tubing and clean or replace it. It isn't necessary to use the gear oil originally specified for these fittings. Modern lithium grease will flow through the tubing quite easily, and will not harden with age.

## STEERING GEARBOX

Most TA, TB and TC steering boxes were originally equipped with what looked like a grease fitting in the top cover, although this fitting has long since disappeared from most cars. As it says in the manual, this fitting is for **oil.** Under no circumstances should grease be used in the steering box, as it does not flow freely enough to lubricate the sector shaft adequately. Use only SAE 140 gear oil, just like it says in the manual.

Injecting gear oil through the "grease" fitting in the top cover leaves much to be desired. In the first place, you need a bulk-loading grease gun which can also handle heavy oil, and most of you probably have cartridge-load guns. In the second place, there is no way to tell whether or not the steering box is full. Forget about the grease fitting, and proceed as follows.

Remove the top cover, which is held on by two bolts and the grease fitting, or three bolts if the fitting has been removed. Don't lose any of the shims which are under the cover, and don't let any dirt get into the interior of the box! Inspect the lubricant in the box. If it looks thick like grease or a mixture of oil and grease (anything thicker than SAE 140 gear oil is too thick), then get it out of there. Use your fingers, brushes, rags or anything else that will do the job, but get out as much of that thick goo as you can.

Now fill the box with SAE 140 gear oil and put the cover back on. Don't forget the shims! Now sit back and contemplate the top of the steering box. You will notice that the box and column slope uphill towards the steering wheel. Remove the top cover bolt which is the farthest uphill (left rear bolt as you face the box from the side) and dribble more SAE 140 through the hole until it overflows. Replace the bolt. The steering box is now as full as it needs to be, and future toppings-up may be done through that bolt hole. Not much oil should be required in the future unless the box leaks pretty badly around the sector shaft.

Some TA steering gears have a filler hole drilled in the top side of the steering column about ten inches up from the steering box. If your car is so equipped, simply push aside the spring clip which covers the filler hole and put in the SAE 140 oil until it starts to overflow. This is a worthwhile modification for other TA/TB/TC steering boxes, since it ensures a plentiful reservoir of oil for these notoriously leaky units. Don't try to drill the new filler hole with the unit in the car, though, since the drilling chips will fall into the bearings and ruin them. Wait until you can take the steering box out of the car, dismantle it, drill the hole, and clean the box thoroughly.

### STEERING RACK

The original lube charts call for the use of gear oil in the TD/TF/Y steering rack, but modern multi-purpose lithium grease works just as well and isn't nearly as messy. If you want to use SAE 90 or SAE 140 oil as was originally specified, then you will need a bulk-loading grease gun which can be filled with oil instead of grease.

### FRONT WHEEL BEARINGS

The instructions given in the manuals for greasing the front wheel bearings are next to useless. For most models, we are asked to remove the grease cap (disc wheels) or locknut (wire wheels), fill the cavity with grease, and replace the cap or locknut. This does a great job of keeping the outer end of the hub greasy, but very little of that grease finds its way into the bearings where it is needed. On some TDs and Ys a grease fitting is provided which gets the grease to the right place, but if the hub is already pretty full you will find yourself forcing grease past the seal and into the brake drums. This is a no-no unless you happen to like lubricated brake linings.

A far more effective procedure is that which is common practice for almost every other make of car. First, remove the hubs. This will usually require a puller, so if you don't have one or can't borrow one you might want to entrust wheel bearing lubrication to a service station. Once the hubs are off, remove the bearings and seals. Clean the bearings thoroughly in clean kerosene or gasoline, then dry them. Use compressed air if it is available, but don't let the stream of air spin the bearing. Pack each bearing with fresh multi-purpose grease. Work the grease well down between the balls and the races, and also smear some around the inside of the hub. Don't use old-fashioned wheel bearing grease. It is so stiff that once it has been thrown out of the bearing by the rotation of the bearing, it cannot flow back into the bearing. Now put the bearings back into the hubs, install new seals, and put the hubs back onto the spindles. If this procedure is followed every 12,000 miles the bearings will get all the lubrication they need, and you won't have to worry about excess grease being forced into the brakes.

### REAR WHEEL BEARINGS

The rear hubs on the TA, TB, TC and some Ys are equipped with grease fittings, and the manuals say to shoot some grease into them every 6,000 miles. Forget it! This is another place where it is too easy to overdo it, but in this case you will be forcing excess grease into the rear brakes. Rear wheel bearings need be greased only when they are first installed, and any time subsequent to that when the hubs are removed for a brake job or whatever. Enough gear oil seeps into the hubs from the rear axle to keep the bearings very well lubricated. The tricky part is to keep the gear oil from leaking out of the hub and into the brakes, but that's the subject for a later article.

TD, TF and YB rear wheel bearings are lubricated by oil from the axle, so they require greasing only when they are first installed.

### REAR AXLE

Procedures for draining and refilling the rear axle are clearly explained in the manuals, but it is important to emphasize that you must not overfill the axle. Overfilling will increase the chances of oil leaking into the brakes, and this does no-one but the local brake shop any good.

The YA/YT rear axle has a dipstick, making it a simple matter to avoid overfilling. The TD/TF/YB rear axle should be filled to the bottom thread in the filler plug hole, and that's also pretty easy to manage. The TA/TB/TC rear axle has two plugs which must be removed: a large brass filler plug on the left side of the axle nosepiece, and a smaller oil level plug on the right side. Remove both plugs, and add oil slowly through the filler opening until it starts to run out of the oil level hole. Let it run out until it stops, then put both plugs back in again. A number of TA/TB/TC owners have made the mistake of filling to the bottom of the filler hole, ignoring the oil level plug entirely. This makes the oil level way too high, and you can count on the excess getting into the brakes eventually.

All models have a small diameter breather hole somewhere on the rear axle. On the TD/TF/YB axle it is located on top of the left axle tube, and on all other models it is in the filler plug. Poke a wire through the breather hole every time you check the oil level, just to make sure the hole is not blocked up. As the oil in the axle heats up, pressure builds up inside the axle housing. If the breather hole is clogged up this pressure will force oil out into the brakes.

### TRANSMISSION

The comments made above about overfilling also apply to the transmission. In this case, overfilling will increase the chances of oil leaking past the front seal and into the clutch housing. This doesn't matter so much in the case of the TA, since its clutch runs in oil anyway, but the other models use dry clutches and they should be kept that way. An oily clutch is almost as bad as oily brakes; in the one case you can't stop, in the other you can't go. All T and Y transmissions have dipsticks, so maintaining the proper oil level should be no problem. All models also have breather holes in the filler plug, and these should be kept open for the same reasons discussed earlier.

### LEAF SPRINGS

The leaf springs on most American cars are not lubricated, but they are already so soft that you wouldn't notice much difference if you did lube them. On the other hand, the TA, TB and TC will ride a lot more comfortably if you take the trouble to lubricate all four leaf springs every now and then. The first step is to wire brush the dirt off the outside of each spring. From there on you have two ways to go.

The easy way out is to use your spray can of silicone lubricant or a spray can of motorcycle drive chain lubricant. Take the weight off each spring by jacking up the chassis, then spray the lubricant in between the spring leaves. This works fairly well for a while, but the effects are not as long lasting as those obtained by the second method. Springs lubricated by spray can will require re-lubing every 1,000 miles or so.

The second method is a bit more trouble, but well worth it. First knock open the clips which hold the leaves together (four on each spring), or unbolt them if they are the take-apart type. Then jack up the chassis to take the weight off the spring. Next, use a knife blade or other thin instrument to work grease in between the leaves. Some people like to mix a quantity of powdered graphite with the grease, and this seems to be quite effective. When you are finished, let down the jack and put the clips back around the leaves.

The rear springs on the TD and TF (and maybe the Y, but I can't remember at the moment) have rubber pads between the spring and the axle and rubber buffers between the ends of the leaves. These springs must not be lubricated with grease or chain oil, since mineral-based lubricant will destroy the rubber. Use only silicone lubricant. Some replacement springs do not have these rubber pads and buffers, and if you have this type you may lubricate with grease as described for the TA/TB/TC.

## MISCELLANEOUS ITEMS

There are literally hunderds of other parts not mentioned in the manuals or earlier in this article which nonetheless require periodic lubrication. All rotating parts should be lubricated with SAE 30 motor oil. All metal-to-metal sliding or rubbing parts should be lubricated with grease or stick lubricant. All rubber parts should be treated with silicone lubricant, which will minimize wear and also protect the rubber from weather cracking.

This is a time-consuming task, but it has to be done. The best way is to start at one end of the car and work towards the other end. If you jump around from spot to spot you are bound to miss something. Accumulated dirt, dust, and old lubricant should be wiped off before applying the new lubricant. Operate each mechanism a few times to work the new lubricant in, then wipe off any excess.

Things like door hinges and latches are obvious points for attention, but don't stop with the obvious. A lot of parts which are out of sight and usually out of mind also require lubrication, but the list would be far too long to include here. What I like to do is mentally divide the car into small sections, then examine each section to see what needs attention. As a general rule, if it rotates, slides, rubs, squeaks or shows other signs of friction, then lubricate it.

## CONCLUSION

That's all for now, although there are so many things to be covered under the heading of lubrication that I'm sure I've left something out. Please let me know if you notice any errors or omissions.

Tune in next time for the first installment covering real tune-up work. In part five you will learn how to perform and interpret a compression check and how to adjust the valves. Happy wrenching!

# RECOMMENDED LUBRICATION INTERVALS: M.G. SERIES T & Y

### KEY TO RECOMMENDED LUBRICANTS

MO 20 - SAE 20 Motor Oil
MO 30 - SAE 30 Motor Oil
MO M-V - Multi-viscosity Motor Oil (SAE 10W-40 or 20W-50)
GL 90 - SAE 90 Hypoid Gear Lubricant
GL 140 - SAE 140 Gear Lubricant (hypoid or straight)
MPG - Multi-purpose Lithium Grease
SL - Stick Lubricant
Sil - Silicone Lubricant
HF - Hydraulic Fluid
BF - DOT-3 Brake Fluid

### EVERY FUEL STOP

1. ENGINE: Check oil level & add if low. *MO M-V*
2. RADIATOR: Check water level & add if low. *WATER & ANTIFREEZE*
3. BATTERY: Check electrolyte level & add if low. *DISTILLED WATER*

### EVERY 500 MILES

1. KING PINS: *MPG*
2. TIE ROD & DRAG LINK ENDS: *MPG*
3. FRONT SPRING PINS (TA, TB, TC): *MPG*
4. FRONT & REAR SPRING TRUNNIONS (TA, TB): *MPG*
5. FOOT PEDAL SHAFT (LHD TD, TF, Y): *MPG*

### EVERY 1,000 MILES

1. 500 MILE LUBRICATION: plus the following:
2. TRANSMISSION & REAR AXLE: Check oil level & add if low. *GL 140* (TA, TB, TC, YA, YT). *GL 90* (TD, TF, YB)
3. DRIVE SHAFT: *MPG*
4. CARBURETORS: Remove caps & fill reservoirs. *MO 20*
5. WATER PUMP: One or two strokes of grease gun. *MPG*
6. BRAKES: Check fluid level in master cylinder & add if low. *BF*

### EVERY 3,000 MILES

1. 1,000 MILE LUBRICATION: Plus the following:
2. ENGINE: Drain oil (hot) and refill. *MO M-V*
3. DISTRIBUTOR: Oil advance mechanism & shaft, grease cam. *MO 20 & MPG*
4. GENERATOR: Unscrew grease cup & refill. *MPG*
5. AIR CLEANER: Clean & re-oil. *MO*
6. STEERING GEARBOX (TA, TB, TC): Fill (see text). *GL 140*

### EVERY 6,000 MILES

1. 3,000 MILE LUBRICATION: Plus the following:
2. OIL FILTER: Install new filter or filter element.
3. TRANSMISSION & REAR AXLE: Drain (hot) & refill. *GL*
4. TACHOMETER DRIVE GEARBOX: Two strokes of grease gun. *MPG*
5. HANDBRAKE CABLES (TA, TB, TC, Y): One stroke of grease gun. *MPG*
6. STEERING TACK (TD, TF, Y): Fill (see text). *MPG*

### EVERY 12,000 MILES

1. 6,000 MILE LUBRICATION: Plus the following:
2. FRONT WHEEL BEARINGS. Clean & repack (see text). *MPG*
3. LEAF SPRINGS (TA, TB, TC): Clean & grease (see text). *MPG*
4. SHOCK ABSORBERS: Check fluid level & add if low. *HF*

### AS REQUIRED

Lubricate door locks, hinge pins, hood latches, controls, linkages, rubber parts and all other items not covered above which are subject to wear (see text). *MO 30, MPG, SL, Sil.*

### ANNUALLY

Cars which are seldom driven should receive complete lubrication at least once each year, even if the recommended mileage has not been reached in that time.

# Back to Basics #5 --- Tuneup

By F. E. Old III

## BEGINNING THE TUNE-UP

In parts three and four of this series we dealt with engine and chassis lubrication service, which can be considered preventive or preservative maintenance. It doesn't make the car run better to any appreciable extent, but it does enable it to run longer without wearing out. In this installment and in most of those which follow, we will deal with mechanical maintenance which is required if the car (and particularly the engine) is to run as smoothly and powerfully as it should. The most basic part of this mechanical maintenance is called a tune-up.

## BACKGROUND INFORMATION

Before you learn all the steps involved in performing a tune-up you should have at least a basic understanding of why a tune-up is necessary, and before you can grasp that you will have to understand what makes an engine run. Those of you who already know please bear with me while I explain it to the rest. I'll explain only in very basic terms. Those of you who wish to delve deeper into the subject should read a book on basic automotive fundamentals (try your local library). In fact, that's not a bad idea for all of you. The better your understanding of what makes a car go, the easier it will be for you to cope with maintenance and repair.

The sole purpose of the automobile engine is to convert fuel (usually gasoline) into power which can be used to move the car. In order for the engine to accomplish this, a definite sequence of events must take place within the engine. This sequence of events can be divided into four stages, each stage corresponding to one "stroke" of the piston inside the cylinder. A stroke occurs when the piston travels from one end of the cylinder to the other. The uppermost position of the piston in the cylinder is called "top dead center" (TDC). The lowest position of the piston in the cylinder is called "bottom dead center" (BDC). Therefore a stroke is piston movement from TDC to BDC, or from BDC to TDC.

When the entire sequence of events in the cylinder requires four strokes of the piston, the engine is called a four-stroke cycle engine (or sometimes just four cycle, although this term isn't accurate). The four piston strokes are called intake, compression, power and exhaust. (See fig. 1).

**INTAKE:** During the intake stroke the piston starts at TDC and moves to BDC. The intake valve is open, thus creating an open passageway between the carburetor and the cylinder. The downward movement of the piston draws air through the carburetor (where it picks up vaporized gasoline) and into the cylinder. By the time the piston reaches BDC the cylinder is filled with this mixture of air and fuel.

**COMPRESSION:** When the piston reaches BDC the intake valve closes, sealing the cylinder. The pison now begins to move back up towards TDC, and since the cylinder is sealed the air/fuel mixture is compressed into the top of the cylinder (the combustion chamber). By the time the piston' reaches TDC again, the mixture is compressed to about one seventh or one eighth of its original volume.

**POWER:** When the piston reaches TDC on the compression stroke, the ignition system sends a surge of high-voltage electricity to the spark plug. This current jumps the gap in the spark plug, creating a spark. This spark ignites the fuel/air mixture in the combustion chamber, causing it to burn rapidly (it does **not** explode). As the mixture burns, hot gases are produced which try to expand very rapidly. Since the gases cannot escape (the valves are still closed), they push with tremendous force against the inside of the cylinder. The only moveable object in the cylinder is the piston, so it is forced back towards BDC.

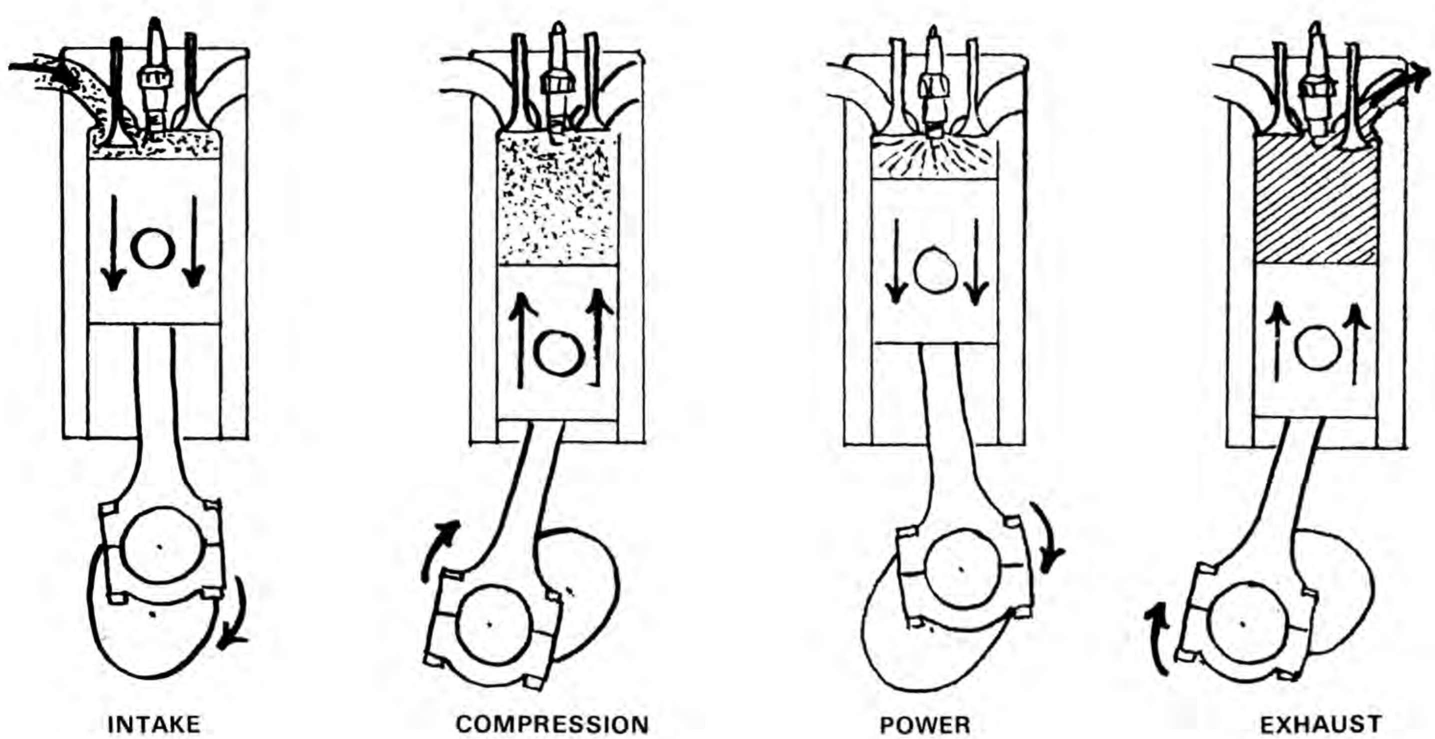


*Fig. 1: The four-stroke operating sequence.*

**EXHAUST:** When the piston reaches BDC during the power stroke, the exhaust valve opens the passageway between the cylinder and the exhaust pipe. The hot gasses are still under pressure, so most of them rush out immediately. The piston moves back towards TDC, forcing the remaining gasses out of the cylinder. When the piston reaches TDC the exhaust valve closes, the intake valve opens and the sequence starts over again with a new intake stroke.

If you are still with me you will have noticed that power is actually being produced during only one of the four strokes. During the other three strokes (intake, compression, exhaust) piston movement is dependent upon the inertia produced during the power stroke. The piston (which moves up and down) is connected to the crankshaft (which rotates) by a connecting rod. During the power stroke the connecting rod transmits the piston's downward thrust to the offset crankpin on the crankshaft, forcing the crankshaft to rotate. The crankshaft and the flywheel which is attached to it comprise a very high rotating mass, and once this mass is started moving it tends to keep moving. During the other three strokes (intake, compression, exhaust) the connecting rod transmits this inertia back to the piston. In other words, during the power stroke the piston moves the crankshaft, and during the rest of the strokes the crankshaft moves the piston.

Besides moving the piston, the rotating motion of the crankshaft also drives other systems to the running engine. It is connected by a chain and sprocket arrangement to the camshaft, which opens the intake and exhaust valves. The camshaft also drives the distributor, which distributes electrical charges to the spark plugs, and it drives the oil pump which circulates lubricating oil to friction points inside the engine. The generator which charges the battery and the water pump which circulates cooling water around the engine are both driven off the crankshaft by a belt and pulley arrangement. Last, but far from least, the rotating force of the crankshaft is transmitted through the clutch, transmission, driveshaft and rear axle to the rear wheels, thereby moving the car down the road.

## WHY TUNE-UP?

Three basic things are required in order for an engine to run: fuel, compression and ignition. As long as these occur at approximately the right times and in approximately the right amounts the engine will run. It may not run very well, but it will run. If, however, we expect the engine to run as smoothly as possible and produce as much power as it is supposed to, then these factors must be much more closely controlled.

The amount of fuel mixed with the air drawn in by the piston on the intake stroke can vary considerably and still produce a burnable mixture which will run the engine. In order for the engine to run really well, though, the mixture must be very closely regulated by the carburetor. If the carburetor falls down on the job, then smoothness and power will suffer.

Assuming that the correct mixture is available from the carburetor, it is now necessary for a full charge of it to be drawn into the cylinder, and for it to be fully compressed. This depends upon the valves opening and closing at the right times, and upon the valves and piston rings sealing properly. If these parts fall down on the job, then the engine will run poorly.

Ignition is especially important to good running. The spark must be intense enough to jump the gap at the spark plug, and it must occur at exactly the right time in order to start the air/fuel mixture burning at the optimum point relative to piston position in the cylinder. If the spark is timed too early or too late, the mixture will not burn properly and power will suffer. If the spark is too weak to fire the mixture, then of course no power at all will be produced.

When an engine is new all factors are very closely controlled and the engine will run smoothly and powerfully. However, as the engine runs and the various parts lose their adjustment because of vibration, wear, etc., power will begin to fall off noticeably. When this happens, corrective measures are required to bring power back up to normal. These corrective measures fall into three major catagories:

**MINOR TUNE-UP:** This is the simplest form of tune-up, involving lubrication service (covered in parts 3 & 4), visual inspection, simple instrument tests, and adjustments to several componants. Normally no actually repairs are made during a minor tune-up, only adjustments.

**MAJOR TUNE-UP:** This includes everything covered in the minor tune-up plus some actual repair work. Usually the carburetors, fuel pump and distributor will be removed from the engine, disassembled, cleaned, and reassembled after replacing worn or damaged parts. More sophisticated instrument checks might also be performed to provide the technician with a very good picture of engine condition. The usual practice is to perform a major tune-up only when it is obvious that simple tests and adjustments will not pinpoint and cure whatever is wrong.

**ENGINE OVERHAUL:** This involves removing the engine (or large portions of it) from the car, disassembling it, cleaning it thoroughly, and replacing and/or remachining worn parts to bring the entire engine back to "as new" condition.

In the remainder of this installment and in the next two or three installments we will deal with the minor tune-up. After that we'll go on to the major tune-up. Complete engine overhaul is way outside the scope of **Back To Basics,** so we'll leave that to the professionals for the time being.

## THE MINOR TUNE-UP

The minor tune-up is what is usually performed by service stations and back-yard mechanics. It can be done using only common hand tools and a very limited amount of test equipment. Of special importance to the beginner is the fact that a minor tune-up can be accomplished fairly successfully by someone who has relatively little mechanical experience so long as step-by-step instructions are provided. I'm going to try to provide good instructions for you to follow, but if they are not detailed enough or not understandable please don't hesitate to tell me so.

We will be progressing through the tune-up in a definite sequence of operations. There is nothing to stop you from performing these operations in a different order, but you'll save yourself a lot of agravation if you do them in the correct order. For example, it is useless to adjust the carburetors before you have adjusted the valves, the spark plugs and the distributor, since these all will have an effect on the mixture required to run the engine. After these adjustments were made you would find it necessary to re-adjust the carbs. Unfortunately, the carburetors are the firtst things the amateur usually wants to fiddle with when the engine isn't running right. Don't do it! Nine times out of ten the culprit is something else. Here is the sequence of operations we will be following:

1. Visual Inspection
2. Lubrication Service
3. Compression Test
4. Valve Lash Adjustment
5. Ignition Point Service
6. Ignition Timing Adjustment
7. Spark Plug Service
8. Carburetor Adjustment

Let's stop talking and get our hands dirty.

## VISUAL INSPECTION

The first step in the tune-up is also the easiest, but it also tends to be the least interesting. Open up the bonnet (both sides) and spend some time contemplating the contents of the engine compartment. If everything is covered by a thick layer of grease, oil and grime, get a spray can of engine degreaser and clean off as much of the goo as you can. Working on a dirty engine is no fun at all! Now inspect everything under the bonnet, keeping your eye out for abnormal conditions like wires with no insulation, rotten or leaking water hoses, frayed or badly worn fan belt, bad oil leaks, sticking throttle linkage, and so on. Fix these things now, before you forget about them.

This is also the best time to check the tension of the fan belt. Grab hold of the belt at the center of its top run, halfway between the water pump and the generator. Using firm hand pressure, you should be able to move the belt up and down about half an inch. If it moves more or less, then you'll have to adjust the tension. This is done by slightly loosening the two pivot bolts under the generator and the locking bolt in the slotted link at the top of the generator (see fig. 2). To tighten the belt, move the generator away from the engine using gently hand pressure only, then retighten the top bolt and check the adjustment. If it is correct, then tighten the two pivot bolts.

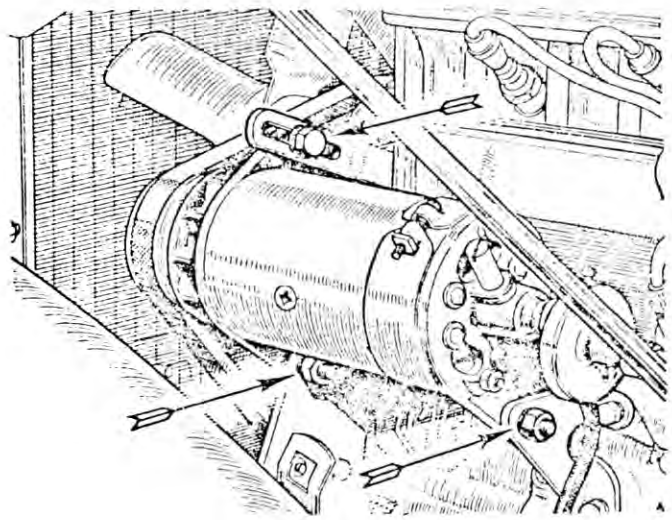

*Fig. 2: Arrows indicate the three bolts which must be loosened for fan belt adjustment.*

The engine must be warmed up to normal operating temperature before you go on to the next few steps, so why don't you drive around for a while? Don't just putter around like a Model T Ford, either. Run it up fast through the gears several times, and keep the revs up to blow some of the carbon out of the combustion chambers. As soon as you can tear yourself away from the fun of driving the car, go home, shut it off, and get to work.

## THE COMPRESSION TEST

There are several instrument tests which can be performed to help determine the mechanical condition of the engine, but the simplest and best-suited for the beginner is the compression test.

The ability of the engine to develop high equal compression in all of its cylinders is an important factor contributing to good running. If compression is high and nearly equal in all cylinders, then we know that the engine has the potential to run well once other systems are properly adjusted. If the compression is too low, or if it is not equal in all cylinders, then no amount of tune-up adjustment will make that engine run as well as it should.

Low compression is caused by leakage which can occur past the piston rings, past the intake or exhaust valves, or past a faulty cylinder head gasket. An engine with excess leakage in all cylinders will suffer from an unacceptably low power output. If excess leakage occurs in only one or two cylinders, power will be low and the engine will also run very roughly. In either case, fuel economy will suffer. If the leakage occurs past the piston rings, then the engine will suffer from high oil consumption and spark plug fouling. By testing the compression of each cylinder we not only get a good idea of the condition of the engine, but we also can determine whether or not major mechanical repairs are required before it will be worth the time and effort needed for a tune-up.

So now you know why a compression test is necessary, and your engine is all warmed up and ready to be tested, so let's get busy. The following procedure can be performed by one person if necessary, but it's a lot quicker and easier if you have a helper.

**REMOVE SPARK PLUGS:** Open the left side of the bonnet (the car's left, not yours) and look at the engine. If you already know where the spark plugs are, then skip the next few sentences. If not, then look for the four thick wires which seem to come out of the side of the engine up near the top at evenly spaced intervals. Those are the spark plug wires. At the end where they go into the engine you will find the spark plugs. At the end where they all come together lower down on the side of the engine you will find the distributor. Stick a piece of masking tape or adhesive tape on each wire and number them one through four, starting at the front of the engine. This will make it easier to put the wires back in the right places later on.

Next, pull the wires off the spark plugs. Don't just grab the wire and yank, or you might pull it loose from its connector. Pull on the connector itself, which is the fat plastic or rubber-covered thing at the spark plug end of each wire.

Now use your spark plug wrench to loosen each spark plug about one full turn. Hold the wrench straight so that it doesn't bear against the procelain insulator. If you put any pressure against the insulator it might crack or break off. Don't scew the plugs all the way out yet. When they are all loose, re-connect all the spark plug wires.

Next, start the engine and run it at a fast idle (about 1500 rpm) for a few seconds. This will blow out any carbon particles which might have flaked off the inner ends of the spark plugs when you loosened them. If you skip this step those carbon particles can lodge under one of the valves and hold it open slightly. This will give you a false low reading when you test the compression.

Now stop the engine, remove the spark plug wires again, and unscrew the spark plugs the rest of the way. Lay the plugs down in a clean place where you won't step on them, and keep them in order just like the came out of the engine.

**TEST COMPRESSION:** For this step you will need a compression gauge to take readings from each cylinder and paper and pencil to record those readings. The compression gauge is nothing more than a pressure gauge with a fitting which screws or pushes into the spark plug holes. The better gauges usually have a threaded connector which screws in, or a rubber connector which pushes in and stays without being held. If you have this type you can get by without a helper if necessary. Cheaper gauges have a cone-shaped rubber tip which has to be held against the spark plug holes. If you have this type you will need a helper unless you happen to have three or more extremely long arms.

The actual test is very simple. Connect the gauge to #1 spark plug hole, which is the one closest to the front of the engine. Screw it in, push it in, or hold it in, whichever is required by your particular gauge. If you are working alone, position the gauge so that you can see it clearly from the driver's seat. If you have a helper, put him or her in the driver's seat while you watch the gauge from alongside the car.

Now you have to crank the engine over so that cylinder #1 goes through six compression strokes. The ignition switch should be left in the off position. The throttle must be open for an accurate reading, so hold the gas pedal down to the floor. Pull out the starter knob now and watch the gauge. The needle will jump every time the cylinder goes through a compression stroke, so count six jumps and let go of the starter knob. Now record the gauge reading on your piece of paper. Release the pressure in the gauge (every gauge has a release button of some sort) and perform the same test on the remaining three cylinders. If you're unsure of yourself this first time through, then repeat the test on all cylinders as a double-check. That's all there is to it.

**SPECIFICATIONS:** Now you have to interpret those readings to learn what they can tell you about the condition of your engine. First, however, you have to have something to compare them against, and that's where specifications come into paly. Most auto manufacturers specify a maximum compression, minimum compression, and maximum compression variation (the difference between one cylinder's readings and another). I have never been able to find published figures of this sort for the T and Y-Series engines, but experience has shown the following specifications to be a good guideline:

| SERIES | MAXIMUM | MINIMUM | MAX. VARIATION |
|---|---|---|---|
| TA | 130 psi | 90 psi | 20 psi |
| TB, TC, TD, Y | 140 psi | 100 psi | 20 psi |
| TD Mk II, TF | 150 psi | 110 psi | 20 psi |

(psi = pounds per square inch)

These figures may not be perfect from the manufacturer's point of view, but they are close enough for our purposes. Compression pressure is directly related to the engine's compression ratio, so if the compression ratio of your engine has been raised then you can expect the maximum and minimum allowable pressure to be somewhat higher.

**INTERPRET YOUR COMPRESSION READINGS:** Compare your compression readings to the appropriate specifications in the table. If the readings for all four cylinders are within the maximum/minimum range and they do not vary from one cylinder to the next by more than 20 psi, then your engine passes the compression test. For example, suppose your car is a TC and your readings are as follows:

| CYLINDER | READING |
|---|---|
| #1 | 130 psi |
| #2 | 135 psi |
| #3 | 125 psi |
| #4 | 130 psi |

All cylinders read within the maximum/minimum pressure range specified for the TC engine, and the maximum variation between cylinders is within the 20 psi limit. This engine is O.K. But suppose the readings come out like this:

| | |
|---|---|
| #1 | 140 psi |
| #2 | 135 psi |
| #3 | 110 psi |
| #4 | 135 psi |

The readings for all cylinders are within the maximum/minimum limits, but the variation between cylinder #3 and the others is greater than the 20 psi limit. Something has gone wrong in that cylinder, and it will be impossible to make the engine run really smoothly because of that imbalance. Or, suppose the readings come out like this:

| | |
|---|---|
| #1 | 110 psi |
| #2 | 90 psi |
| #3 | 105 psi |
| #4 | 110 psi |

In this case none of the cylinders vary more than 20 psi from the rest, but cylinder #2 is below the minimum allowable pressure. The cylinders are still pretty well balanced, so the engine may run fairly smoothly after a tune-up. However, since all the cylinders show compression pressures near or below the minimum the engine cannot be expected to produce as much power as it should. Chances are good that this engine has seen many miles and is due for an overhaul.

It is often hard to tell exactly what is causing low compression without running more sophisticated tests or possibly even tearing the engine down for inspection, but you can usually get a pretty good idea by watching the behavior of the compression gauge needle as you test each cylinder. If the engine is in good condition the needle will jump nearly to its highest reading on the first compression stroke, and will climb in smaller jumps on the remainig five strokes.

If the compression reads low on the first stroke and builds up slowly on the remaining five strokes but never reaches normal, then you can be pretty sure that the piston rings are worn. This can be confirmed by performing a "wet compression check". Squirt a tablespoon of motor oil into the offending cylinder through the spark plug hole, crank the engine over a few times to spread the oil around the rings, then test again. The oil will temporarily seal the rings if they are bad, and your readings on the wet test should be much higher than the original readings. This confirms piston ring problems.

If the wet test makes little or no difference in the readings, then the trouble is either a leaking valve or a leaking head gasket. These conditions are also revealed by a compression reading which starts off low on the first stroke and stays low on the following five strokes.

If you get nearly equal very low pressure readings from two adjacent cylinders, then the head gasket has probably blown out between those two cylinders.

**WHAT NEXT?:** If your engine passed the compression test then you are ready to go on to the next step in the tune-up procedure. You can be reasonably sure that your engine will respond well to the adjustments which follow.

If your engine flunks the compression test, then you have a problem. If the test seems to indicate that the piston rings are worn, then the only permanant solution is to have the engine completely overhauled. At one time it was not unusual for piston rings to get so gummed up with sludge and carbon that they would stick in their grooves, to the deteriment of their sealing ability. Modern detergent oil has almost completely eliminated this problem, so don't count on a quick cure by STP or one of the other wonder additives. It won't hurt to try, but don't expect a miracle. You'll have to face the fact that your rings are probably worn out. Overhaul is the only cure.

If the compression test seems to indicate valve problems, then it is just barely possible that matters are not as bad as they seem. It is possible (but unlikely with modern oils) for gum and varnish to build up on a valve stem to such an extent that the valve sticks partly open. It is also possible (but again unlikely) that the valve lash is set much too tight, so that one or more valves are not allowed to close completely. Both can be cured, and the engine will suffer no ill effects if these conditions have not been allowed to go unfixed for too long. We will explain how to cure these problems in the next installment, but don't expect miracles. Chances are that your valves are so badly eroded or burned that they are no longer able to seal properly. If this is the case, then your car needs a valve job.

If mechanical repairs as extensive as an overhaul or a valve job are temporarily out of the question, then you can choose to ignore the warning signs and proceed to the next step in the tune-up sequence. Your car may run a bit better after the tune-up, but you will have to be content with the fact that it cannot possibly run as well as it should. In fact, you may find that the engine will be extremely difficult to tune, since it will not respond as it should to each of the adjustments made during the tune-up.

Tune in next time for a discussion of valve lash adjustment and maybe more, depending on how much space we have. Happy wrenching!

# Back to Basics #6 — — — Rocker Arms

By F. E. Old III

In the last installment of Back To Basics (TSO Aug. 1976) we discussed the "whys" of engine tune-up and started working on the "hows" with an explanation of how to perform and interpret a compression test. This time we'll discuss the measurement and adjustment of rocker arm clearance. You'll sometimes hear it called valve lash, valve clearance, tappet clearance, or any of several other names, but they all refer to the same thing: the amount of free play existing in the mechanism which operates the valves.

**BACKGROUND INFORMATION:** A good-running engine is very dependent upon the proper operation of the mechanism which opens and closes the valves, usually called the valve train. If the valves don't open when they are supposed to and as wide as they are supposed to, then the result is incomplete filling and scavanging of the cylinders, and power suffers. If the valves don't close completely and seal tightly, then compression is lost and again power suffers. The first condition, the timing of the opening and closing of the valves, depends upon accurate machine work and careful installation of the camshaft and timing chain when the engine is built. Once the engine is together and in the car, it is impractical to make corrections to the valve timing, and at any rate none should be required until the next time the engine is overhauled. Even then, it's a matter of replacing worn parts as no means of adjustment is provided.

The second condition, the complete closing and sealing of each valve, depends upon the existence of a small amount of clearance (or backlash or free play, if you prefer) between the various parts of the valve train.

In a pushrod-operated overhead-valve engine like ours, the valve train is a sort of hip bone connected to the thigh bone, thigh bone connected to the knee bone sort of affair. The camshaft, deep in the bowels of the engine, rotates at half the speed of the crankshaft. On the camshaft are eight eccentric lobes, each one corresponding to one of the valves in the cylinder head. Above the camshaft in small bores machined into the side of the block are eight cylindrical tappets (or cam followers or lifters, if you prefer), with the bottom of each one resting against one of the camshaft lobes. On top of each tappet is a long tubular pushrod which extends from the tappet up the side of the engine and through the top of the cylinder head. On top of the cylinder head are eight rocker arms (one for each valve), pivoted on a rocker shaft which runs the length of the head. One end of each rocker arm rests against the top of a pushrod, while the other end rests against the top of a valve.

As the camshaft turns, the high spot or bump on each lobe pushes the tappet up, which pushes the pushrod up, which in turn lifts one end of the rocker arm. The rocker arm is pivoted in the middle, like a see-saw, so the other end of the arm moves down. This pushes the valve open against the pressure of the valve spring. When the cam lobe moves past its high point, the valve spring closes the valve, which moves the rocker arm, pushrod and tappet back the other direction until they have all returned to their at-rest position. When the high point on the cam comes around again, the whole procedure starts over.

The question naturally arises "Why must there be any clearance between the pieces? Wouldn't it be more efficient to operate the valve train at zero clearance, so there is no lost motion?" True, it would be more efficient if it could be made to work, and it does work after a fashion if hydraullic tappets are used. However, our M.G. engines don't use hydraulic tappets. Mechanical tappets like ours could be set at zero clearance if we could ensure that engine temperature would always remain the same, and if all the parts of the valve train could be made absolutely inflexible and unstretchable. Put another way, we could set the clearance to zero if we could be sure that the combined length of all the parts of the valve train would remain absolutely the same under all conditions.

Unfortunately, this ideal state of affairs is impossbile to achieve. Temperatures within the engine fluctuate considerably, depending on how hard it's working at any given time. Metal expands and contracts as it heats and cools, and the parts of the valve train are no exception. When this happens to the individual parts of the valve train, the total length of the valve train changes. At the same time this is happening, all those parts are thrashing around at a terrific rate; at 50 mph each valve has to open and close about twenty-five times every second. The parts of the valve train reverse direction fifty times per second at the same road speed; once to open the valve, and once when it closes. These rapid changes in direction cause some parts to flex a little bit and others to compress and/or stretch a little bit; not much, to be sure, but enough to change the overall length of the valve train many times each second. To compensate for these dimensional changes, we have to allow a bit of free play, for the very important reason that we have to make sure that the valve is always allowed to close completely. If we set the system up with zero clearance, as soon as the engine overheats a bit or thrashes a little harder the length of the valve train will at some point increase past normal, and the valve will be held open slightly even when the tappet is on the low point of the cam.

The immediate result is a temporary decrease in power, since compression is lost past the partly-open valve. The long range effect is much worse. The valves operate at a very high temperature, and one of the main ways this heat is dissipated is through the valve seat when the valve is closed. If the valve is held open all the time, the temperature can build up almost to the point where the metal becomes molten. When this happens, the gasses rushing past the valve can actually erode away little globs of semi-molten metal from the edge of the valve head, thus destroying its ability to seal properly. This is called a burned valve, and it is a highly undesireable state of affairs.

This is a very simplified explanation, but it should give you the general idea of why a certain amount of clearance is required in the valve train. This clearance is allowed for when the camshaft is designed, so it causes no loss of efficiency. The actual amount of clearance required will depend upon the overall design of the engine and upon the shape or contour of the lobes of the cam, so the actual amount may vary from one make of engine to the next. Indeed, not all T-Series engines require the same rocker clearance, as we shall see in a moment.

Due to the wear which will inevitably occur in the course of running the engine, periodic measurement of the clearance is required, and if it is not correct it must be adjusted. On most pushrod-operated overhead-valve engines like ours, the clearance is measured between the top of the valve stem and the tip of the rocker arm (see fig. 1). Adjustment is made by means of an adjusting screw at the opposite end of the rocker arm, which, when turned in or out, changes the total length of the valve train.

**SPECIFICATIONS:** Before you attempt to measure and adjust the rocker arm clearance, you need to know just what

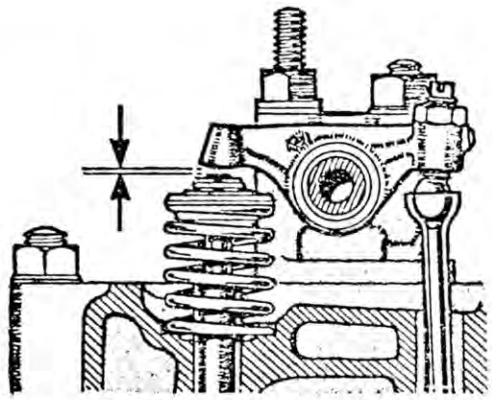

*Fig. 1: Relationship between pushrod (right), rocker arm (center), and valve stem (left) can be seen here. This is not a T-Series engine.*

that clearance is supposed to be for your particular engine. This information can be found in the shop manuals, but if you still haven't gotten around to buying one then refer to the specification table included elsewhere in this article.

The matter of choosing the correct clearance is quite straightforward if you car still has the original engine in it. However, unless you know for certain that this is the case, it is best to check the engine number as shown on the number plate on the engine itself. Since so many engine swaps have been done over the years, you cannot always depend on the engine number shown on the makers plate on the firewall. Once you have determined the correct engine number, compare that number to those shown in the chart and find the correct clearance that way.

The matter is further complicated by the fact that many of the earlier engines have, in the course of a rebuild, had the later type camshaft installed. If your engine number indicates that you should set the clearance at .019 in., but you know that the later camshaft has been installed, then you should use the .012 in. clearance specified for the later engines. If you're not sure, then stick with the .019 in. clearance for the time being.

**TOOLS & PARTS NEEDED:** Gather all the tools you will need before you start work, otherwise you will waste a lot of time running back to the house to find the one tool you forgot. Here's what you need:

— Screwdriver: Straight-bladed type to turn the adjusting screws.
— Wrench: 1/4W or 5/16BS to loosen the locknuts on the adjusting screws.
— Feeler Gauge: To measure the clearance.
— Spark Plug Wrench: To remove the plugs.
— Starting Handle (crank): To turn the engine over by hand.
— Rocker Cover Gasket: Just in case you mess up the old one.

**PRELIMINARIES:** The clearance shown in the specifications are to be measured with the engine hot, so the first order of business is to run the car until it reaches normal operating temperature. This can't be done by idling the engine for a few minutes in the driveway, so go out and drive around for half an hour. Enjoy yourself. If you are adjusting the valves immediately after doing a compression check (see Back To Basics #5), then your engine should already be warmed up and you can skip the drive. All set? Then let's get dirty.

First, open up the left side of the bonnet and remove the spark plugs. Don't forget to label the high-tension cables so you can put them back on the right plugs later on. In the course of setting the rocker clearance you will have to turn the engine over a few times by hand, with the crank. It's a lot easier to turn with the plugs out, since you won't be fighting against compression.

Next you have to remove the rocker arm cover, which is that rectangular pressed steel or cast aluminum box on the very top of the engine. On models which have the air cleaner mounted above the engine, the air cleaner has to come off first. On other models, simply disconnect the breather hose that runs from the rocker cover to the air cleaner. Once that's done, remove the two thumbnuts on top of the rocker cover and lift the cover straight up off its studs. Don't lose the two fiber washers which fit under the thumbnuts. If the gasket under the rocker cover stays on the cylinder head, leave it there. If it sticks to the rocker cover, leave it stuck. If some of it sticks to the head and some of it sticks to the cover, then you are going to need that spare gasket. We'll worry about that later.

You should now be on the left side of the engine looking down at what was under the rocker cover you just removed. You should see the eight pushrods sticking up through the top of the head, each one connected to a rocker arm. To prevent confusion later on, we'll call that end of the rocker arm the "pushrod end". Under the other end of each rocker arm, the end farthest way from you, you will see a valve spring. Right under the tip of the rocker arm, in the center of the spring, is the top end of the valve stem. We'll call that end of the rocker arm the "valve end". The main drawing in figure two shows the pushrod end quite clearly. The inset in the same figure shows the valve end, as seen from the other side of the engine. While you are standing there staring at the top of the engine, mentally number the rocker arms one through eight, starting from the front. This will make things easier later on.

If this is the first time you have seen what is under the rocker cover, have a friend operate the starter pull for a few seconds (ignition switch off) to turn the engine over, while you watch how the pushrods push, the rocker arms rock, and so forth. After reading my explanation earlier in the article, you're probably thoroughly confused. If you can see it happen it might all make sense.

We have already learned that the clearance is measured under the valve end of the rocker arm, but don't be too hasty to shove a feeler gauge into the gap. The clearance must be measured and adjusted when the amount of free play in the valve train is at its maximum. This occurs only when the valve is fully closed and the tappet is resting on the lowest part of the cam lobe. Now, the cam and tappets are out of sight down inside the engine, so you can't see when they are in the right position. Nor can you tell very accurately by looking at the rocker arm, because it can appear to be in the fully closed position even when it isn't really there.

On the other hand, the opening motion of the valve train is rather fast, so it is fairly easy to tell when a valve is fully open. Use the starting crank to turn the engine over while you watch one of the rocker arms and you'll see what I mean. The valve end of the rocker will begin to move down rather abruptly, and once it has reached the full open position it will almost immediately begin to move back the other way. When the valve end of the rocker arm is as far down as it will go, the valve is fully open. Using the crank, practice finding the fully open position until you get the hang of it. If the rocker arm starts to move back up, you've turned too far and must turn the crank another two turns and try again.

**SYSTEMS OF NINES: Thanks to the way the sequence of events inside the engine is timed, when any one valve is fully open there is always one other valve which is fully closed. Each valve has** its exact opposite in the open/close cycle, and these pairs are symetrically arranged starting at opposite ends of the engine and working towards the middle. In other words, when #1 is wide open #8 is fully closed (and vice versa), when #2 is open #7 is closed (and vice versa), when #3 is open #6 is closed, and when #4 is open then #5 is closed.

So, to get rocker arm #1 in the right position for checking and adjusting (fully closed), we simply turn the crank until rocker #8 is in the wide open position. If you want to you can then turn the crank until #1 is wide open and check #8, then do the other three pairs the same way, but this requires that you spend most of the afternoon thrashing away with the crank. There is an easier way. By checking the rockers in the following sequence the whole thing is done with only two complete rotations of the crank:

| WITH THIS OPEN | ADJUST THIS |
|---|---|
| #8 | #1 |
| #6 | #3 |
| #4 | #5 |
| #7 | #2 |
| #1 | #8 |
| #3 | #6 |
| #5 | #4 |
| #2 | #7 |

This same sequence is given in most of the manuals, but the slightly different way in which it is presented tends to confuse a lot of first-timers. Now, if you have #1 rocker arm in the checking position (#8 wide open), we'll move on.

**MEASURING THE CLEARANCE:** Many manuals intended for the do-it-yourself mechanic will tell you to use one feeler gauge of the correct thickness, and talk about snug sliding fits and other such vague nonsense. It should be obvious that what feels like a snug fit to one person might well feel rather loose to another person and too tight to yet another. Too much is left to individual interpretation, and accuracy suffers as the result. Checking the clearance by this method is a chancy business on a new engine, and is downright risky after the engine has seen a large number of miles. The sliding action of the rocker arm against the tip of the valve stem tends to wear a slight groove into the radiused tip of the rocker arm. If we measure the clearance using only one blade of the feeler gauge, the blade tends to bridge across that groove, giving us a false reading. The actual clearance will then be the thickness of the gauge plus the depth of the groove.

The only absolutely accurate way to measure the rocker clearance under these circumstances requires the use of a dial indicator, but the price of this instrument places it outside the realm of normal tune-up tools, especially for the home mechanic. In lieu of this we will use what is called the "go and not-go" method of measurement with feeler gauges. This requires the use of two blades of the gauge: one .001 in. smaller than the specified clearance, the other .001 in. larger.

For example, let us assume that the specified clearance for your engine is .019 in. First find the .018 in. blade of the feeler gauge and insert it in the gap between the tip of the valve stem and the rocker arm. It should slide in very easily, telling you that the clearance is greater than .018 in. Now find the .020 in. blade and try the same thing. It should be impossible without forcing it to insert this blade, telling you that the clearance is smaller than .020 in. Now, if the clearance is greater than .018 in. but smaller than .020 in., then it must be .019 in. or close enough that the difference doesn't matter. On the other hand, if the .018 in. blade won't go in or the .020 in. blade will go in, then you know the clearance is wrong. It's all quite straightforward, with no worrying about snug sliding fits and other similar confusions. The blades will either go in or they will not; it's as simple as that.

If your "go and not-go" measurement tells you that the clearance at #1 rocker arm is correct, then turn the crank a partial turn farther until #6 is wide open and check the clearance at #3, and so on through the sequence given earlier. However, you will more than likely find that the clearance at rocker #1 is not correct, so before you go on to the next one you should adjust the clearance.

**ADJUSTING THE CLEARANCE:** Adjustment is quite simple once you get the hang of it, although the first time through you will probably feel all thumbs. The first order of buiness is to slack off the locknut at the pushrod end of the rocker arm, using your 1/4W or 5/15BS wrench. It will probably be quite tight, so give it a good grunt. Now use the screwdriver to run the adjusting screw in and out a few turns, just to make sure it turns freely. Also check to make sure the locknut turns freely on the screw. If, as is often the

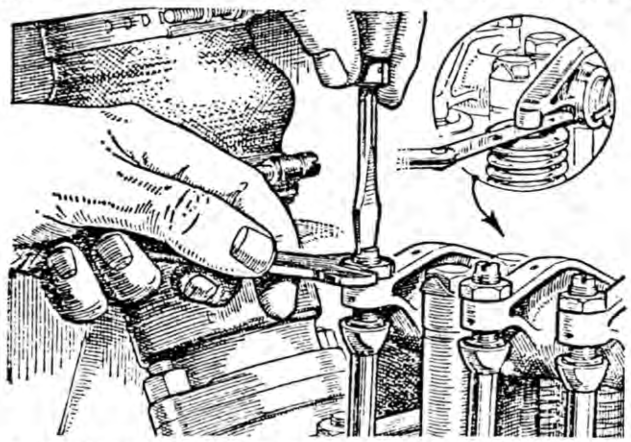

*Fig. 2: Adjusting screw on pushrod end of rocker arm can be turned after locknut is loosened. Inset shows feeler gauge inserted under valve end of rocker.*

**ROCKER ARM CLEARANCE SPECIFICATIONS**

| CAR | ENGINE | INTAKE CLEARANCE | EXHAUST CLEARANCE |
|---|---|---|---|
| TA | MPJG (all) | .010 in. | .015 in. |
| TB | XPAG (all | .019 in. | .019 in. |
| TC | XPAG (all) | .019 in. | .019 in. |
| TD | XPAG/TD (all) | .019 in. | .019 in. |
| TD | XPAG/TD2 (to #24115) | .019 in. | .019 in. |
| TD Mk II | XPAG/TD3 (to #24115) | .019 in. | .019 in. |
| TD | XPAG/TD2 (from #24116) | .012 in. | .012 in. |
| TD Mk II | XPAG/TD3 (from #24116) | .012 in. | .012 in. |
| TF | XPAG/TF (all) | .012 in. | .012 in. |
| TF 1500 | XPEG (all) | .012 in. | .012 in. |
| YA | XPAG/SC (all) | .019 in. | .019 in. |
| YA | XPAG/SC2 (to #18096) | .019 in. | .019 in. |
| YA, YB | XPAG/SC2 (from #18097) | .012 in. | .012 in. |
| YT | XPAG/TR & XPAG/TL (all) | .019 in. | .019 in. |

case, it is frozen to the screw, use the wrench to turn the nut while you hold the screw with the screwdriver.

Now find the blade of your feeler gauge which corresponds to the correct clearance for your engine (.019 in., for example), and insert it in the gap. Turn the adjusting screw down with the screwdriver until the blade is just trapped between the valve stem tip and the rocker arm tip. Next, tighten the locknut with the wrench, at the same time holding the screwdriver rock steady to prevent the adjusting screw from turning with the nut. It often happens that tightening the locknut will alter the setting slightly, so check your work by using the next smaller and larger blades as described earlier. If the clearance passes the "go and not-go" test, then move on to the next rocker arm in the sequence. If it fails, then keep trying until you get it right.

One word of caution: the locknut should be tightened down good and snug, but don't use superhuman effort or a cheater bar to do it. Overdoing it will eventually distort the threads on the screw and nut so badly that future adjustments become very difficult.

**TA OWNERS ONLY:** You will notice that the clearance specifications given for the MPJG engine differ from all the rest in that two different clearances are required: .010 in. for the intake valves and .015 in. for the exhaust. This makes your job a bit more difficult: not only do you have to manipulate a total of six feeler gauge blades for measuring and adjusting by the "go and not-go" method, but you also have to worry about which rocker arms correspond to intake valves and which ones correspond to exhaust valves. The problem of the gauges should be easy to overcome, as I'm sure you are all absolute marvels of dexterity. The problem of which rocker is which is also easily solved if you can remember the following: #1=exhaust, #2=intake, #3=intake, #4=exhaust, #5=exhaust, #6=intake, #7=intake, #8=exhaust.

**CLOSING IT UP:** Once you have the clearance properly set at all eight rocker arms, there remains only the relatively unexciting task of re-fitting the rocker cover and whatever else you had to remove to disconnect to do the job. If the rocker cover gasket was not damaged when you removed the cover, then replacement of the cover is fairly straightforward. You will probably notice a groove or slight depression in the gasket when the cover was clamped down against it. If so, try to get the bottom edge of the cover back into that groove, otherwise the joint will probably leak oil. Don't forget to put the two fiber washers back on the studs under the thumbnuts. If they are omitted oil will seep out from under the nuts.

A good snug hand-tightening of the thumbnuts is all that is required. If the joint leaks, look for trouble with the gasket or the gasket edge of the rocker cover. Do not tighten the nuts with pliers or anything else which makes them more than finger tight. This will only distort the cover and make the leaking worse.

If the old gasket was damaged when you removed the cover, then you will have to fit the spare. First, use a screwdriver or putty knife to scrape the remains of the old gasket off the bottom edge of the rocker cover and the top of the cylinder head. Be careful not to drop pieces of gasket down into the engine.

Now coat the bottom (cylinder head side) of the new gasket with a non-hardening gasket cement (like Permatex #3) and set it in position on top of the cylinder head. Next, lower the rocker cover into place and check all sides to make sure it seats squarely on the gasket. If all is well, install the fiber washers and thumbnuts. Do not use gasket cement on the top side of the gasket if you do, there's a good chance that the gasket will be torn apart next time you take off the cover. With cement only on the bottom side, the gasket will stay on the engine when you lift off the cover, and will last through many sessions of rocker arm adjustment.

**CONCLUSION:** Those of you who do not have a starting crank are probably wondering just how to turn the engine over so you can adjust the rocker clearance. Well, you have three choices. The best bet is to break down and spend the money on a crank. It will make rocker adjustment and several subsequent tune-up operations much easier, and besides you may actually need it to start the car some day. The second choice is to grab hold of the fan belt on its top run (between the water pump and the generator) and pull it towards you to turn the engine. This isn't easy, even with the spark plugs out. The third choice is to put the car in high gear, then push it forward to turn the engine. This is a pain in the neck, since it's rather difficult to push the car and then stop it at the exact moment the rocker arm is in the right position. Maybe you'd better buy a crank.

If you are impatient to drive the car (as you should be), you can put the spark plugs back in now. Otherwise, leave them out until the next installment when we will discuss ignition tune-up.

Happy wrenching!

# Back to Basics #7———Ignition

**By Chip Old**
**Technical Editor**

Before we delve into the intricacies of the ignition system, hunt up your copy of the April 1977 TSO and turn to page 24. In the table of rocker arm clearance specifications at the bottom of the page, please note that the correct exhaust clearance for TD Mk II with an engine number up to XPAG/TD3/24115 is .019", not .010" as shown. Quite a few of you caught the error and wrote to me about it, for which I thank you. Somehow I missed it when I proofread the article. If you adjusted your exhaust valves to .010", go reset them to .019" now, before you burn a valve.

## IGNITION SYSTEM BASICS

In an earlier installment of this series we discussed very briefly what makes an internal combustion engine work. We learned that if the engine is to operate efficiently, several things must occur at exactly the right time relative to the movement of the crankshaft and the pistons. Perhaps the most important of these things is the ignition of the fuel/air mixture in the cylinders. If the mixture starts to burn too soon or too late, then the engine will not produce full power. Indeed, if the point of ignition is too far off the mark, the engine can be seriously damaged if it runs at all.

In all modern gasoline-fueled engines, ignition is accomplished by means of an electrical spark which occurs at the spark plug. It is the job of the ignition system to create a surge of electrical current powerful enough to produce that spark, and to deliver it to each spark plug at the optimum time in the power cycle of each cylinder of the engine. In the days before emission controls, this task was performed by a remarkably simple group of electrical and mechanical devices: a battery to provide electricity, a coil to transform that low-voltage supply into high voltage, assisted by a contact breaker (we Yanks call them "points") which triggers the coil to provide a very high-voltage pulse, which is then led via the distributor to the appropriate cylinder where it jumps across a gap in the spark plug to create the spark which ignites the fuel/air mixture. The only other essential item is a condensor wired to the contact breaker to prevent excess arcing or sparking when the points open.

Despite the system's lack of physical complexity, it performs a job which is extremely exacting. At the relatively sedate engine speed of 3000 rpm the ignition system in your four-cylinder M.G. produces one hundred sparks every second, and is capable of producing more than twice that amount if you're feeling frisky. What's more, those sparks are each timed to an accuracy measured in thousandths of a second. This calls for a high degree of precision in the manufacture and maintenance of all parts of the system. When they are working right, your engine will run for mile after mile with the right spark going to the right cylinder at the right time, but if any one of those deceptively simple parts should fail then the whole system will falter and the engine will not run as it should, if at all.

I am a firm beliver in the idea that the better a person understands the construction and function of something, the better he is able to do whatever is necessary to make that thing work right. This is true even in the case of relatively simple tune-up operations. My first draft of this article included a detailed description of the ignition system which, although it wouldn't have made you an expert on the subject, was nevertheless long enough to fill this issue of TSO from cover to cover. Therefore we will have to make do with a much-simplified explanation. If you want to learn more, there are any number of good books on the subject. Try your local library.

The ignition system consists of two simple electrical circuits. The circuit which handles low-voltage (12 volts in our case) from the battery is called the primary circuit, while the circuit which handles high voltage (often as high as 30,000 volts) from the coil is called the secondary circuit. Both circuits are controlled by switches, although you might not recognize them as such, and both circuits have their own wiring. Primary wiring is skinny stuff, much like the wiring in the rest of the car, while secondary wiring (the manuals call it High Tension Cable) is very thick.

The sequence of events which hopefully ends with a big fat spark at the spark plug begins when you turn on the ignition switch. This allows 12 volt current to flow from the battery to the "SW" (switch) terminal on the coil. The current then flows through the primary winding (many wraps of wire around a central core) in the coil and comes out at

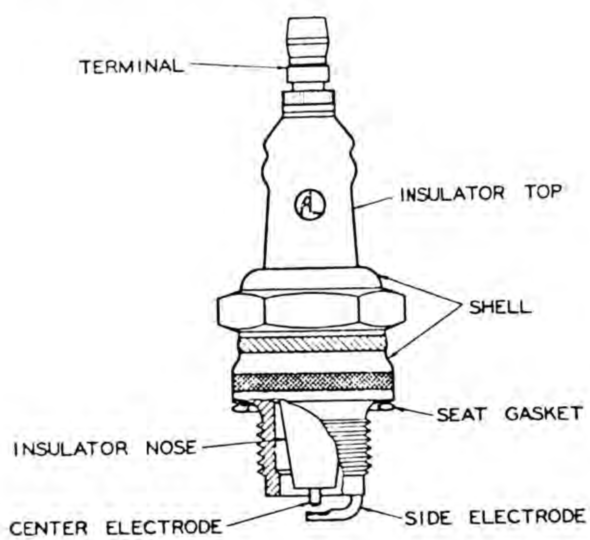


*Fig. 1: Cross section of a typical spark plug.*

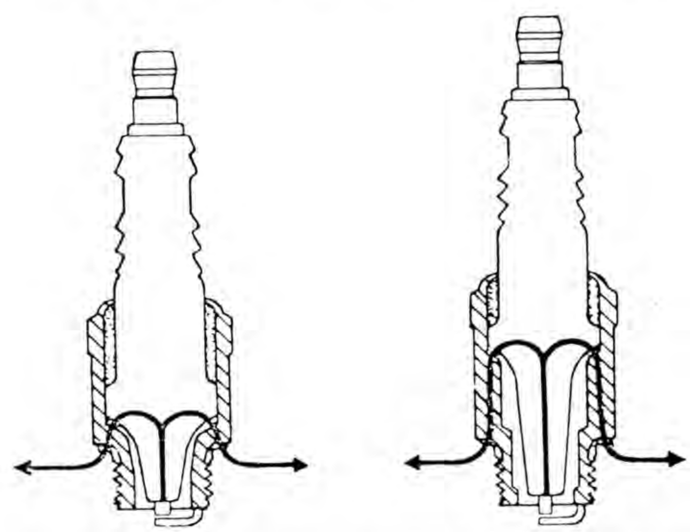

*Fig. 2: Arrowed lines show distance heat must travel to escape a cold plug (left) and a hot plug (right).*

the "CB" (contact breaker) terminal. From there it travels by wire to the distributor where it meets a second switch called the contact breaker (or breaker points or ignition points). The breaker points are opened and closed (turned off and on) by a cam in the distributor. This cam has four lobes, one for each cylinder of the engine, and is turned by the distributor shaft. When the points are open, no current can flow through the coil. When the points are closed, current flows through the coil, putting the secondary side of the system into action.

At this point it might be well to describe the coil more fully. It is essentially an electromagnet, similar in many respects to the one you probably made in elementary school science class. If you wrap wire many times around an iron bar, then attach the ends of the wire to a battery, the iron bar becomes a magnet. An ignition coil has an iron core, and the primary winding corresponds to the wire wrapping in the simple electromagnet. However, in the coil there is another winding of wire, called the secondary winding, between the iron core and the primary winding, and the whole thing is encased in a heavy cylinder of iron. The secondary winding is inside the magnetic field created by the flow of current through the primary winding.

When the ignition switch is on and the breaker points are closed, current flows through the primary winding and a magnetic field is created in the coil. When the distributor cam opens the points, the flow of primary current stops and the the magnetic field collapses. This induces a flow of current in the secondary winding of the coil, but this wire is wrapped many times more around the core than is the primary wire, so a transformer effect takes place and the voltage leaving the secondary side of the coil is much higher than that which goes into the primary side.

This very high secondary voltage leaves the coil through the very thick high tension cable attached to the top of the coil. If this were a single cylinder engine, that H.T. cable would be attached at its other end directly to the spark plug, and that would be that. However, we are dealing here with four cylinders, each of which must fire at a different time, so some device is needed to send the secondary current to the right spark plug at the right time.

To accomplish this, the H.T. cable from the coil goes back to the distributor, where it enters through the center of the distributor cap. Secondary current flows through the wire to the rotor, which is mounted on top of the distributor shaft and rotates with it. As the rotor rotates, its outer end passes very close to four metal studs which protrude down through the distributor cap. To the top of each stud is connected a length of H.T. cable, the other end of which is connected to a spark plug.

The innards of the distributor are designed so that each time the coil produces a pulse of secondary current, the outer end of the rotor is passing by one of those studs in the distributor cap. The current jumps from the rotor to the studs, and travels through the H.T. cable to the spark plug. In effect, the rotor and the distributor cap act as a rotary switch which determines which plug will be fired by the pulse of current from the coil.

## TUNE-UP REQUIREMENTS

Like most other systems covered in this series, the ignition system contains a number of parts which are succeptable to wear. To compensate for this wear it is necessary to adjust and/or replace these parts at fairly regular intervals. In the realm of the basic tune-up there are four items in the ignition system which require attention every 3000 miles:

1. **Spark Plugs:** These must be cleaned, filed, and the gaps reset, or if they are badly worn they should be replaced.
2. **Breaker Points:** These should be filed or stoned smooth, and the gap or dwell angle reset. If they are badly worn, they should be replaced.
3. **Distributor Cap & H.T. Cables:** These must be cleaned, inspected for damage, or replaced if necessary.
4. **Ignition Timing:** This should be adjusted.

There are other maintenance operations required from time to time, but these fall into the realm of major tune-up and troubleshooting, which will be covered later in this series. For the remainder of this installment we will discuss spark plugs. Next time we'll finish up the ignition system phase of the tune-up with a discussion of breaker points, ignition timing, and wiring inspection.

## SPARK PLUG THEORY

The spark plug is a simple little thing screwed into the side of the combustion chamber, and, more often than not, forgotten about until something goes wrong with it. It has a steel shell with threads at one end and hexagon flats at the other so it can be screwed into the engine with a wrench. Through the center of the steel shell is inserted a long, more or less tubular insulator, which in modern plugs is made of sintered aluminum oxide. Through the center of the insulator is inserted a long metal electrode, the top of which serves as a terminal for the H.T. cable. At the other end, where the electrode protrudes into the combustion chamber, it ends in close proximity (about .025") to a second, shorter electrode called the ground electrode, which is welded to the bottom of the steel shell. The space between the two electrodes is called the spark gap, and it is across this gap that the high voltage charge from the coil jumps, creating the spark which sets the fuel/air mixture on fire.

Electrically the spark plug is nothing more than a calibrated spark gap, and were it required to work only in the open air its life would be rather easy. Unfortunately, it doesn't work in the open air. Instead, it operates in an extremely hostile environment, with temperatures and pressures inside the combustion chamber reaching incredibly high levels, and with electrical pressures going as high as 30,000 volts. To withstand these extreme conditions the spark plug requires mechanical and electrical properties which make it a real tower of strength. A detailed discussion of materials and construction would take much space and would serve no purpose here, but if you want to learn more try a book from the library.

## CHOOSING THE RIGHT PLUGS

**BRAND:**When you go shopping for spark plugs you will have to decide between a number of different brand names. If you listen to a group of enthusiasts discussing spark plugs, chances are good that there will be some who are convinced that "brand X" is without doubt the best, while others in the group will stoutly maintain that only a fool would use anything other than "brand Y". In actual fact it is not all that important which brand you choose as long as it is a well-known and reputable one. The best-known American-made plugs are Champion, A.C. and Autolite. Several foreign plugs with equally good reputations can be had from dealers specializing in foreign car parts; Lodge, KLG, Bosch and NGK are the most widely distributed in this country, but there are others. For what it's worth, most M.G. owners seem to prefer Champion spark plugs, and although I don't intend to become embroiled in a brand-loyalty argument, I must admit that I have always used Champion plugs in all my cars and motorcycles with completely satisfactory results.

I strongly recommend that you buy premium-quality name-brand plugs, but this does not mean that you have to pay the premium prices. A Champion plug bought for 89¢ at a discount store is just as good as the same Champion plug bought for twice the price at the local filling station. Champion does not sell 'seconds", nor do any of the other reputable manufacturers.

**TYPE:** Once you have decided which brand to buy, you have to determine which of that manufacturer's plugs are appropriate for your car. Every manufacturer supplies a wide variety of conditions encountered in a wide variety of engines. Spark plugs which work well in the family sedan might fit into the spark plug holes on your M.G. engine, but this does not mean that they are the correct plugs for the M.G. Spark plugs are classified according to a large number of physical and electrical characteristics, but there are three basic characteristics which are most important to this discussion: diameter, reach and heat range.

**Diameter** refers to the diameter of the threaded part of the plug shell, where it screws into the engine. Most cars, including our M.G.s use plugs with a 14 mm thread. Other sizes are available, but we need not be concerned with them.

**Reach** refers to the length of the threaded portion of the plug shell, and until recently most cars used plugs with either a ½" or ¾" reach. Unfortunately, our M.G.s use both sizes, and this can be confusing to the novice mechanic. More will be said about this later.

**Heat range** refers to the ability of a spark plug to dissipate the heat it absorbs from combustion away from the lower end of the insulator and the central electrode. Within the bounds of a given thread diameter and reach catagory, the plug manufacturer offers several different heat ranges. In the Champion line-up, for example, an L-7 and an L-10 are both 14mm diameter, ½" reach spark plugs (as indicated by the "L" prefix), but the higher number indicates a "hotter" plug. In other words, the L-10 does not dissipate heat as readily as the "colder" L-7.

The need for a variety of heat range choices is brought about by the fact that a spark plug operates most efficiently when the lower ends of the insulator and electrode are within a fairly narrow range of temperatures. If the plug temperature drops below that range, deposits will build up on the electrodes until the plug is unable to fire. If the temperature goes too high, the electrodes will be eaten away very rapidly. In severe cases the lower end of the plug can become so hot that it acts like a glow plug and ignites the mixture before the spark jumps. This is called preignition, and it can blow a hole right through the top of a piston!

Now, no two different engine designs will operate at the same combustion temperature, nor is it likely that their cylinder heads will dissipate heat away from the spark plug area at the same rate. Since the spark plug temperature must still be kept within that ideal narrow range, each of those engines will require plugs with heat ranges suited to that engine. Driving conditions and engine conditions also come into play here. Each car manufacturer specifies a particular heat range for normal all-around use. However, if the car is driven mostly at high speeds it may require a colder than normal plug to compensate for the higher combustion chamber temperatures brought about by high-speed driving. If the same car is driven mostly on very short low-speed jaunts to the supermarket, then it might well require hotter plugs to fight low-temperature fouling. If the car is an oil-burning old clunker, it will probably require hotter than normal plugs to combat oil fouling regardless of driving conditions.

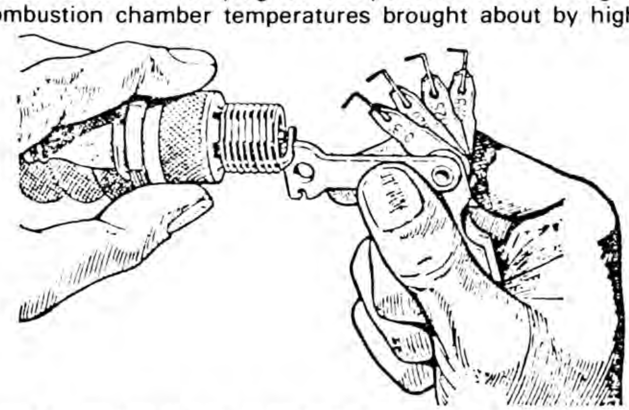

*Fig. 3: Bending bar on a typical gapping tool being used to bend the ground electrode. Note the wire-type thickness gauges on this tool.*

**PLUGS FOR YOUR M.G.:** There are two very easy ways to choose spark plugs for most "normal" cars. One is to consult the owner's manual or shop manual; the other is to consult the plug manufacturer's chart which shows which plugs fit which car. Unfortunately there are two factors which make it a bit more difficult in our case. The easier of the two to cope with is the fact that several of the plug manufacturers have changed their plug designations so that they no longer agree with the designations shown in the manuals, and other manufacturers have discontinued the plugs listed in the manuals and replaced them with improved types. For example, the manuals specify Champion L.10S plugs for the TB, TC and early TD, and NA.8 plugs for the late TD and all TFs. But, if you look at a modern Champion applications list, you will find that Champion now recommends the L-7 for early cars and the N-5 for later models. This had been a source of confusion to many owners, including this writer, until a query to Champion elicited the information that L.10S and NA.8 are obsolete plugs. The closest modern equivalents in the Champion line are L-7 and N-5. Similar changes have been made by other plug manufacturers, so always consult an up to date listing from the manufacturer of your choice.

The second difficulty is brought about by the fact that midway through the TD and YB production runs, M.G. changed the design of the cylinder head casting for the XPAG engine. This casting change necessitated a change in spark plug reach from ½" (Champion "L" series) to ¾" reach (Champion "N" series), and a change in heat range from "7" to "5" on the modern Champion heat range scale. The manuals tell us that the changeover took place at TD engine #22735 and YB engine #17994. Prior to those engine numbers the correct plug is the Champion L-7, but from those numbers on the correct plug is the Champion N-5.

Unfortunately for the novice, the two types of cylinder head are interchangeable among all XPAG and XPEG engine blocks, so after all these years it is not at all unusual to find a late-type head on an early engine or an early head on a late engine. The MPJG engine used in the TA cannot be fitted with an XPAG or XPEG cylinder head, so the TA owner need not worry about this unless his car has been retrofitted with an XPAG or XPEG engine. If you are not certain that your engine still has its original head, there are several ways to determine which spark plugs are correct for your engine.

The simplest way, although I'm not sure it is foolproof, is to look for the number which is cast into the top surface of the cylinder head at the front right corner. The number can be seen without removing the rocker cover. All XPAG heads I have seen or heard about which bear the number 22592 are early heads, which therefore require ½" reach L-7 plugs. The later heads bear several different numbers, but as far as I have been able to determine any head showing any number other than 22592 requires ¾" reach N-5 plugs.

If you want to double-check, bend the end of a piece of stiff wire into an "L" shape and insert it into a spark plug hole. Hook the leg of the "L" onto the inner end of the hole, mark the wire at the outer end of the hole, pull the wire out and measure from the leg of the "L" to your mark. If the measurement is about ½", then you need L-7 plugs; if it is about ¾", then you need N-5's.

If you should happen to remove the cylinder head some day, perhaps for a valve job, you can dispell any remaining uncertainty about the correct plug reach by turning the head unside down and looking at the water holes which conduct coolant from the engine block to the head. If they are oblong (sometimes described as banana-shaped), then you have an early head. If they are round, the head is a late one.

You may think that I have spent an undue amount of time on this matter of correct spark plug reach, but it is extremely important. If a ½" reach plug is used in a head designed for ¾" plugs, the engine will run but the electrodes of the plug will be shrouded by the unfilled part of the spark plug hole and will foul rapidly. This is not necessarily harmful to the engine, but it can lead to poor running which will be difficult to diagnose unless you know what to look for. On the other hand, the use of ¾" reach plugs in a head designed for ½" reach plugs can have several serious consequences. In this case, about ¼" of the threaded portion of the shell protrudes into the combustion chamber. The exposed threads will overheat, possibly to the point where they cause preignition. Also, deposits will build up on the exposed threads, making spark plug removal very difficult. Finally, if the compression ratio has been raised, either by milling material off the gasket face of the head or by fitting domed high-compression pistons, then it is quite likely that the pistons will hit the protruding part of the plugs at top dead center, with disastrous results.

## SPARK PLUG MAINTENANCE

Spark plug maintenance consists of three operations which should be carried out every three thousand miles: inspection, cleaning and adjusting.

**INSPECTION:** If the plugs are not already out, as they should be following rocker arm adjustment, unscrew them and lay them out on a flat surface so they won't roll away. Keep them in order as you remove them so you can tell which plug came from which hole. Don't lose the washers!

The experienced mechanic can tell a lot about the internal condition of an engine by examining the deposits on the electrodes, insulator and plug shell where they are exposed to the combustion chamber. This article will not turn you into an experienced mechanic by any stretch of the imagination, but there are several things even the novice can learn by examining spark plug deposits:

If the insulator is brown or a light yellowish-gray, the electrodes gray, and the bottom end of the shell is covered with a light layer of dry soot, then chances are good that the engine is not burning oil and the carbs are set to deliver the correct fuel/air mixture.

If the insulator and shell are covered with a thick layer of soot, then two possible problems are indicated. If the soot is dry, then the carbs are probably set too rich; that is, the fuel/air mixture contains too large a proportion of fuel. If the sooty deposit is wet and oily looking, this indicates that the engine is burning oil, which means that the piston rings and/or valve guides are worn out.

If the insulator is white or very light tan and the electrodes look like they are being burned or eroded away at the tips, this usually indicates that the carbs are set too lean. That is, the fuel/air mixture contains too great a proportion of air.

Sooty or burnt plugs can also indicate that you have been using plugs with a heat range unsuited to the type of driving you do or for the condition of your engine. For example, if a TC fitted with "normal" L-7 plugs is taken on an extended high-speed trip, the insulator and electrodes may burn, giving the false impression that the mixture is too lean, when in fact the burning was caused by the higher combustion temperatures encountered in continuous high-speed driving. If the mixture is in fact set correctly, then the solution is to switch to the colder L-5 plugs for extended high-speed use.

At the other extreme, if the same TC fitted with "normal" L-7 spark plugs is subjected to many short, low-speed trips, the plugs may soot up and give the false impression that the mixture is too rich or the engine is burning oil. In this case the plug (and indeed the whole engine) was not run long enough and hard enough to reach its optimum operating temperature, so it sooted up. If this happens to you and most of your driving is of this nature, then you might be better off with the hotter L-10 plugs. Again, we will assume that the carbs are set to provide the correct mixture.

The thing to remember here is that the "normal" plugs specified for any engine are chosen to cope with average conditions: moderate speeds, with occasional periods of high or low speed. If your driving style is outside the "normal" range, then "normal" plugs will probably be unsatisfactory.

You should also inspect each spark plug for physical damage. If you find a cracked, chipped or broken insulator, then the plug should be discarded. Electrodes which are broken or very badly eroded are also signs of a useless plug. A set of new plugs is fairly inexpensive, so trying to make do with an old set in questionable condition is false economy. In fact, many people who accumulate mileage very slowly on their M.G.s prefer to install new plugs at every tune-up rather than go through the bother of cleaning and regapping the old ones.

**CLEANING:** The next step is to remove all the deposits which have built up on the parts of the plug exposed to combustion, and to wipe off any dirt which may have accumulated on the outside of the plug. The latter is simple to take care of; just wipe off the dirt with a rag moistened with gasoline or alcohol. If the dirt is baked on, scrub at it with a brush. The outside of the insulator must be kept clean, because deposits of dirt and oil can provide a path for electrical current. We want the charge to travel down the center electrode and jump the gap; if instead it travels down the outside of the plug, then the plug won't fire. While you are cleaning the outside of the plug it is a good idea to clean off the threads on the shell with a wire brush. This makes it easier to screw the plug back into the engine, and helps to ensure an uninterrupted path for heat flow from the plug to the cylinder head.

The deposits which build up on the bottom end of the plug are usually more difficult to remove, and this is best handled by a plug-cleaning machine which sandblasts the bottom of the plug. Many service stations have plug cleaners, and the charge for cleaning a set of four plugs is minimal. Have the station blow out the bottom of the plug with compressed air to remove any leftover particles of sand. If you don't have access to a plug cleaner, then you can get fairly good results by the judicious use of a wire brush on the electrodes and by gently scraping out the space between the insulator and the shell with a thin-bladed knife or screwdriver. This doesn't do as thorough a job as the plug cleaner, but in most cases it will suffice. If any hard deposits on the electrodes resist your wire brush, scrape them off with a knife.

We have one more cleaning operation to see to before the gap can be adjusted. An electrical spark will jump more easily (requiring lower voltage) between electrodes which have flat sides and sharp edges, like those found on a new spark plug. After many miles of service the sharp edges are eroded away until the electrodes appear to be very rounded on the ends. When this occurs, the amount of voltage required to push the spark across the gap rises, and if the rest of the system is in marginal condition it might not be able to produce enough voltage to do the job. To correct this the lower tip of the center electrode should be filed flat, and the ground electrode should be filed to a nice squre shape with sharp edges. This is best accomplished with an ignition file, which can be had at very low cost from any auto supply store and from most hardware stores. To give the file working clearance between the electrodes, you will have to bend the ground electrode away from the center electrode with the bending bar on your spark plug gapping tool. Do not bend any farther than is necessary, and do not file any more than is necessary.

**ADJUSTMENT:** Now you are ready to set the gap between the center electrode and the ground electrode to the correct measurement. When our cars were new the factory recommended a gap of between .020" and .022", but since that time it has been found that a slightly wider gap usually gives more satisfactory results. Champion now recommends a gap of .025" and this seems to work well.

To gap the plugs you will need a spark plug gapping tool which incorporates several thickness gauges for measuring the gap, a bending bar for bending the ground electrode to set the gap, and (in better-quality tools) a file for filing the electrodes as described above. The various types of gapping tools were discussed in the first installment of Back To Basics, but that was so long ago that a brief recap might be in order. Gapping tools can be had for as little as 59¢, but, as is true with almost everything, you get what you pay for. The more expensive tool will last longer, be easier to use, and will give more accurate results. Cheap gapping tools usually have flat-bladed thickness gauges, while the better ones have gauges made of pieces of wire of graduated thicknesses. The flat-bladed type is less accurate, because the flat blade tends to bridge across any irregularities and give false readings. The bending bar on a cheap gapping tool will probably be made of mild steel, which is more likely to bend itself than to bend the ground electrode. Better tools have tool steel bending bars, which will last nearly forever. The best I've come across to date is the Champion (that name keeps popping up, doesn't it) Spark Plug Gap Tool #CT-454. This has wire-type gauges, a tool steel bending bar, and an electrode file, all of which retract into a sturdy plastic and aluminum case. Very neat, but it costs about $4 at most auto supply stores.

To measure the gap, find the .025" wire or blade on the tool and insert it between the center and ground electrodes. The gap is correct if the gauge can be inserted with a light drag, but without forcing or springing the electrodes apart. If the gap is incorrect, it is adjusted by bending the ground electrode. Never try to move the center electrode, as this will destroy the seal between it and the insulator. The bending bar has several different-sized slots; find the one which is a snug fit on the ground electrode and place it over the electrode near where it is welded to the shell of the plug. Bend the ground electrode closer to or away from the center electrode, whichever is required, and measure the gap again. Keep trying until you get it right. Always bend the electrode near its junction with the shell, never in the middle.

**INSTALLING THE PLUGS:** It is a good idea to use new washers every time the plugs are installed, but this is not always possible since very few auto supply stores sell plug washers separately. Examine the old washers carefully. Unless they have been squashed absolutely flat by overtightening, they can almost always be re-used without any problem.

If the threads on the plug and in the head are clean and undamaged, you should be able to scew the plug in until the washer bottoms against the head using only your fingers. If not, and assuming that you cleaned the threads on the plug per the instructions earlier in this article, then get a flashlight and examine the threads in the cylinder head. If they are clogged with carbon, then they will have to be cleaned. Your local auto supply store can sell you a tool which cleans and restores dirty or slightly damaged spark plug hole threads, and this is a handy tool to have around. However, you can do a reasonably good job using an old spark plug. Clean the threads on the plug thoroughly, squirt a bit of penetrating oil on the threads and in the hole, and screw the plug in as far as you can without forcing it. Turn it back out, wipe off the threads, re-squirt with penetrating oil, and screw it in again. Keep this up until the threads are clean. If this is unsuccessful, you can make a crude tap from the old plug by filing several deep grooves perpendicularly across the threads. If the threads in the cylinder head are badly damaged, then more drastic action is required. This is beyond the capabilities of the average novice, so consult a mechanic.

The most common mistake made by the novice in fitting plugs to the engine is overtightening. This flattens the washer, which may then leak, and if grosly overdone it may strip the threads in the cylinder head. On the other hand, if the plug is undertightened the washer will not be compressed enough to provide a good seal against compression, and heat transfer from the plug to the cylinder head will be impaired.

According to Champion (sorry about that) in a cast iron head a 14 mm plug should be tightened to 26-30 lbs./ft. torque. This is all very well if you have a torque wrench, but you can come close enough by scewing the plug in with your fingers until the washer bottoms on the head, then tighten an additional ¼ to ⅜ of a turn with your spark plug wrench. Those of you whose engines are fitted with Laystall-Lucas aluminum cylinder heads should tighten the plugs to 18-22 lbs./ft., or finger tight plus ⅛ to ¼ turn with the wrench.

**NEW PLUGS:** It is seldom economical to use the same set of spark plugs for more than 12,000 miles, so new ones should be installed at least that often. If, in the process of cleaning and gapping used plugs, you find cracked insulators, broken or burned off electrodes, or if the electrodes are so badly rounded or pitted as to make filing impractical, or if they have already been filed so much that you have to bend the ground electrode to an acute angle in order to obtain the correct gap, then throw them out and install new ones. Spark plugs are cheap, so it is hardly worth going to a great deal of trouble to prolong the life of old plugs.

Never assume that new spark plugs are pre-set to the correct gap, because they usually are not. Champion (oops!) plugs seem usually to be pre-gapped to .028" or .030", and although these are commonly-used gaps on American cars they are too wide for your M.G. Always measure the gap on new plugs and, if necessary, re-gap to .025".

## CHAMPION L-7 PLUG DISCONTINUED

**The spark plug originally recommended for earlier examples of the T-Type (to engine nos. XPAG/TD2/22734 — XPAG/SC2/17993) was the Champion L-10S, but this plug was discontinued by Champion many years ago. The plug recommended as a replacement was the Champion L-7, which had the same thread reach and approximately the same heat range as the old L-10S. Unfortunately, a lot of owners didn't catch on to the change, and have been using the L-10 (no "S" suffix) which is far too hot for satisfactory use in the XPAG engine.**

**Now Champion has made the situation even more confusing. I recently learned that the L-7 plug has been discontinued, and the plug now recommended by Champion for the earlier XPAGs is the L-85. This plug has a heat range approximately equivalent to the old L-7 and the older L-10S. The only real difference is in the thread reach; the reach of the L-10S and L-7 was exactly ½", while the reach of the L-85 is 12 mm (.472"). This means that the threaded portion of the plug is .028" shorter than the older plug, but in most cases this will not cause any problems.**

**If you are still confused, take comfort in the fact that you are not alone. Just try to remember to ask for Champion L-85 plugs, not L-10 or L-7.**

**Owners of later cars requiring the ¾" reach Champion N-Series plugs should remember that the NA-8 originally specified was superceded by the N-5.**

## WHERE DID IT COME FROM?

If you pay attention to the new member listings in each issue of TSO, you can't help noticing that some cars are listed as having replacement engines. I receive quite a lot of mail from owners of such cars who want to know where their replacement engines originally came from. While I cannot say with any certainty that XPAG number such and such originally came from TD number so and so, I can pass along some information which might be of interest to those of you with replacement engines.

Replacement engines fall into two general categories, not including non-M.G. engines (which are another matter entirely). The first category consists of the factory-rebuilt engines which are seen fairly frequently in Great Britian and occasionally on this side of the Atlantic. These engines were rebuilt by Morris Motors Rebuilding Service (later by BMC), and were installed in cars on an exchange basis. The original engines from these cars were then rebuilt and installed in other cars. The Morris Motors rebuilds are usually identifiable by a square engine number plate (replacing the original octagonal one) bearing the inscription "Replacement Engine" and an engine number. These engines were assigned new numbers, so their original identity is lost forever. Morris Motors replacement engine numbers almost always are preceded by the letter "B" or "C", but the significance of this is unknown to me. A typical number on one of these rebuilds might be "XPAG/B 52616" or "XPAG/TD2/C 90763." Many of these engines also have a rectangular plate rivited to the crankcase, bearing the inscription "Morris Motors Ltd. Replacement Engine." and specifying the cylinder bore oversize, the crankshaft undersize, and the number of the shop which did the work.

At some point in time after Nuffield and Austin combined to form BMC, the factory replacement engine picture becomes a bit cloudy. T-Type engines were still being rebuilt and installed in cars on an exchange basis, but the manner in which they were identified is not always clear. Some of the BMC factory rebuilds have engine number plates similar to those already described, but others still bear their original plates. This was the era of the so-called "Gold Seal" replacement engine, which had a reputation (largely undeserved) for being as well put together as a rebuilt engine could possibly be.

The second category of replacements consists of engines still bearing their original identification plates, and this category is much more common on this side of the Atlantic. These engines come from a number of sources: auto salvage yards, parts cars, wrecks, and from several shops which once upon a time supplied rebuilt engines on an exchange basis. The origin of such an engine is usually easy to determine. By referring to the engine type designation as shown on the engine number plate, the owner can easily tell what sort of M.G. the unit originally inhabited.:

**XPAG:** This designation, without additional letters, indicates that the engine is a TB or TC unit. Engines numbered XPAG 501 through XPAG 882 are TB units, and those numbered XPAG 883 and after are TC.

**XPAG/TD:** These are early TD and early TD Mk.II engines. The numbering sequence starts over again, running from XPAG/TD/501 through XPAG/TD/9407. During this early period of TD production there was no special designation for TD Mk.II engines.

**XPAG/TD2:** These are later TD and TD Mk.II units. The change to the "TD2" designation simply indicates that the engine has a larger clutch and flywheel than the earlier versions. Numbering starts with XPAG/TD2/9408 and continues to approximately XPAG/TD2/30300, when TD production ceased. TD Mk.II engines up to #17028 also carry the XPAG/TD2 designation, but after that number they have a special designation all their own.

**XPAG/TD3:** Beginning with engine number 17029 and continuing until the end of TD production, this designation is used on TD Mk.II engines. However, the engine numbers are still part of the standard TD numbering sequence.

**XPAG/TF:** These are 1250 cc TF engines, and are numbered from XPAG/TF/30301 through approximately XPAG/TF/36330.

**XPEG:** This is the 1466 cc TF 1500 engine. The numbering sequence begins over again with XPEG 0501, and ends with XPEG 3940.

**XPAG/SC:** This is the single carburetor (hense the "SC") version of the XPAG which is found in the Y and YB Saloons. The numbering sequence begins at XPAG/SC/10001 and continues through XPAG/SC/16915.

**XPAG/SC2:** This engine is a late YB unit. The "SC2" (like TD2) indicates that a larger clutch and flywheel are used. Engine numbers begin with XPAG/SC2/16916, but the last XPAG/SC2 number is not known to me.

**XPAG/TR & XPAG/TL:** These are YT units, and are in most respects identical to the XPAG as used in the TC. The "TR" stands for Tourer, right hand drive, and the "TL" for tourer, left hand drive, although why it was considered necessary to differentiate between the two in the engine number is unknown. Engine numbers for the XPAG/TR and XPAG/TL are part of the XPAG/SC numbering sequence.

**XPJM & XPJW:** These 1140 cc units are from the Morris 10/4 Series M and the Wolsely 10 HP, introduced in 1938 and 1939 respectively, and may be considered the direct antecedents of the XPAG. These blocks are rarely found in T-Types as replacements, but I have seen a few.

**XPAW:** This 1250 cc unit is from the Wolseley 4/44, introduced in 1952. Except for the dipstick being on the wrong side (easily relocated) the XPAW block is almost identical to the late XPAGs. For this reason it is often found as a replacement in T-Types. In fact, a few years ago one of the major suppliers of T-Type parts in this country sold a number of XPAW short blocks as replacements for the XPAG.

There are about a million and a half other things which can be said about M.G. engine type designations, engine numbers, and the history of these sturdy little powerplants, but these are matters for a future article.

# Back to Basics #8 -- Distributors

**By Chip Old**
**Technical Editor**

In part seven of this series (TSO August 1977) we discussed the operation of the ignition system, including the distributor, so we can dispense with theory in this installment and get right down to the dirty work. The distributor must be serviced every 3,000 miles, or once every year, whichever occurs first. The required service consists of cleaning, inspection, lubrication and adjustment. We have a lot of ground to cover, so this will probably be the longest **BACK TO BASICS** column to date.

### DISTRIBUTOR CAP

The distributor cap is the first thing you'll notice as you look down at the distributor. It's the black plastic thing on top that all the spark plug wires are connected to. The cap is secured to the distributor by two spring clips, one on either side. Pry the clips loose at the top, then lift the cap off the distributor. All subsequent operations can be accomplished with the cap tucked off to one side. However, the silly thing tends to get in the way at some critical point, so it's easier to pull the wires loose from the spark plugs and lift the cap completely out of the way. Mark the wires first so you can reconnect them to the right plugs. The second and third plug wires are nearly the same length, so it's easy to reverse them if they are not marked.

Wipe the cap clean, inside and out, with a clean rag. Inspect it carefully for cracks; if you find any, get a new cap. Looking at the inside, you will see in the center of the cap a spring-loaded carbon contact. If it is broken or missing, or if it does not move freely against the tension of the spring, get a new cap. In a circle around the central contact are four metal posts which serve as contacts. If any of these are broken or very badly eroded, replace the cap. Look for tracks of hard, black carbon on the inside surface of the cap. These are almost impossible to remove satisfactorily, so if they are present get a new cap. Carbon tracks serve as a path for electrical current, but not the right path, and we don't want that since it can cause misfiring.

Those four metal posts are probably blackened and/or slightly pitted, so wrap a piece of sandpaper around a knife blade or the tip of a screwdriver and polish them. Do not remove any more metal than is necessary to clean up the posts. Be careful not to scratch the inside of the plastic cap, as oil and dirt can become trapped in the scratch marks and eventually carbonize, creating an unwanted electrical path. Wipe out any last traces of oil, dirt and sandpaper grit, and put the distributor cap aside with the wires still attached.

### ROTOR

Now look at the top of the distributor and locate the rotor (see fig. 1). Remove it by pulling it straight off the top of the cam. If it resists, pry gently with a screwdriver. If it slips off very easily and is a very loose fit on the cam, get a new one. The rotor should be a fairly snug fit on the cam. If it's loose, ignition timing will be eratic and engine performance will suffer. Also replace the rotor if the plastic is cracked or broken, or if the metal blade is loose.

The tip of the blade will probably be blackened or slightly pitted so clean it up with fine sandpaper or an ignition file. Keep the tip of the blade flat, with sharp edges. This facilitates the flow of current by reducing the voltage required to jump the gap between the rotor and those four posts in the distributor cap. Also use the sandpaper to polish up the other end of the blade, at the top center of the rotor, where the spring-loaded contact in the distributor cap bears against it. After many miles of use this area tends to get slightly scored, causing accelerated wear of the spring-loaded contact. Put the rejuvenated rotor back on the cam, making sure that the lug on the rotor engages the slot in the top of the cam.

### CENTRIFUGAL ADVANCE MECHANISM

Attention to the advance mechanism (automatic timing control, see fig. 1) is not usually considered part of the minor tuneup, but most of these distributors have seen more than their share of miles and could stand some extra care. The advance mechanism alters the timing of the spark to suit engine speed, and unless it does its job the engine will lose power. To check it out, twist the rotor counter-clockwise against spring pressure. There should be no feeling of grittiness in the movement. When you release the rotor, there should be an audible click as the advance weights snap back together. If your distributor fails either of these tests, the advance mechanism requires cleaning. The job takes only a few minutes and helps to prolong the service life of your distributor, so why not do it as part of every tune-up? The breaker points and condenser are mounted on the breaker base, which is secured to the distributor body by two small screws. Remove the screws and lift out the base, complete with points and condenser. Remove the screw in the top of

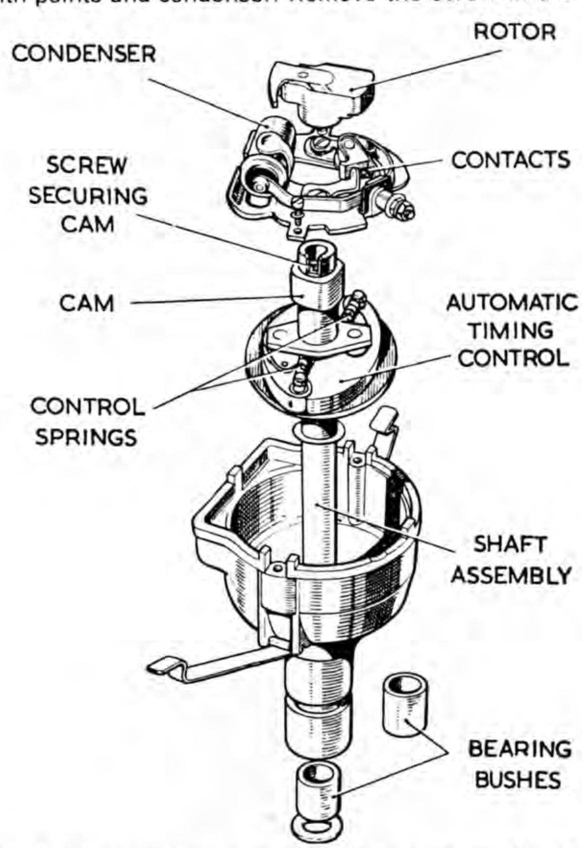


*Fig. 1: Exploded view of distributor used on TB, TC, early TD and early Y. Those used on other models differ slightly in some details.*

the cam and lift off the cam, making note of which way the slot in the cam is facing so you can put it back in the same position. Now lift out the advance weights, complete with springs and toggles.

Clean the weights, springs and toggles thoroughly, paying particular attention to all the pivot points. Also clean the advance plate, which is still in the distributor. The weights, springs and toggles may be dunked in solvent, but use a clean rag dampened with solvent to clean the advance plate. Do not pour solvent into the distributor.

Once all the parts are clean and dry, lubricate all the pivot points with engine oil and reassemble everything. Also oil the advance plate so the weights will slide freely on it.

Try the twist test again before you reinstall the breaker base. It should be all right, but if not chances are good that the springs are shot or the weights are badly worn. New parts are the only cure, but unfortunately they are no longer easy to obtain.

## BREAKER POINTS

The British manuals call them contact breakers or contacts, but in this country you're more likely to hear them referred to as breaker points, ignition points, or just plain points. Whatever you call them, dirty or mis-adjusted ones are the number one cause of hard starting, rough running and poor economy.

**CLEANING:** Inspection and cleaning of the points may be done with the breaker base still in the distributor, but it's a lot easier with it out. If you examine the points you will see that they are comprised of two parts: the stationary point mounted on a plate which is screwed to the breaker base, and the movable point mounted on a rocker arm. Push the movable point as far away from the stationary one as it will go, then examine the contact surfaces. When the points are new the surfaces are smooth and shiny, but after some use they tend to get blackened and rough.

This roughness must be eliminated to bring the points back to peak efficiency and to facilitate accurate adjustment of the gap between them. In cases where the roughness is not too severe, a piece of sandpaper or emory cloth may be doubled over to provide two abrasive surfaces, then inserted between the points. Let the spring pressure hold the points together while you slide the sandpaper in and out to polish the contact surfaces.

In really bad cases you may notice a little hill on one contact surface and a corresponding valley on the other. This calls for the attention of an ignition file, which can be gotten at any hardware or auto supply store. Insert it between the points and stroke it back and forth, applying pressure to the movable point to force the contact surfaces against the file on the cutting stroke. Continue filing until the bump is removed. It is not important if the valley in the other contact surface is not removed completely.

Instead of using sandpaper or an ignition file you may prefer to remove the points from the breaker base and rub them on a whetstone as suggested in the TD/TF shop manual (see fig. 3). The problem with this method is that each contact surface must be done separately, so it is difficult to keep the two surfaces parallel. The novice will find it much easier to maintain contact surface parallelism if a file or sandpaper are used with the breaker points still mounted on the breaker base.

Regardless of the method used, the desired result is to get the contact surfaces as smooth as possible, so follow up with a piece of doubled-over fine-grit sandpaper rubbed between the points. Finish up with a piece of hard paper (like a business card) drawn between the closed points to remove any remaining traces of dirt, oil or sanding grit. That sanding grit is one good reason for removing the breaker base from the distributor for the cleaning operation. If the points are filed or sanded with the base in place, then a lot of the grit is bound to drop into the distributor where it will eventually find its way into the bearings and the advance mechanism. This must be avoided if we want the distributor to enjoy a long service life.

**FITTING NEW POINTS:** It should be obvious that after several tune-ups there will not be enough material left on the contact surfaces to allow any further filing or sanding. When this time comes you will have to install new breaker points. In fact, many mechanics feel that the continued filing of old points to clean them up is not worth the trouble, so they recommend new points at least every second tune-up. Some ignition experts say that the contact surfaces lose some of their ability to conduct electricity after many miles of use, even if they are cleaned up to look as good as new, so new points should be installed every six thousand miles or so. This is debatable, so the choice is up to you.

To remove the old breaker points it is first necessary to disconnect the primary wire by removing the terminal nut from the side of the breaker base. On the same threaded stud is a second nut, which should be loosened but not removed. This allows the breaker point spring to be lifted up from behind the inner end of the stud, and then the movable point can be lifted off its pivot. Next, remove the two screws which secure the stationary point to the breaker base, and lift this off. Don't lose the lockwashers and flat washers which should be under each screw head.

Install the new stationary point, taking care to use a lockwasher and a flat washer under the head of each screw. Drop the fiber washer over the pivot post, then smear a light film of oil all around the post. Push the movable point onto the post, then twist it to be sure it pivots freely. Slip the slotted end of the spring over the stud, and tighten the nut

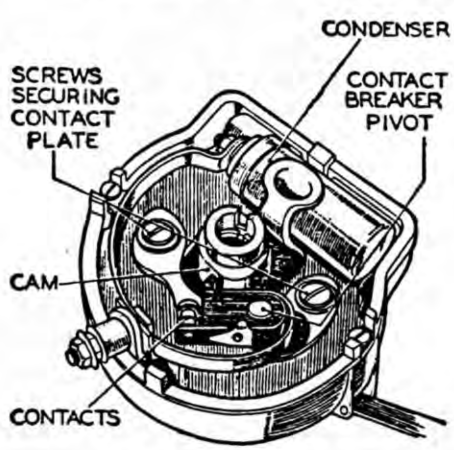


*Fig. 2: Top view of distributor with cap and rotor removed.*

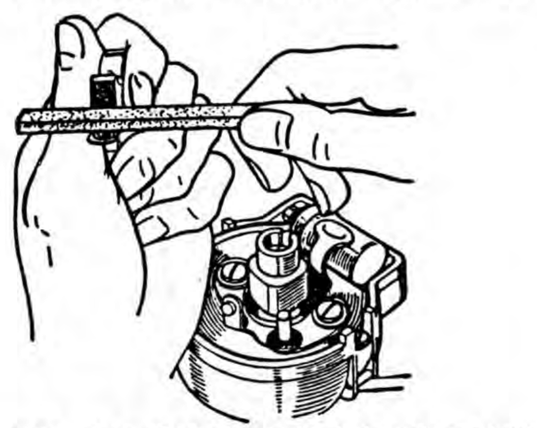

*Fig. 3: Contact surface of breaker point being cleaned with whetstone. Alternate method described in text is recommended for the novice.*

to secure it. The insulating washer on the stud must be between the spring and the tab on the breaker base. If not, the points will be grounded and the engine will not run. Reconnect the primary wire and install the breaker base assembly back into the distributor.

**ADJUSTING THE POINTS:** As the distributor cam rotates it opens and closes the points, which makes and breaks the primary electrical circuit to the coil. In order for the coil to function properly, the points must be closed for a specific period of time in relation to the rotation of the cam. This is measured in degrees of cam rotation, and is called the "dwell" or "dwell angle".

There are two ways to measure the dwell angle. The most direct method requires the use of a dwell meter, an electrical instrument which is attached to the primary distributor wire and to a suitable ground. With the engine running, the meter's dial provides a direct reading of the dwell angle. The second method is an indirect one, requiring the measurement of the gap between the points when they are held at their widest distance apart by the cam. The distributor manufacturer (Lucas in this case) provides specifications which tell us what point gap corresponds to the correct dwell angle. This gap is measured with a feeler gauge, just as we measured the rocker arm clearance in a previous installment of this series.

The use of a dwell meter is recommended for the very high degree of accuracy which it provides, but naturally even a cheap meter costs far more than the best set of feeler gauges. For this reason the average novice mechanic makes do with the feeler gauge method, and if care is exercised an entirely acceptable level of accuracy can be achieved. If you own a dwell meter, hook it up according to the manufacturer's instructions and refer to the specifications given elsewhere in this article for the correct dwell angle setting for your distributor. Since most of you will be working with feeler gauges, we will devote the majority of our discussion to that method of measurement.

**SPECIFICATIONS:** Before we go any farther, you must determine what the correct breaker point gap or dwell angle is for your distributor. If we were dealing with any "normal" car this would be a simple matter. We could simply look up the gap or dwell in the specifications list for our make and model of car, then go about our business with a minimum of fuss and bother. Unfortunately this is not the case with older Lucas distributors. Our friends at Joseph Lucas Limited used no less than three different types of distributor cams during the time our cars were built, and all three types may be found in our distributors. The result is two different breaker point gap specifications and three different dwell angle specifications. Before the points can be adjusted, we must determine which of these specifications is appropriate for your particular car.

The three types of cam are called Symmetric, Asymmetric and High Lift, and are illustrated in figure four. There are theoretically three ways to determine which type you have in your car: by engine number, by distributor part number, and by visual inspection. The latter is the only really reliable method, for several reasons.

SYMMETRIC ASYMMETRIC HIGH LIFT

*Fig. 4: The three types of distributor cam, as seen from above. Point gap and dwell angle specifications for each type are given in the text.*

According to the manuals, all engines prior to XPAG/TD2/24489 (T-Type) and XPAG/SC2/18097 (Y-Type) were equipped with distributors using symmetric or asymmetric cams, while all later engines used distributors with high lift cams. Unfortunately, the engine numbers given in the factory manuals are usually only approximate, and besides, after a quarter of a century quite a few replacement distributors have been installed which may or may not have the same type of cam as the original. Engine numbers are not really very reliable indicators of the correct specifications.

All Lucas distributors have a part number stamped in them, and that part number is followed by a suffix letter. According to all official Lucas literature, a suffix letter of A through D indicates that either a symmetric or an asymmetric cam was originally used. If the suffix is E or a later letter, then the cam is the high lift type. This method of identification has two serious drawbacks. First, the part number is often impossible to see with the distributor mounted on the engine. Second, after all these years we have no way of knowing whether or not a new cam of a different type was installed in the course of some long-forgotten distributor overhaul. All three types of cam are interchangeable, and Lucas stopped making the symmetric and asymmetric types a long time ago.

This leaves the visual inspection method, which is really the only reliable way to determine cam type. Pull off the rotor, look straight down at the top of the cam, and compare the cam profile to those shown in figure four. The differences are readily apparent. The symmetric type looks likes a square with perfectly flat sides and well-rounded corners. The high lift cam also looks like a square, but the sides bulge slightly and the corners are fairly sharp. The asymmetric cam is sort of in between, with the well rounded corners of the symmetric and the bulging sides of the high lift. Incidentally, the asymmetric type is not often encountered in these cars. Most use either the symmetric or the high lift types.

Once you have identified the cam type used in your car, make a note of it somewhere so you won't have to go through all this rigamarole again. You might also make note in the same place of the gap and dwell specifications for the cam, which are as follows:

| CAM TYPE | SYMMETRIC | ASYMMETRIC | HIGH LIFT |
|---|---|---|---|
| POINT GAP | .010-.012 in. | .010-.012 in. | .014-.016 in. |
| DWELL ANGLE | 41° - 49° | 45° - 53° | 57° - 63° |

Armed with this knowledge, you are now ready to adjust the breaker points.

**ADJUSTMENT:** When feeler gauges are used to measure the point gap, it is first necessary to ensure that the cam is holding the points in the fully-open position. Use the starting crank to turn the engine over until the heel of the fiber rubbing block on the movable point is exactly on the tip of one of the cam lobes. If you don't have a crank, you can rock the car in high gear, pull on the fan belt, or use quick pulls on the starter knob to get the same results. The starting crank is lots quicker and more accurate. The engine will be easier to crank if the spark plugs are removed.

Now use your feeler gauge to measure the gap between the contact surfaces of the points. The preferred method is the same "go and not go" technique we used to adjust the rocker arm clearance in part six of this series. The ideal setting is right in the middle of the gap range given in the specifications. Using the high lift cam as our example, this means that the ideal gap setting is .015 inch. Therefore we want to use the .014 inch and .016 inch feeler gauges to measure the gap. If the gap is set correctly, the .014 inch gauge should slip between the points without dragging, but there should be a very noticeable drag when the .016 inch gauge is tried.

If the gap is incorrect, as will probably be the case, then adjustment is needed. Loosen the two screws which secure the base of the stationary point to the breaker base just enough so that the point can be moved by pushing with the tip of a screwdriver against the end farthest from the pivot post. Move the stationary point as required to get the gap right, then righten the securing screws. Tightening the screws will often alter the gap slightly, so check again using the "go and not go" method. Keep trying until you get it right.

If you are using a dwell meter, connect it according to the manufacturer's instructions and set the selector knob (if any) to the four cylinder position. Start the engine and run it at idle, noting the dwell angle reading shown on the dial of the meter. If the engine will not start, the gap is probably so far off the engine won't fire. If this happens, set the gap with feeler gauges and then double-check and fine-tune it with the dwell meter. As with the point gap, we want to aim for the ideal setting which is right in the middle of the dwell angle range given in the specifications. In other words, we want to try for a dwell angle of 45° for a symmetric cam, 49° for an asymmetric cam, and 60° for a high lift cam. If the dwell reading is too high, widen the gap between the points. If the reading is low, narrow the gap. You may find it difficult to hit exactly upon the ideal setting, but you will be all right if you come as close as possible to the center of the range specified for your cam. This will be a far more accurate setting than most people can achieve with feeler gauges.

If the points are used ones they should require no farther adjustment until tune-up time comes around again. However, if the points are new they will get out of adjustment rather quickly. This happens because the heel of the fiber rubbing block wears very quickly until it beds in against the cam. To compensate for this some mechanics set the gap on new points slightly wider than standard (or the dwell angle slightly smaller), so that the initial quick wear will narrow the gap to something approaching the correct measurement. This works after a fashion, but sometimes that extra-wide gap setting causes hard starting and uneven running. The preferred method is to set the gap or dwell angle right the first time, then to measure and re-set it about five hundred miles later. By that time most of the initial rubbing block wear will have taken place, and the new setting should hold up until the next tune-up is due. Cam lube on cam — see figure 8.

The last thing to be done to the points is to draw a piece of paper between the contact surfaces while they are closed, in order to remove any traces of oil left behind by the feeler gauges. Oil left on the points will burn when current flows across the contact surfaces, leaving a layer of carbon which will impair their efficiency.

### IGNITION TIMING

In order for the engine to run efficiently, the mixture of fuel and air in the cylinders must be ignited at exactly the right time in relation to the position of the piston. On most cars that ignition point is somewhere near top dead center on the compression stroke when the engine is idling, but it must occur progressively earlier and earlier as engine speed increases. To understand why, envision the piston travelling up through its compression stroke, then starting down on the power stroke. On every engine there is one particular postition in the power stroke where it is best for the burning and expanding gasses to provide their greatest push against the top of the piston. In order for this to happen, the mixture must be almost completely burned by the time the piston reaches that position, so it stands to reason that the mixture must start burning somewhat earlier. Now, the time required for the mixture to burn stays pretty much the same regardless of engine speed (an oversimplification, but it will serve). The "optimum push point" of the piston also stays

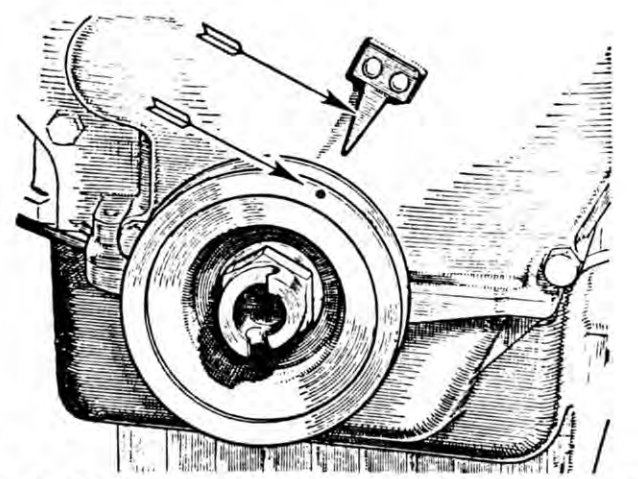

*Fig. 5: TDC is determined by lining up mark on edge of pulley with pointer on timing chain cover.*

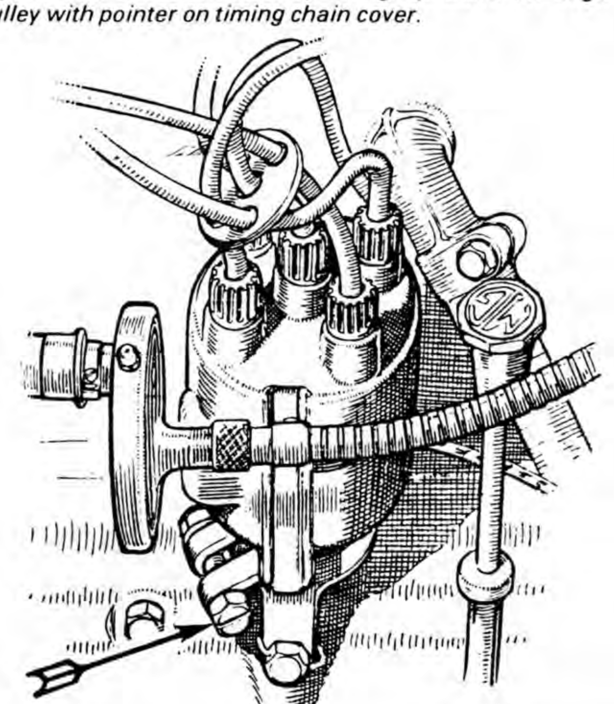

*Fig. 6: Arrow indicates distributor clamp bolt on early TD and Y. TA, TB & TC use a similar clamp which also incorporates micrometer adjustment.*

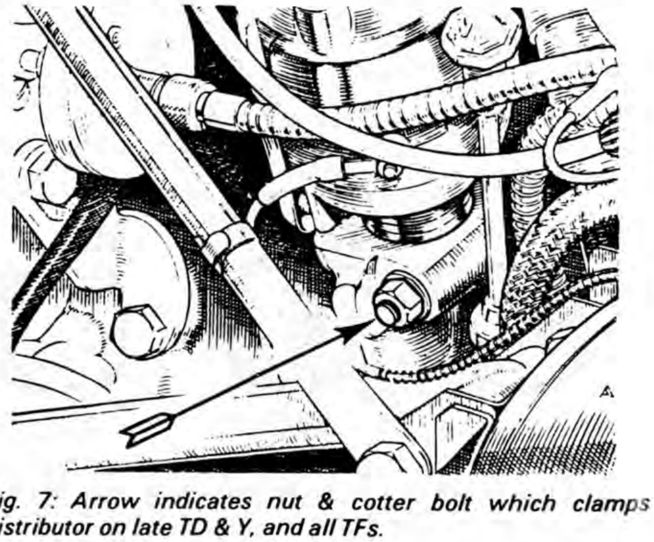

*Fig. 7: Arrow indicates nut & cotter bolt which clamps distributor on late TD & Y, and all TFs.*

about the same regardless of speed. However, it takes less and less time for the piston to approach and pass that "optimum push point" as the speed of the engine increases. To allow for this and have the mixture completely burned by the time the piston reaches that position, the point of ignition must be altered so that it occurs earlier and earlier as engine speed increases. Piston position is difficult to measure without taking the engine apart, so we speak of ignition timing in terms of degrees of crankshaft rotation, which is directly related to piston travel.

To clarify matters, let's use a typical XPAG engine as an example. At very low engine speeds (around 700-800 RPM) the spark occurs at exactly top dead center (TDC) on the piston's compression stroke. This allows the mixture enough time to burn before the piston reaches its "optimum push point", but only at that very low engine speed. By the time the engine is running at 5000 RPM, the spark must occur approximately 30° of crankshaft rotation **before** the piston reaches TDC. Otherwise the mixture will not have time enough to burn completely before the piston reaches that "optimum push point". This is called "advancing the spark", and is taken care of by the centrifugal advance mechanism. As engine speed increases, centrifugal force moves the advance weights outwards against spring tension. As the weights move, they change the position of the cam on the distributor shaft, so that as engine speed increases the breaker points open earlier and the spark occurs earlier. The weights and springs are calibrated to advance the spark just the right amount for any given engine speed. More modern distributors usually have a secondary advance mechanism operated by intake manifold vacuum which helps to tailor the spark advance more closely to the actual needs of the engine under all speed and load conditions, but our T and Y-Types are not blessed with such modern conveniences.

Our M.G. engines have no provision for checking the spark timing through the entire ignition advance range, but we do know that the spark should occur at exaclty TDC before the centrifugal advance mechanism goes into action. We can safely assume that the engineers at Lucas and M.G. knew what they were doing when they designed the spark advance curves for these engines, so if we set the initial spark to occur at TDC we can rely upon the advance mechanism to take care of the rest.

**TIMING CHECK:** In order to verify that the timing is correct we must be able to answer two questions. First, when is the piston at TDC on its compression stroke? Second, when does the spark actually occur? The first question is taken care of by a pointer on the timing chain cover at the front of the engine (see fig. 5). When the crankshaft is turned so that the notch or hole on the rim of the crankshaft pulley is aligned with the pointer, then the pistons in cylinders number one and four are at TDC. You needn't worry about which one is on its compression stroke unless you have removed the whole distributor from the engine. If you've done that, you are way beyond the scope of this basic "how-to" article. Anyway, finding TDC is obviously no problem at all.

To determine exactly when the spark occurs we need to become a bit more ingenious. We will be setting the timing without running the engine, so there will be no spark for us to observe at first hand. However, if you think back to the previous installment of this series and our discussion of basic ignition theory, you will remember that the spark sparks at the instant the breaker points open and allow the magnetic field in the coil to collapse. Therefore if we can determine the exact instant the points begin to open, we will have also determined the exact time when the spark occurs.

Simply observing the points as they open and close is not accurate enough. By the time we see the points move, they will actually have been slightly open for quite a while. To determine the exact instant the points begin to open we will have to resort to slightly more sophisticated methods. Several equally good methods can be used, but for the novice the simplest, most foolproof and least expensive method is to connect a twelve volt test light in parallel with the breaker points. In other words, connect one lead from the light to the primary terminal on the side of the distributor, and the other lead to any convenient ground like the distributor body or the engine block.

You can purchase a suitable 12 volt test light at almost any auto supply store, but it is very easy and somewhat less expensive to make your own. All you need is a light socket, some wire, two alligator clips, and a twelve volt bulb to fit the socket. The wattage of the bulb is unimportant as long as it is bright enough to be seen in broad daylight. Cut the wire into two equal lengths; about twelve inches each will allow adequate flexibility. Attach one wire to the central terminal on the socket, and the other wire to the side shell. The exact method of attachment will depend upon the construction of the socket, but you can figure that out easily enough. Attach an alligator clip to the free end of each wire, and screw in the bulb. Test your homemade test light by touching the alligator clips against the terminals of your car battery. If you have assembled it correctly, the bulb should light up. You're almost ready to check the timing.

First, however, we have to delve once more into some basic theory so that you'll understand why this method of timing works. With the test light hooked up parallel to the breaker points, as described earlier, we have provided two alternate paths for the electrical current to follow to ground. One is through the points, and the other is through the test light. Like almost everything else in this universe, electrical

*Fig. 8: Cam should receive very thin smear of lithium grease to minimize rubbing block wear.*

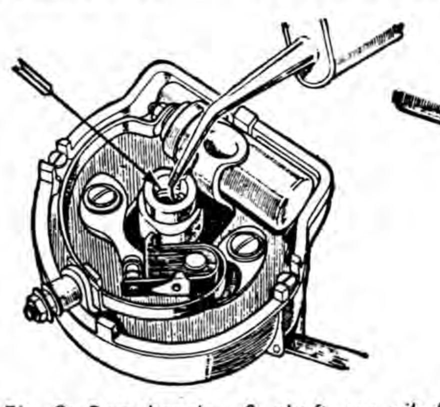

*Fig. 9: Cam bearing & shaft are oiled through cavity under rotor.*

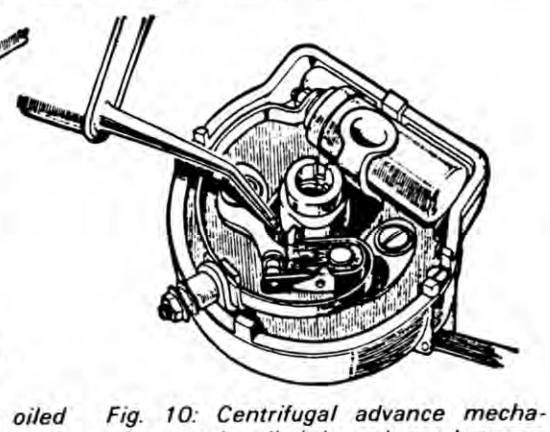

*Fig. 10: Centrifugal advance mechanism may be oiled through gap between breaker base & cam, but text suggests better method.*

current follows the path of least resistance. When the points are closed the current flows through them to ground, bypassing the test light because the points offer less resistance. When the points open, the test light offers the only available path. Current flows through the test light, and the bulb lights up. Therefore, the instant the bulb lights is the instant the points begin to open.

The procedure used for checking the timing is quite simple. The points should already be cleaned and gapped. The distributor cap should be off, but the rotor should be in position on top of the cam. The spark plugs should be removed so the engine can be turned easily with the starting crank. Attach one lead of the test light to the primary terminal on the side of the distributor, and the other lead to any good ground. Prop the light up where it can be seen from in front of the car. Twist the rotor **clockwise** to make sure the advance mechanism is in the fully retarded position. Turn on the ignition switch.

Now use the starting crank to turn the crankshaft. Turn the crank through several complete revolutions, watching the test lamp. It should go on and off several times. If it doesn't, then you have hooked something up incorrectly. When you are satisfied that the light is working properly, turn the crank again, this time watching the timing marks. When the mark on the pulley is about one inch from the pointer, turn your attention back to the light. Turn the crank very slowly, just barely nudging it around. Stop turning the instant the test light goes on. If you miss the exact spot, turn through two complete revolutions and try again. You must stop turning the instant the bulb lights up.

Now look closely at the timing marks, keeping your line of sight in line with the pointer. The mark on the pulley should be exactly in line with the pointer. If it is, the timing is set correctly. If not, then you will have to adjust it. Try it several times to make sure you get it right.

**TIMING ADJUSTMENT:** Begin by turning the crank until the timing marks are exactly aligned. Next, loosen the clamp which prevents the distributor body from rotating in the engine block. Several types of clamps are used on these cars. Early TDs and some Ys use the type shown in figure six. Loosen the bolt indicated by the arrow until the distributor is free to rotate. Do not loosen the bolt which secures the clamp to the engine block.

The TA, TB, TC and some early Ys use a similar clamp, but the clamps on these models incorporate a micrometer adjustment. Turn the knurled knob to set the micrometer adjuster to zero, then loosen the clamp bolt as described in the preceding paragraph.

Later TDs, Ys and all TFs use an entirely different clamping method, illustrated in figure seven. To loosen the distributor, slacken off the nut indicated by the arrow and tap the cotter bolt inward.

Double check to make sure the timing marks are aligned, and twist the rotor clockwise to make sure the advance mechanism is fully retarded. Now turn the body of the distributor **counter-clockwise** until the test light goes out, indicating that the points are closed. Then turn it very slowly **clockwise.** Stop turning the instant the bulb lights up. Try it several times to make sure you've done it right. When you are satisfied, re-tighten the clamp bolt, being very careful not to move the distributor in the process.

Now check the accuracy of your work by turning the crankshaft as described earlier. If the setting is right, your test light will light up the instant the timing marks are aligned. If not, try again. If your car is equipped with the micrometer adjustment you can use it to make the necessary correction if the initial setting is not too far off. On other models it is necessary to loosen the clamp bolt or cotter bolt and try again. Sometimes the distributor will shift slightly when the clamp bolt or cotter bolt is tightened. To decrease the chance of this happening, loosen the bolt only just enough so you can rotate the distributor, but no more.

This method of timing is called "static timing", because it is performed with the engine off and the advance mechanism in the static or fully retarded position. In the days before emissions regulations necessitated the use of more sophisticated ignition equipment, this was the recommended timing method for almost all Lucas-equipped cars.

There is another timing method, called "dynamic timing", which is performed with the engine running. A stroboscopic timing light is attached in such a way that it flashes each time the number one cylinder fires. When aimed at the timing marks, the flashing strobe light makes the marks appear to stand still. The mechanic need only twist the distributor this way and that until the marks are aligned, then clamp it down.

This method of timing is remarkably simple and extremely accurate if the engine was designed to be dynamically timed. An engine designed for dynamic timing will have its timing marks arranged to line up at a specific amount of advance and at a specific engine speed. When this is done, timing will be accurate throughout the rest of the speed range.

T- and Y-Series engines can be dynamically timed, but we must take into account the fact that the timing marks are arranged to show the correct firing position only when the advance mechanism is fully retarded. In order to set the timing with a strobe light, we must set the engine speed low enough so that the advance mechanism remains in the retarded position. In the case of the Lucas distributors used on our M.G.s, this requires that the engine speed be kept below 700 RPM while the timing is being set. If the springs which control the advance weights are weakened by long use, the required engine speed will be even lower. A tickover speed this low is often difficult to maintain unless the engine is in really top condition.

If we attempt to time the M.G. with the engine idling in the usual 800-1000 RPM range, the automatic advance mechanism will already have advanced the spark about 4° - 7°. If we turn the distributor until the timing marks line up under the flashing strobe light, we will probably believe that the timing is set at TDC. However, with the engine at rest we would find that the actual timing is now retarded by four to seven degrees. In other words, with the advance weights in the "at rest" or fully retarded positions the spark actually occurs 4° - 7° after TDC. This retarded condition is extended, of course, through the entire range of engine speeds, since the whole automatic advance range is now set back by 4° - 7°.

A retarded spark will prevent the engine from producing full power, and will cause it to overheat. If you must set your timing with a strobe light, set the engine to idle as slowly as possible. If you cannot get it down to 700 RPM or less, don't bother to try dynamic timing. The novice will be better off following the static timing procedure discussed earlier.

## DISTRIBUTOR LUBRICATION

Like all moving parts, the distributor requires lubrication. Four items require attention every three thousand miles or once a year, whichever occurs first. This may be done as part of the lubrication sequence covered earlier in this series, or as part of the distributor tune-up service covered here. The latter is probably the more practical approach.

**CAM LOBES:** To minimize wear on the breaker point rubbing block, a thin film of lithium grease should be smeared around the outside of the cam (see fig. 8). This is best done while you have the breaker base out of the distributor, because this improves access to the cam. Wipe off the old grease which may have bits of dirt stuck in it. The new film of grease must be very thin. If any thick blobs are left on the cam they will eventually find their way to the contact surfaces of the points.

**BREAKER POINT PIVOT:** Apply a very tiny drop of oil to the top of the pivot pin. Most oil cans won't dispense a drop small enough, so you might try dipping a toothpick or something of that general size into the oil, then transferring it to the pivot pin. Work the moveable point open and closed several times to work the oil down the length of the pin. Do not over-oil! Excess oil will eventually find its way to the contacts, where it will burn.

**CAM BEARING & DISTRIBUTOR SHAFT:** Remove the rotor and add several drops of oil to the cavity in the top of the cam (fig. 9). This lubricates the bearing surface between the cam and the top of the distributor shaft. On early distributors (through approximately XPAG/TD/20942) this also lubricates the lower end of the distributor shaft, where it rides in bronze bearings. An oil hole is provided in the screw holding the cam down, which corresponds to a hole drilled down through the top half of the shaft. On later distributors this oil hole is missing, and lubrication of the shaft bushing is dependent upon oil splash inside the engine.

**ADVANCE MECHANISM:** Add several drops of oil through the space between the breaker base and the cam (fig. 10). This will lubricate the advance weights where they slide over the plate, but very little oil will get to the pivot points of the weights and toggles, where it is really needed. This is another good reason for disassembling, cleaning and lubricating the advance mechanism during every tune-up.

In fact, it is really best to lubricate each item while you are working on it. In other words, oil the advance mechanism while you have it apart for inspection. Oil the cam bearing and distributor shaft while the cam is out. Grease the cam and oil the breaker point pivot while the points are out.

### HIGH TENSION CABLES

The H. T. Cables (or spark plug and coil wires) should be inspected very carefully for cracked or damaged insulation. This is not likely to occur with modern types of insulation, but is a real problem with old-style rubber insulation. If the insulation has gone bad, the cables should be replaced.

Also inspect the terminals at the end of the cables, first the spark plug terminals. These should be tightly attached to the cables, and should grip the spark plug snugly. The original spark plug terminals were a good type for their day, but after a quarter century many of them have lost their grip.

At the distributor end of each cable, unscrew the terminal nut which holds the cable to the distributor cap. Inspect the end of the cable for corrosion, and also look for corrosion on top of the metal post down inside the hole where the cable fits into the distributor cap. Corrosion can be cleaned off the post and the cable end with a knife blade. Get them as clean as possible, otherwise there will be unwanted resistance in the high tension secondary circuit.

If the wire end is so badly corroded that it cannot be cleaned satisfactorily, slide the terminal nut back out of the way, unbend the wire strands from around the copper washer, and pull off the washer. Cut off the corroded wire strands and strip off about ¼ inch of insulation to expose clean wire. Reassemble the nut, washer and cable as shown in figure eleven. In most cases the cable will not be shortened enough to matter.

If when you remove the H. T. cable from the distributor cap, you discover that the cable does not end with the washer shown in figure eleven, then someone has installed a set of replacement cables intended for a different type of distributor. On most American and European cars the end of the cable is a push fit into the distributor cap. A metal sleeve or clip on the end of the cable fits into a tubular metal sleeve inside the cap, making a good mechanical and electrical connection.

Lucas has recently switched over to this type of connector, but on older Lucas distributors like ours a good connection depends upon the wire strands at the end of the cable being clamped down against the terminal post by the washer and terminal nut. The American/European type connector can be pushed into the Lucas distributor cap, but this usually leaves a rather large gap between the connector and the terminal post. This often results in misfiring which the novice will find difficult to cure unless he knows what to look for.

If you find yourself in this predicament, you'll be well advised to convert back to the correct Lucas nut-and-washer terminal even if you have noticed no trace of misfiring. If the cables appear to be in otherwise good condition, cut off the incorrect terminals and inspect the raw cable ends. If the core of the cable is stranded copper or steel wire, then you need only strip back the insulation ¼ inch and install brass washers as shown in figure eleven.

If the cable core seems to be non-metallic, then the cables are probably the carbon-core resistance type used on most modern cars to reduce radio interference. This cable will not work with Lucas nut-and-washer terminal connectors, so throw it away. You can buy the correct cables complete with spark plug and distributor terminal from most T-Series parts suppliers (the easy way out), or you can make up new cables yourself.

If you decide to do it yourself, measure the old cables and buy the required length of high-quality metallic-core spark plug wire, plus a bit extra to allow for mistakes. Most auto supply stores carry the stuff in long reels, and will cut off as much as you need. Also buy four spark plug terminals, preferably a type which is secured to the cable by solder or a grub screw. Have the salesman show you how to attach them.

You will also need six copper or brass washers: one for each spark plug cable and two for the coil cable. The original style Lucas brass washers work best, because they are split and slightly sprung like a lock washer. This helps to prevent the terminal nut from working loose. You may be able to find them at a parts store specializing in foreign cars, but chances are that you'll wind up ordering them from one of the T-Series parts suppliers. If you can obtain a piece of ⅜ inch brass rod you can make your own washers. Drill a small hole up the center of the rod, just large enough for the bare strands of wire to slip through, then slice off thin discs with a hacksaw. You can sometimes find brass or copper washers in the hardware store with the correct ⅜ inch outside diameter, but the hole through the middle is usually much too large. These can be used in an emergency as long as the hole is not large enough to slip over the post inside the distributor cap.

Cut the new cable to the required lengths, using the old ones as patterns. Attach the spark plug connectors according to the salesman's instructions, making sure they are securely fixed to the cables. Attach the nut-and-washer distributor

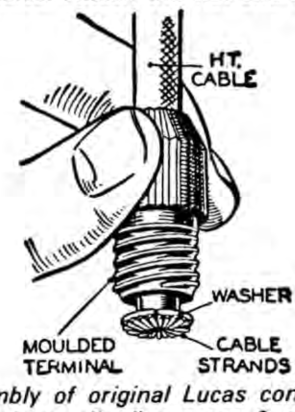


*Fig. 11: Assembly of original Lucas connectors for high-tension terminals on distributor cap & coil. No other type works well on these distributors.*

and coil connectors as shown in figure eleven. It is usually a good idea to remove and replace one cable at a time, re-labeling the new ones so you'll know which spark plug it goes to. If you mix them up the engine won't run well, if at all, and considerable damage can be done.

### FIRING UP

Once you have everything back together, try to start the engine. It should start up at least as quickly as it did before you started to work, if not more quickly. If the ignition system has been tuned up correctly, the engine should fire almost immediately after you pull the starter knob. If it is hard to start, the most likely cause is an incorrect breaker point gap. Remove the distributor cap and re-check the gap; if you find that it is outside the gap range given in the specifications, re-set it. Changing the gap also alters the ignition timing, so you may have to re-set that as well. If the car refuses to start at all, check to be sure all connections are tight. You did remember to reconnect the primary wire from the coil to the side of the distributor, didn't you? If the connections are correct, remove the distributor cap and inspect the breaker point mounting. Is the fiber insulating washer in the correct position between the point spring and the vertical tab on the breaker base? Is the fiber washer in the correct position between the arm of the movable point and the base of the stationary point? If either of these washers is incorrectly installed, the points will be grounded and the engine will not fire. There are any number of other possibilities, but these are the most common reasons for an engine not to start following an ignition tune-up. If we go beyond these reasons, we are getting into the realm of troubleshooting, and that is the subject of a later installment in this series. Don't worry, though; unless you have made an incredible blunder somewhere along the line, your car should fire right away and purr like a kitten.

This completes the basic tune-up service for the ignition system. Tune in next issue for basic carburetor theory and adjustment. Until then, happy wrenching!

# Back to Basics #9 -- Review

**By F. E. "Chip" Old**
**Technical Editor**

This ninth installment of the **Back To Basics** series was supposed to deal with basic carburetor service, but as you will see it does not. Of all the tune-up operations required to keep our cars running sweetly, S.U. carburetor adjustment seems to be most difficult for the novice. I've often heard the complaint that the description of this operation provided in most service manuals tends to confuse rather than clarify, so it was my intention to write a reasonably foolproof how-to article on the subject. So far I have been somewhat less than successful. The thing has been written and re-written several times, then tested for clarity on wife and friends, but each time some fault remained to confuse the reader. I'm still trying, so look for it in the next issue. In the meantime, let's backtrack a bit to clarify, add to, and correct information given in earlier installments, based on the comments I've received from all of you out there in TSO readerland.

**WHERE HAVE WE BEEN?**: Those of you who are relatively new to the Register might be interested to know what topics have already been covered in **Back To Basics.** The titles used for each installment have not always described the content very clearly, so in the list which follows the subject matter actually dealt with is shown, not the actual titles.

#1 Basic Tool Requirements. June 1975
#2 Manuals & Terminology. August 1975
#3 Engine Lubrication. October 1975
#4 Chassis Lubrication. April 1976
#5 Tuning Theory & Compression Test. August 1976
#6 Rocker Arm Adjustment. April 1977
#7 Ignition Basics & Spark Plug Maintenance. August 1977
#8 Distributor Service. December 1977
#9 You're reading it!

I have received numerous requests, mostly from newer members, for copies of past installments of this series, but unfortunately the problems of photocopying, billing and so forth make this unfeasible at the present time. However, **most back issues of TSO are available from Les Weiss (see Regalia page of any TSO). If you want earlier installments, please order the appropriate issues from him.**

**PURPOSE:** Generally speaking, this series has been received far more enthusiastically than I dreamed it would, which indicates to me that something like it was needed. However, several technically oriented readers have commented that it is too basic, too detailed, and that it covers ground already covered in the workshop manuals. Yes, it is very basic and very detailed, but let's not lose sight of the purpose of the series. To the average novice, the factory workshop manuals are about 50% gibberish. This is to be expected, since they were written for the mechanic with a good understanding of basic automotive fundamentals and experience in applying those fundamentals. **Back To Basics** is not written with the experienced mechanic or even the experienced amateur in mind. It is written for the M.G. owner who does not have the basic knowledge and experience needed even for the simplest tune-up work, so I have tried not only to explain each operation in more detail than you will find in the manuals, but also to explain why each operation must be performed, which the manuals neglect to do almost entirely.

**MOTOR OIL:** Much has been said in these pages regarding the advantages of using modern multi-viscosity oil in our older M.G. engines, but I still hear occasionally from misguided readers who insist upon using old fashioned single-viscosity oil. Some even go out of their way to find non-detergent oil! Modern multi-viscosity detergent oil offers far superior lubrication performance, and to resist using it for the reasons usually given is sheer folly. I know it leaks out of the engine more readily than heavy single-viscosity oil, and it tends to get past worn piston rings more easily, but the possibility of higher oil consumption should not overshadow the vastly improved lubrication characteristics of the multi-vis oils. After all, the purpose of oil is to lubricate the engine, preventing as much internal wear as possible. Oil is an expendable item; it should not be chosen purely on its ability to stay in the engine. I've been told that multi-viscosity oil cannot withstand the "intense heat and high revs" of the M.G. engine, causing it to break down prematurely. This is nonsense; modern API Grade SE multiviscosity oils are designed to take the abuse handed out by modern emission-controlled engines. In contrast with these modern engines, our old faithful MPJG, XPAG and XPEG engines are relatively easy on oil. I've even been told that our engines were designed to work only on single-viscosity non-detergent oil, or that multi-viscostiy detergent oil is the result of an oil cartel conspiracy to dupe the consumer out of more money! These arguments don't even deserve discussion.

To the best of my knowledge no-one has performed formal tests with these old M.G. engines to determine which type of oil works best, but quite a few T and Y-Types have been run on multi-viscosity oil for many thousands of miles, and all reports indicate that bearing and camshaft life are increased dramatically. The preferred viscosity for use when temperatures remain below freezing is SAE 10W-40 or SAE 10W-50, and these may be used year round if you so desire. However, SAE 20W-50 is recommended for heavy-duty hot weather use. Use multi-viscosity oil in your M.G. Your engine will thank you.

**TRANSMISSION OIL:** Several readers who also own MGBs have told me that they use SAE 20W-50 motor oil in their T-Type gearbox because that's what is recommended for the MGB. Motor oil is great stuff for engines, but it is not formulated to withstand the entirely different demands of gearbox lubrication. Gear oil is specially formulated with extreme pressure additives which are not needed in motor oil but which are absolutely essential in the transmission and rear axle. I don't know why the MGB manuals recommend 20W-50 oil, but I suspect that it has something to do with efficient operation of the overdrive unit. Use only

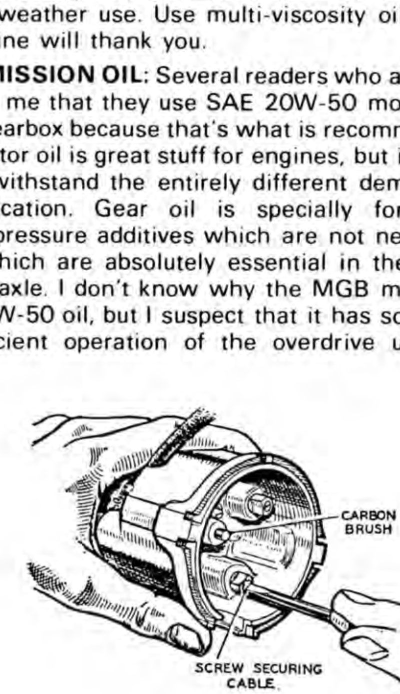


*Fig. 1: Y-Type distributor cap with H.T. cables secured by grub screws from inside.*

genuine gear oil in the T and Y-Type transmissions and rear axles, unless you enjoy rebuilding those components frequently. The original recommendations were SAE 140 for the TA, TB, TC, YA and YT, and SAE 90 for the TD, TF and YB, and these recommendations are still good. However, in recent years multi-viscosity gear oils have been developed which offer the same sort of benefits as multi-viscosity motor oil, and a number of T and Y-Types are being run on them with good results. If you want to try it, use one with a high viscosity rating of SAE 140 and a low viscosity rating of SAE 90 (i.e., SAE 90-140). This offers the improved low temperature flow characteristics of SAE 90 oil, which you don't get with straight SAE 140 oil, and the improved high temperature protection of SAE 140, which you don't get with straight SAE 90 oil. SAE 90-140 should be an improvement in all models.

**OIL ADDITIVES:** I still can't understand why some people insist upon buying the cheapest possible single-vis non-detergent oil, then add an expensive dollop of STP, Motor Honey, Bardahl or whatever. All this gives you is a higher-viscosity detergent oil, so why not buy good oil in the first place? Modern grade SE oil contains all the special-purpose additives your engine needs, and it is usually cheaper than the combination of cheap oil and expensive Motor Goo. What's more, the additives already in good oil are designed to work well together, but the additives in STP, etc., may not be compatible with the additives already in even the cheapest oil (no oil is 100% additive free). For what it's worth, I understand that Andy Granatelli (STP) has just lost a rather expensive court case involving false advertising. I don't know all the details yet, but I understand that it had something to do with the claims made in his STP Oil Treatment ads. 'Nuff said!

**TD/TF/Y STEERING LUBRICATION:** The manuals call for the use of gear oil in the rack and pinion steering gear, which has prompted several people to ask just how they are supposed to get the stuff into the steering box through the grease nipple on the rack housing. What you need is a bulk-load grease gun, i.e. the type which you scoop grease into from a can rather then the cartridge loading type. Most bulk-loading guns will handle heavy oil, although they might drip a bit. Actually, modern lithium grease seems to work just as well, so why bother. The bulk-loading grease gun can also be used to add oil to the TA/TB/TC Bishop Cam steering gear, but under no circumstances should grease be used here.

**BRAKE FLUID:** Several readers have taken me to task for recommending good old American MVSS #116 DOT 3 brake fluid instead of the genuine British Lockheed stuff. I think enough has already been said on the subject, so I'll simply say here that American brake fluid will **not** damage your Lockheed brakes. It will **not** rot the rubber parts, dissolve the brake hoses, eat away the cylinders or do any of the many other terrible things usually attributed to it by the Lockheed diehards. However, an even better choice is silicone brake fluid, as described in the December 1977 **Technically Speaking** column.

**COMPRESSION TEST:** One reader took exception to the tables of acceptable compression pressures given in **Back To Basics #5**, claiming that my figures for the maximum allowable variation between cylinders (20 psi) were too lenient. He pointed out quite correctly that the closer to zero variation you can get, the better the engine will run, and he suggested that 15 psi or even 10 psi might be more desirable.

I suppose this really depends on what you are willing to accept as a satisfactory level of performance. If you are building a racing T-Type, or if you insist that your street engine be honed to a razor's edge, then perhaps a maximum variation of 10 psi will best suit your needs. However, you will have to accept frequent value regrinds as a way of life. This series is not aimed at the racer or the serious performance addict, but rather at the average owner just learning how to tune up his M.G. Obviously an engine which shows a 20 psi variation between cylinders will not run as smoothly or as strongly as one showing a smaller variation, but it is still a tuneable engine, and that's the whole point of this series. The ability of the engine to respond to a tune-up decreases as the variation between cylinders increases. The 20 psi figure used in **Basics #5** has proven to be a good dividing line between acceptable and poor, in terms of potential to respond to tuning procedures.

**ROCKER ARM ADJUSTMENT:** After reading **Back To Basics #6**, several readers pointed out the incorrect exhaust clearance given for the XPAG/TD3 up to #24115. It should be .019", not .010", and the correction was made in the next installment. Aside from that, there were no complaints. I suppose I shouldn't be too smug about it, though; after all, what's controversial about rocker adjustment?

**DISTRIBUTOR CAPS:** No-one has complained about it yet, but I inadvertently slighted Y-Type owners in **Back To Basics #8**. Most Y-Series cars originally came with a distributor cap very different from that used on the T-Types. Instead of the H.T. cables sprouting from the top of the cap, secured by terminal nuts and washers as described in the article, on the Y-Types the cables emerge from the side of the cap and are secured by grub screws inserted from inside the cap. When fitting new cables to this type of distributor cap it is not necessary to strip back the insulation. Simply insert the cable into the appropriate hole and tighten the grub screw. The sharp point of the screw penetrates the insulation to make contact with the metal core of the cable. Carbon-core radio suppression wire can be used with this type of arrangement, but metallic-cored wire is generally more reliable.

One reader suggested that I should have given more emphasis to the importance of using the correct type of nut and washer terminal connection on the T-Type cap, pointing out quite correctly that American-style cable ends used in the Lucas distributor cap are especially likely to cause problems during wet weather. He also pointed out that temporary terminal washers can easily be cut out of an aluminum pie plate. I wouldn't recommend aluminum washers as a permanent installation, because of the possibility of electrolytic reaction with the copper wire, but it sounds like a good emergency fix.

**IGNITION TIMING:** In **Back To Basics #8** I explained that following the normal American practice of setting the timing with a strobe light and the engine running can result in timing which will appear to be correct, but which will actually be retarded by four to seven degrees, thanks to the design of the Lucas distributor. Several readers felt that I did not state this strongly enough, and they may be right. A retarded spark will almost always cause the engine to overheat, and these M.G. engines seem to be more susceptible to this than most. The uninitiated will often spend days flushing the cooling system, playing with the thermostat, rebuilding the water pump, adding extra fan blades and trying other extreme measures which accomplish nothing towards curing the real problem. Nine times out of ten he will not even consider the possibility that incorrect timing is at fault. Always set the timing by the static method described in **Basics #8**, and do it yourself. Very few gas station mechanics will take the extra time to time your engine statically, and many don't even know how.

**WHERE DO WE GO FROM HERE?:** The next few installments will deal with basic carburetor, fuel pump and cooling system service, but beyond that I have no specific topics in mind. How about letting me know where **you** think this series should go from here, bearing in mind the fact that **Back To Basics** is intended for the novice M.G. mechanic who wants to take care of his car but doesn't know how.

# BACK TO BASICS #10: CARBURETION

**By F. E. Old III**
**Technical Editor**

If you have been following this series closely, you should now be ready to tackle the last major step in the basic tune-up: carburetor cleaning and adjustment. But before we begin, I must apologize to those of you who have been waiting for this segment of **Back To Basics.** And waiting. And waiting. Until I looked back through TSO to find the previous installment, I had no idea it had appeared so long ago. The most recent installment (April 1978) was just a short review, and the last real get-your-hands-dirty installment was way back in December 1977. That's a whole year ago! Where did the time go? The next installment will be in the next issue. I promise. I hope.

### THE S.U. MYTH

I'm sure you've heard all the horror tales about the S.U. carburetor: finicky, hard to tune, needs adjustment at least once a week, goes out of whack when the moon is full or when the sun goes behind a cloud, and all the rest of that rubbish. When the M.G. TC first appeared on these shores there were almost no professional mechanics and even fewer of the backyard variety who had ever seen an S.U. carburetor, much less worked on one. Except for the fact that it performed the same function, it had almost nothing in common with the Carter, Stromberg, Tillotson, or any other All-American "normal" carburetor. Who ever heard of a carburetor mounted on its side instead of bolt upright like a self-respecting carb should be? And what was that funny dome-shaped thing on top, looking like some sort of mis-shapen coffee percolator? And who ever heard of a carburetor with a big piston inside it? Or one which was adjusted by turning a nut underneath instead of a proper idle mixture screw on top? It didn't even have a proper choke butterfly! And how in the world were you supposed to get two separate carbs on one engine to work together?

Small wonder the S.U. got such a bad reputation during its early days in America. In fact, many American drivers were so rabidly anti-S.U. that a fairly flourishing aftermarket industry sprang up to produce conversion kits using American carburetors. No matter that the good old Stromberg 97 was far too big for the little XPAG engine, that it was a less efficient fuel mixer than the S.U., and that the car never ran

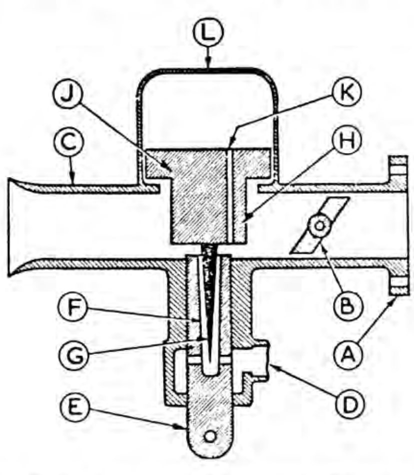


*Fig. 1: Basic S.U. layout. A=Mounting Flange, B=Throttle Valve, C=Air Intake, D=Fuel Intake, E=Jet Head, F=Jet, G=Needle, H=Air Slide, J=Piston, K=Air Passage To Suction Chamber, L=Suction Chamber.*

quite right after the conversion. At least we Yanks knew how to tune the thing!

After all these years, most foreign car mechanics have learned how to handle the S.U., but most back yard mechanics believe the same old myths. The truth is, there is no real basis for these myths. The S.U. is **not** hard to tune. True, the tuning procedures are a bit different than those used on the average domestic car, but they are not really any more difficult once you get the hang of it. The S.U. does **not** get out of whack at the slightest excuse. Once adjusted, it will keep its adjustment just as long as any other carburetor if you don't constantly fiddle with it. The good old American pastime of tuning the carbs to cure everything from rough running to flat tires is to blame for half the bad reputation. If tuned right and left alone, the S.U. will work amazingly well for a long time.

Don't be afraid of the S.U. carburetor, regardless of what you may have heard about it. Chances are the guy who told you all the horror tales had never tried to work on an S.U. They are different, but they are definitely not the diabolical machines they are made out to be. If you can ignore the myths and overcome your fear of the unknown, you've got it licked.

As I've said before, I firmly believe that in order to do a good job of any automotive maintenance operation it is necessary to have a good understanding of the particular item being worked on. What does it do? Why does it do it? How does it do it? How does it interelate with other componants? Armed with this knowledge it is much easier for the novice to approach the job with some degree of confidence. The tuning of the S.U. carburetor has probably caused the novice more grief than any other tune-up operation, so we will spend more time than usual on basic carburetion theory and the basic operating principles of the S.U. carb. In fact, unless it takes less space than I anticipate, this whole installment of **Back To Basics** will be concerned with theory. The "how-to" part of it will be covered next time.

### CARBURETION THEORY

As we learned way back in an early installment of this series, the internal combustion engine runs on a mixture of air and fuel. This mixture is comprised of approximately fifteen parts air to one part gasoline (by weight) as a general rule of thumb, but the mixture requirements may vary above or below this 15:1 ratio depending upon the momentary needs of the engine. For example, when the engine is loafing along at part throttle, it needs a "weaker" mixture, that is, one containing less fuel in proportion to air. When the engine is idling, or when full power is called for, a "richer" mixture is required, containing a larger proportion of fuel. The actual mixture may vary from about 17:1 on the weak side to about 13:1 on the rich side. Cold starting and sudden acceleration require even richer mixtures, but only for very short periods of time.

It is the function of the carburetor to supply the correct mixture to the engine, to vary the mixture ratio according to engine load, and to supply it in a form which is easily ignited. Simply dumping one part fuel and fifteen parts air into the cylinder will accomplish nothing. The fuel must be atomized, or broken up into very tiny droplets distrubuted evenly throughout the air. In this form it will ignite easily and burn rapidly.

**THE BASIC CARBURETOR:** In its simplest form, the carburetor consists of an air passage with a throttle valve at the engine end to control the amount of air drawn through the passage. Part of the passage ahead of the throttle valve is narrowed down to form a restriction or "venturi". A fuel passage or "jet" enters the air passage at this point. Air flow through the venturi creates a slight vacuum over the jet, so fuel is sucked out of the jet and mixed with the air stream. To maintain a constant level of fuel in the jet, gasoline from the fuel pump is piped into a "float chamber", which is nothing more than a small holding tank attached to or integral with the carburetor body. Inside the chamber is a valve controlled by a float. When the fuel level in the chamber drops below the correct level, the float drops with it, opening the valve so more fuel can enter the float chamber. When the fuel supply in the chamber reaches the proper level, the float closes the valve again.

All automotive carburetors operate basically as described above, but over the years there have been many different carburetor forms devised to get the job done. The two forms most commonly used today are the fixed venturi carburetor and the variable venturi carburetor.

**FIXED VENTURI CARBURETORS:** Also called fixed choke, variable velocity, variable vacuum and a few other names, this is the type used on most American and European cars. The venturi size is determined by the needs of the engine under whatever runnings conditions are considered normal for the car, but it is always a compromise. Venturi size can be ideal for low speed, or mid-range, or high speed, but not all three. The pressure drop or vacuum acting on the fuel jet varies according to the volume of air passing through the venturi, and this is dependent upon throttle opening and engine speed. Because of this variation, several different types of compensating devises are used to produce the correct fuel flow under all conditions. A separate jet supples the richer mixture needed at idle. Compensating jets keep the mixture right at cruising speeds. A power jet provides the richer mixture needed for full power. An accelleration pump provides the momentary enrichment required for sudden accelleration. The extra-rich mixture needed for cold starts is produced by a choke valve which partially blocks off the air intake end of the carburetor; the resultant high vaccum in the carburetor sucks extra fuel out of the jet. The modern fixed venturi carburetor is a very efficient device, but that efficiency is dependent upon a complex maze of fuel passages, jets, pumps and linkages.

**VARIABLE VENTURI CARBURETORS:** Also known as variable choke, constant vacuum, constant velocity and other names, this type is typified by the S.U. carburetor found on a wide variety of British cars. In this type, the venturi size increases and decreases according to engine demand and throttle opening, maintaining a more or less constant degree of vacuum in the venturi regardless of the volume of air flowing through the carburetor. To maintain the correct air/fuel mixture, a tapered needle moves in and out of the jet to increase or decrease the effective size of the jet according to engine demand. A single jet is used; no additional idle jets, compensating jets, power jets or pumps are usually needed.

Figure 1 shows a very simplified version of the S.U. layout. The venturi is formed by the space between the bottom of the piston (H) and the bottom wall of the throttle bore.

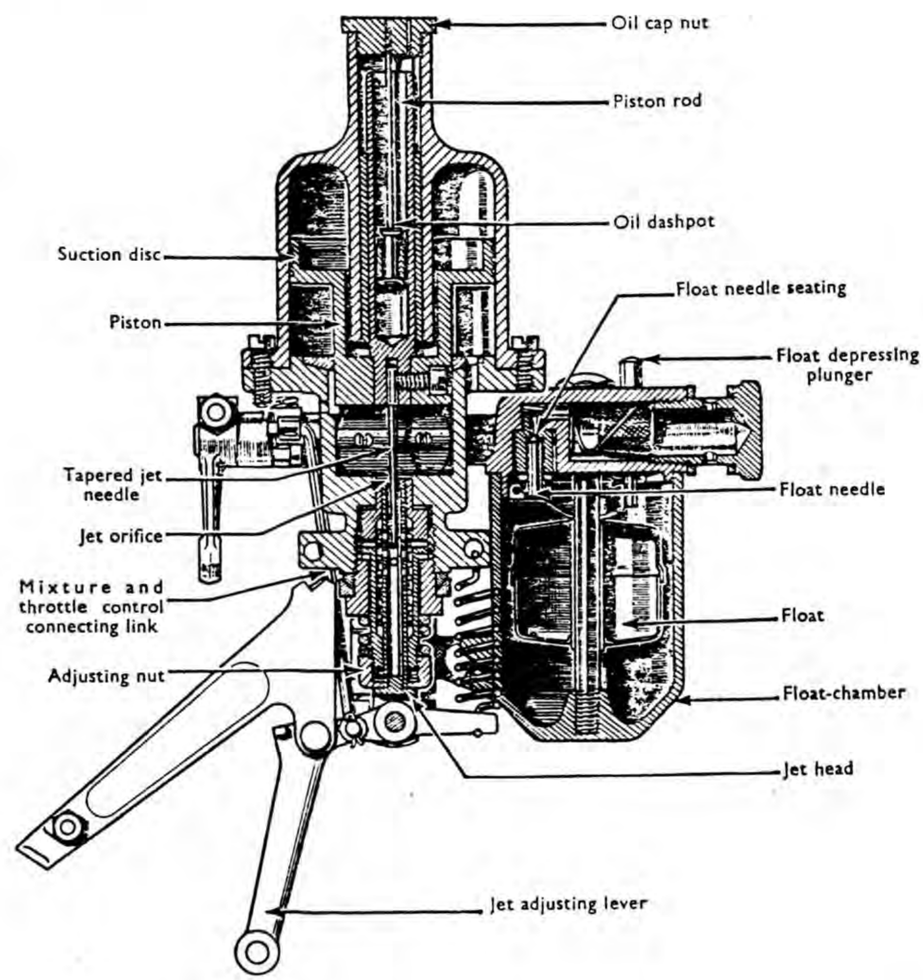


*Fig. 2: Section view of a typical S.U. type H carburetor.*

The piston moves up and down in the suction chamber (L), thus altering the size of the venturi. The tapered needle (G) attached to the bottom of the piston moves up and down with it, moving in and out of the jet (F) to change its effective size. A drilling (K) through the piston provides an air passage between the suction chamber above the piston and the engine end of the throttle bore, so air pressure above the piston is always the same as air pressure in the engine end of the bore. That part of the suction chamber which is below the piston is connected to the throttle bore at the intake end by a passageway (not shown) in the carburetor body, so air pressure below the piston is always the same as air pressure at the intake end of the bore. The top half of the piston, called the air slide (J), is a very close but frictionless fit in the suction chamber, so very little air can leak between the top and bottom of the suction chamber around the piston.

To visualize the action of the piston and needle, it helps to think of the engine as a big air pump which is trying to suck air in through the carburetor. It also helps the layman to think in terms of vacuum, rather than in terms of air flow, volume, pressure differential and all those other more technically correct terms. Those of you who know and prefer the technical terminology please grin and bear it. Remember, this series is meant for the rock bottom beginner.

With the driver's foot off the gas pedal, the throttle valve (B) is almost completely closed. Vacuum in the intake manifold is high, because our air pump (the engine) cannot suck much air through the carburetor. However, vacuum is very low on the other side of the throttle valve and consequently in the top of the suction chamber, so the piston's own weight keeps it almost right down against the bottom wall of the throttle bore, and of course this means that the needle is very deep in the jet. Consequently the venturi and jet opening are very small, in keeping with the small amount of air being sucked through the carburetor. Because only a small amount of air and fuel are being sucked into the engine, it runs very slowly.

When the dirver pushes down on the gas pedal the throttle valve opens wider. The vacuum in the intake manifold now tries to suck more air past the throttle valve, but the lowered piston is still blocking the throttle bore. This causes a high vacuum behind the piston, and therefore in the top of the suction chamber. This sucks the piston higher into the suction chamber, thus widening both the venturi and the jet opening. Air flow and fuel flow are now increased, so the engine speeds up.

As you can see, air flow through the carburetor and fuel flow from the jet are controlled by the height of the piston, which is controlled by the strength of the vacuum in the suction chamber, which is controlled in turn by the throttle opening. Engine speed also has an effect on piston height, because the faster the engine runs, the more air it pumps. If the throttle is held steady, but an outside force acts on the engine to slow it down or speed it up, the piston will react just as if the throttle had been closed or opened a bit. For example, if you hold the throttle steady as the car goes up a hill, the car (and consequently the engine) will gradually slow down. Air flow through the carburetor slows down in direct proportion to the decrease in engine speed. Consequently, vacuum in the suction chamber decreases and the piston drops a bit lower. Thus venturi and jet size decrease to match the lower volume of air being pulled into the engine. If the driver opens the throttle to maintain a steady speed up the hill, vacuum increases in the throttle bore and suction chamber, the piston moves up, and so forth. This description is a bit oversimplified, but it serves to demonstrate that the piston is constantly shifting position to provide precise control of fuel flow, air flow and venturi size to suit the needs of the engine.

I said earlier that compensating devices are not needed on the S.U., but it would be more accurate to say it does not need compensating devices as numerous or as complex as those used in fixed venturi carburetors. If the needle used in an S.U. carb has a uniform taper along its entire length, then theoretically the mixture ratio will always remain the same regardless of engine speed because fuel flow will increase at the same rate as air flow. However, we have learned that a richer mixture is needed to keep the engine ticking over at idle, and our theoreticaly uniformly-tapered needle cannot deliver the extra fuel needed for this rich mixture. We also know that a leaner than average mixture is needed at most cruising speeds, and a richer mixture is needed at very high speeds. Our theoretical needle cannot cope with these conditions, either. Moreover, the mixture needed at one cruising speed may not be the same as that required at slightly higher or lower cruising speeds. For example, an engine which runs best at 55 mph on a 14.1:1 mixture might need a 14.2:1 mixture to run properly at 60 mph. The numerical difference is very small, but very important to your engine's diet.

To take care of these different mixture requirements, S.U. needles are machined to an irregular taper. On most needles the degree of taper changes every eighth of an inch, but the changes are not usually great enough to be seen with the naked eye. S.U. manufactures approximately three hundred different needles to suit the .090" diameter jets used in most S.U. carburetors, each with different overall tapers and different irregularities in the taper. This allows each engine manufacturer to choose the needle which best suits the mixture requirements of his particular variety of engine. Each different needle configuration has a letter and/or number designation which distinguishes it from all other S.U. needles.

It should be obvious that the weight of the piston has a great deal of effect on how high and how fast the piston will rise in response to any given amount of vacuum in the suction chamber. On early TCs, and on most previous models, a rather heavy brass piston was used, but this was replaced on later cars by a light alloy piston. To make up for the difference in weight, a light-gauge coil spring is sometimes inserted between the piston and the top of the suction chamber, thus applying a small amount of preload to the piston. These springs are available from S.U. in several different strengths, providing a means by which the engine manufacturer can tailor piston response to the needs of the engine. The coils at one end of the spring are color-coded to designate the strength.

As we learned earlier, a richer than normal mixture is required to start a cold engine. Instead of the choke valve found on most fixed venturi carburetors, the S.U. employs

**M.G. T & Y-SERIES CARBURETOR SPECIFICATIONS**

| M.G. Model | S.U. Type | Spec. No. | Needle | Spring |
|---|---|---|---|---|
| TA | two HV3 | AUC 374 | AC | — |
| TB/TC | two H2 | AUC 429 | ES | — |
| TD | two H2 | AUC 549 | ES | — |
| TD Mk. II | two H4 | AUC 578 | LS1 | red |
| TF/TF 1500 | two H4 | AUC 728 | GJ | blue |
| YA/YB | one H2 | AUC 456 | FI | — |
| YT | two H2 | AUC 480 | ES | — |

a movable jet to accomplish this temporary enrichment. At the bottom of the carburetor is a jet control lever, pivoted on the carburetor body. This lever is attached to the bottom of the jet, called the jet head (E), and also to the choke cable. When the driver pulls the choke knob, the lever pulls the jet downwards in the carburetor body. This lowers the jet in relation to the needle, enlarging the effective size of the jet, so more fuel can flow. However, the piston is still at its lowest point, so air flow is low in relation to fuel flow, providing the very rich mixture required for starting.

To provide the richer mixture needed for rapid accelleration, most S.U. carburetors have an arrangement sort of like a crude tubular shock absorber which slows down the rise of the piston when the throttle is opened quickly. On all S.U.s, whether or not they have this "shock absorber", the piston is kept centered in the suction chamber by a tubular extension called the piston rod, which sticks up from the top of the piston. The piston rod slides up and down inside a corresponding tubular bore inside the suction chamber. The hollow piston rod is filled with oil, which lubricates the bearing surface between the rod and its bore. When the engine manufacturer determines that a richer mixture is needed for good accelleration, a plunger is attached to the cap on top of the suction chamber, extending down into the oil-filled piston rod. When the piston rises, the resistance of the plunger against the oil prevents it from rising too quickly. This makes the venturi area temporarily small in relation to the air flow, so vacuum is temporarily higher than usual in the venturi. This higher vacuum sucks extra fuel from the jet, providing a rich mixture until the piston is able to rise to its normal height. The plunger offers very little resistance to small, gradual movements of the piston, and offers almost no resistance to downwards movements of the piston. On some cars only the plunger is needed to provide the right amount of enrichment. On others, the piston spring mentioned earlier is enough to do the job. Some cars need neither, while others need both. It all depends upon the requirements of each engine design.

## S.U. TYPES

S.U. carburetors have always worked on the principles described above, but the type has been around for a very long time so there have been many variations on the theme. Through most of S.U.'s history, basic carburetor types have been identified by a letter designation. During the early years of M.G. history, the 1930's, the S.U. types most often used were the OM, the D, and the HV. The type OM, used on most of the smaller overhead cam M.G.s, is a tiny little thing looking more suitable for motorcycle use than automotive. The type D is the downdraft (vertically mounted) unit used on the big M.G. SA models. The type HV, used on the M.G. TA and several earlier models,. dates back at least to the late 1920's, but the only major difference between it and most later types is that the HV has no flange for air cleaner mounting. If the car manufacturer wanted to use an air cleaner, it had to be clamped around the intake end of the carburetor.

The more recent type H was introduced in the late 1930's, and remained the predominant type until about 1960. This was the type used on all T and Y-Series M.G.s, with the exception of the TA. During the 1960's and early 1970's the HD and HS types predominated. These differ from the type H mainly in the methods used to mount and seal the jet, and in the method used to transfer fuel from the float bowl to the jet. Otherwise they work just like all earlier S.U. carburetors. A later varient, the type H1F, is an emission control carburetor.

Each of these S.U. types is made in several different sizes, measured at the engine end of the throttle bore. To identify the size, a number is added to the type designation (HV3, H2, etc.). These numbers run from one to eight, with each larger number indicating a ⅛" increase in throttle bore size. On all pre-war types, excepting the type H, the number "1" indicates a 1" throttle bore, "2" indicates a 1⅛" bore, and so on up to "8", indicating a 1⅞" bore. Thus, the HV3 used on the M.G. TA has a 1¼" throttle bore. On the type H and all subsequent models, the number "1" indicates a 1⅛" bore, and so on in ⅛" increments to "8", indicating a 2" throttle bore. The H2 and H4 carburetors used on most T-Series M.G.s are therefore 1¼" and 1½" respectively.

Within each type and size category there are literally hundreds of variations developed to suit the particular requirements of each engine and car. These variations may be as minor as differences in control linkages (as between the TC and TD H2 carbs) or a difference in needle size. On the other hand, the variation may be something as major as a completely revised main body casting (as between the TD Mk II and TF H4 carbs), mounting flange configuration (two, three or four bolt), or whatever. To bring a semblance of order to this chaos, S.U. assigns a specification number to each variation. The H2 carburetor used on the TC, for example, is S.U. specification number AUC429, while the same basic carburetor as used on the TD is AUC549. They are identical except for the arrangement of the various control linkages.

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I've probably told you more than you cared to know about this subject, so I'll quit before I bore you to death. Tune in next time for the nitty-gritty, get-your-hands-dirty side of the S.U. story: cleaning and tuning. Until then, happy wrenching!

# BACK TO BASICS #11: CARBURETOR TUNING

## *by F.E. OLD*
## *Technical Editor*

"Back to Basics", for those of you who are fairly new to the Register and TSO, is a series of articles designed to help the would-be back-yard mechanic cope with basic automotive maintenance procedures. Unlike most of the M.G. workshop manuals currently available, which assume that the reader is familiar with automotive fundamentals, we have tried in this series to assume nothing. Our aim has been to provide instructions which the rock bottom beginner can follow without too much difficulty.

We began way back in the June 1975 issue with a discussion of the basic tools needed for auto maintenance work. In August 1975, part two dealt with useful manuals and a comparison of British and American automotive terminology. Part three, in October 1975, covered engine lubrication, and part four, in April 1976, covered chassis lubrication. In August 1976, part five discussed the theory behind engine tuning and explained how to perform a compression test. In April 1977, part six took the reader through the procedure for adjusting valve lash or rocker arm clearance. Number seven, in August 1977, described the workings of the iginition system and explained how to clean and gap spark plugs. Part eight, in December 1977, explained how to service the distributor. In April 1978, part nine reviewed what had gone before, for readers just joining in, and mentioned a few things which had been omitted from earlier installments. In December 1978, part ten dealt with carburetion theory and described the S.U. carburetor. Now, about two and a half years later, #11 is finally finished and ready for the printers. The delay was mainly due to the fact that I found it very difficult to write a reasonably foolproof how-to article on the subject of S.U. carburetor tuning. What follows is my fifth or sixth attempt. It's far from perfect, but I don't want to delay publication any longer.

Incidentally, please don't ask me for copies of earlier installments, as I am not able to supply photocopies. Individual **back issues of TSO may be ordered. See the Register Regalia page of TSO for details.**

### TOOLS

Most of the tools you'll need should already be in your M.G. tool box: wrenches in Whitworth and British Association sizes, screwdrivers, and pliers. To do a topnotch job you'll also need a PSW tool kit for the S.U. carburetor, which is sold as an "S.U. Tool Kit" by most of the T Series parts suppliers and may also be found at many foreign car parts stores. You might also want to obtain a Uni-Syn or similar synchronizing tool. You can get by without the PSW kit and the Uni-Sun, but they will certainly make life easier for you.

For cleaning the carbs you will need several clean, lint-free rags, a stiff brush, and some carburetor cleaning fluid. The most convenient type of cleaning fluid comes in aerosol cans, but you can also get it in bulk form if you prefer. Dentured alcohol can be used in a pinch, but it is not as effective.

### PREPARATION

The average back-yard mechanic seems to have a carburetor fetish. When the engine isn't running right, out comes the screwdriver to adjust the carburetors. When he does what he naively thinks is a tune-up, the first things he attacks are the carburetors. When he has nothing better to do, he fiddles with the carburetors. This is wrong! Most cases of poor running are caused by malfunctions in other areas of the engine, not by the carburetors. The carbs should be the last items checked in a troubleshooting sequence unless you are experienced enough to know that they are the only possible cause of the engine's strange behavior.

Similarly, the carburetors should be the last items attended to in the course of a tuneup. Unless the compression checks out okay and rocker arm clearance, spark plug gap, breaker point gap and ignition timing are all correct, it will be useless to adjust the carbs. You may think you have adjusted them correctly, only to find you must do it all over again after you've adjusted the plugs, points and so on.

With the exception of the Y and YB, the cars we are dealing with in this series all have two carburetors. Dual-carburetor setups are especially sensitive to engine condition, and can be difficult if not impossible to tune properly if the rest of the tuneup sequence is not taken care of first. Even then, you will find carburetor tuning very difficult if in the course of the earlier tuneup procedures you discover that the engine is suffering badly from age. If, for example, during your compression test you find that compression in one cylinder is considerably lower than that of the others, then it will be very difficult to adjust the carburetor serving that cylinder. Or, if the automatic advance mechanism in the distributor is so badly worn that it can no longer fire the plugs consistantly at the right time, then carb tuning will be difficult and the resulting setting will quite probably not be correct over the entire rpm range.

These factors are important on single-carburetor models, but are not so critical. When all four cylinders draw through one carburetor, the effect on the carburetor of imperfections in one cylinder are not as strong. Let's consider one of the worst possible examples: an engine which produces a compression gauge reading of nearly zero on one cylinder (due probably to a burnt valve). That cylinder will draw very little air. On a single-carb engine this means about a 25% loss of air flow through the carb, which is bad enough, but on a dual-carb model it means a 50% loss of air flow through the carburetor serving that cylinder. That carburetor will be impossible to tune properly, so don't even bother to try until the cause of the compression loss is found and corrected. Obviously, this is an exaggerated example, but it serves to illustrate my point. Don't attempt to adjust the carburetor until you have tested the compression and found it satisfactory, gapped the spark plugs, inspected and adjusted the distributor, and set the valve lash to the recommended clearance.

### EXTERNAL CLEANING

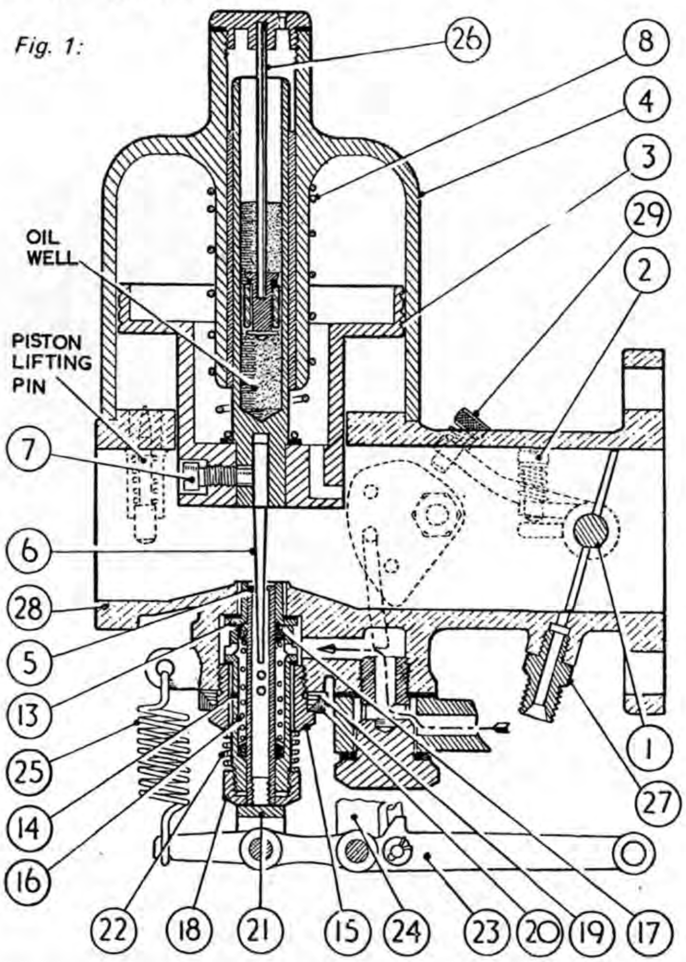
The most important cleaning will be done to individual parts as you disassemble and adjust the carburetor, but before you begin you should clean the outside of the carb as thoroughly as possible. This serves two purposes. First and most important, it precludes the possibility of dirt and grime on the outside of the assembly from getting inside. You won't be doing a great deal of disassembly, since this is a tuneup rather than a complete overhaul, but the parts you will be removing must be kept spotlessly clean. Secondly, it's no fun to work on anything which is covered with countless years' accmulation of gum, grit, oil and miscellaneous crud.

This is where the spray can of carburetor cleaner comes into play. Following the instructions on the can, spray the stuff all over the outside of the carb. Carb cleaner is pretty potent stuff, so be careful to keep it off your skin and off the car's paint. Allow the cleaner to soak into the grime for a short time, then use a stiff brush to loosen stubborn spots. If the instructions on the can say to rinse with water after cleaning, then do so, as some types of cleaner will eat into the aluminum diecastings of the carburetor if left for too long. In any case, it's a good idea to have a water supply handy for rinsing overspray off you and the paintwork.

When the outside of the carb is clean, remove the air cleaners (TF) or air cleaner ducts (all others). With the engine running at 2500 rpm or higher, spray the carb cleaner into as many corners of the carb's innards as you can reach. This will clean most of the gum, and carbon off the throttle bore, throttle plate, and lower part of the piston. Don't use up all the cleaner quite yet, though. You may need it later.

Now we're ready to start exploring the inner workings of the mysterious S.U. carburetor. The instructions which follow apply to the type H carbs used on the TB and later cars, and in the main to the type HV carbs used on the TA. We occasionally see the more modern type HS carbs fitted as replacements, easily identifiable by the fact that fuel is carried from the float chamber to the carb via a piece of tubing. While the same general tuneup principles apply to the type HS unit, detail differences exist which make the purchase of an S.U. tuning manual a good idea.

*Fig. 1:*




*Cross sectional view of typical S.U. carb. 1: Throttle Spindle. 2: 2: Throttle Adjusting Screw. 3: Piston. 4: Suction Chamber. 5: Jet Opening. 6: Needle. 7: Needle Setscrew. 8: Piston Spring. 15: Jet Locking Screw. 18: Jet Adjusting Nut. 21: Jet Head. 22: Locking Spring. 23: Jet Lever. 24: Link. 25: Jet Return Spring. 26: Damper Rod. 28: Main Casting. 29: Fast Idle Screw.*

## THE FLOAT CHAMBERS

In order for the carburetor to meter out fuel accurately, the fuel level in the jet (fig.1, #5) must be kept more or less constant. This is controlled by the fuel level in the float chamber (fig.2) (or float bowl, as it is usually called in this country). The fuel level in the float chamber is in turn controlled by a float-operated needle valve (fig.2 #9) in the chamber lid. This works much like the shut-off valve in a toilet tank. When the fuel reaches the correct level in the chamber, the float (fig.2, #10) closes the valve and stops the flow of fuel into the chamber. When the fuel level drops, the float drops with it, allowing the valve to open. When the engine is running, the needle valve is constantly opening and closing to keep the fuel level approximately constant.

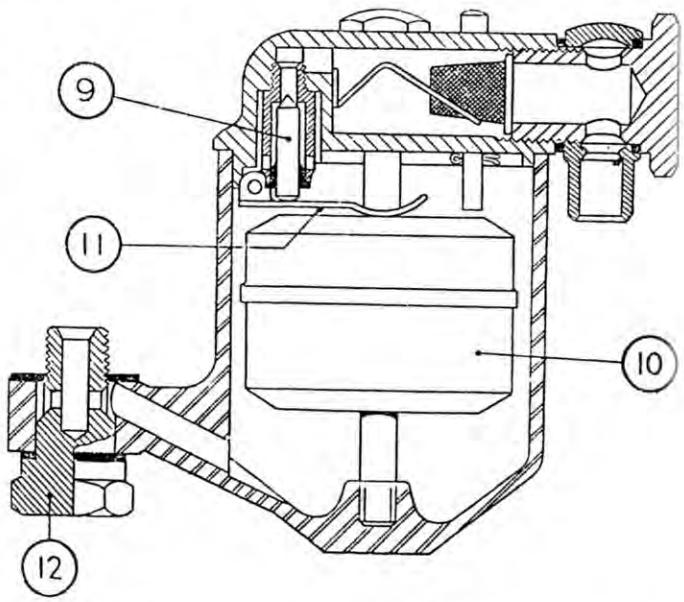



*Fig. 2: The float chamber. 9: Needle Valve. 10: Float. 11: Float Lever. 12: Mounting Bolt.*

**FUEL LEVEL:** The fuel level in the jet need not be exact, as normal jet adjustment will compensate for minor variations. However, the standard measurement for all type HV, H, and HS carbs is $3/8$ inch (9.5mm) below the top surface of the jet bridge, and it should not deviate too much from that. The jet bridge is the flat surface on the bottom of the carburetor throat, against which the piston rests and through which the jet bore is drilled. Even with the suction chamber and piston (fig. 1, #3 & 4) removed and the jet in its fully lowered position, it is nearly impossible to measure the fuel level accurately at this point. Therefore, we substitute a purely mechanical measurement of the position of the float lever when the float valve is closed. This measurement is made between the lever and the chamber lid, as shown in figure four. For the type T2 chambers ($2\frac{1}{4}$" diameter) used on all T and Y Type carburetors, the measurement should be $7/16$ inch (11.1mm). If this measurement is correct, then the float needle will close when the fuel level in the chamber and in the jet are correct.

In order to make this measurement you must first remove the chamber lid. Remove the large banjo bolt which attaches the fuel line to the lid. (fig. 2) remove the fuel line (save the fiber washers,) and remove the spring-loaded wire mesh filter from the bolt hole. Then remove the hold-down bolt which passes through the top of the lid (more washers to save), push the overflow pipe aside, and lift off the lid. Turn the lid upside

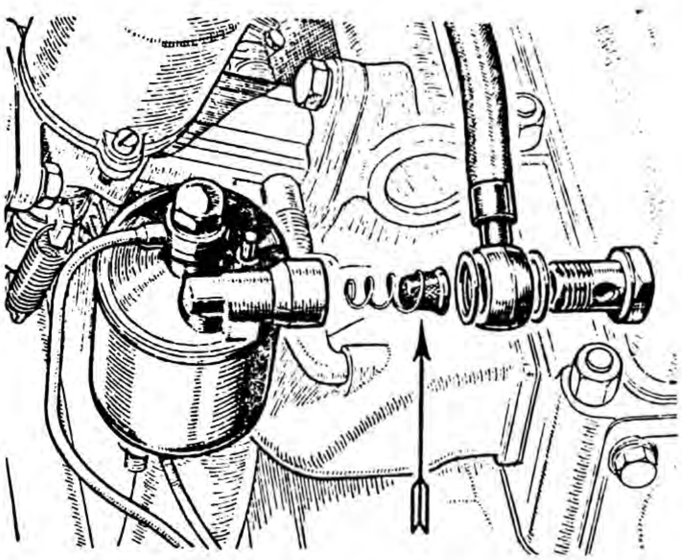


*Fig. 3: To remove float chamber lid, detach fuel hose as shown, remove bolt in top of lid. Filter (arrow) must be cleaned.*

down and you will see the float lever (fig. 2, #11) and, under it, the needle (fig. 2, #9) valve. Remove the pivot pin, lift off the lever, and lift out the needle. If its conical tip is grooved, you should install a new needle and seat. If you're not sure whether or not the old assembly is usable, insert the needle back into its seat and blow through the fuel line opening in the lid while holding the needle against the seat with light finger pressure. If no air leaks through the closed valve, then the old assembly is probably okay to use.

Examine the pivot pin, and install a new one if it is badly grooved where the float lever bears on it. Prior to 1955 the pin was a slip fit into the lugs on the lid, but most pins made since then are knurled on one end to provide a press fit. Either type is suitable, as long as it is not worn. The old type can fall out when the lid is removed from the float chamber, but is easy to remove for inspection. The new type won't fall out, but is more difficult to remove. Use a pin punch, nail, or stiff wire smaller in diameter than the pin to push it out from the end opposite the knurling. I like to reduce the diameter of the knurling with emory cloth or a fine file to make the whole disassembly and inspection process easier.

Also examine the float lever. If there is any obvious damage, replace it with a new one. Both arms of the fork should be equally curved, and the portion of the lever between the fork and the pivot pin ears should be perfectly straight. The area where the lever bears on the needle valve may be shiny, but must not be deeply grooved. When you are satisfied that the needle valve, float lever and pivot pin are in satisfactory condition, assemble them back into the float chamber lid.

With the lid assembly still upside down, insert a 7/16" diameter rod between the lid and the inside curve of the forked end of the lever, as shown in figure three. A rod of the correct diameter is provided in the PSW tool kit, but a 7/16" dowel or a longish 7/16" bolt will do just as well. The lever should rest on the test rod and on the needle valve at the same time. If it doesn't, bend the lever carefully at the point where the curved fork joins the straight section, being careful to see that the straight section remains straight (see fig. 3). Also make sure both prongs of the curved fork rest equally on the test rod. It's very easy to twist the lever slightly out of kilter when you bend it.

The original type of valve needle was made of solid stainless steel, and with this type it's hard to make a mistake in the adjustment. However, in recent years this type has been superceded by a nylon-bodied needle with a spring-loaded pin inserted into the end which touches the float lever. The spring loading lessens the closing impact of the needle and prolongs its life, but it necessitates more care in adjustment. Do not push the lever down against the spring pressure in an attempt to make the fork rest on the test rod. The measurement must be made with the pin fully extended, supporting only the weight of the lever.

In service the setting will change gradually due to the wearing of the needle and the pivot pin, but this wear takes place very slowly. Given the low annual mileage travelled by most T and Y Types these days, once the float level is correctly set, you should never have to set it again. Still, it should be checked each time the carburetors are tuned.

Those of you who have factory workshop manuals (that should include all of you) may have noticed that in some of these manuals the use of a 3/8 in. test rod is specified instead of the 7/16in. rod specified by the S.U. Carburetter Company. I don't know why M.G. chose to deviate from the standard S.U. measurement, but in practice it doesn't really matter. Either dimension will provide a fuel level in the jet which is within the acceptable range, and there will normally be no difference in performance.

**THE FLOAT** Use a piece of wire with a small hook bent into one end to fish the float, (fig.2, #10) out of the chamber. Dry off the outside of the float, then shake it vigorously. If it rattles, or if there is no sound at all, then the float is okay. The rattle is probably just a small blob of loose solder, and is nothing to worry about. If however, you hear the swish of liquid inside the float, then the float leaks.

To find the leak, submerge the float in a pan of very hot water. As the air heats up and expands it will be forced out of the hole or holes, and you will see bubbles in the water. Remove the float from the water, mark the holes, then put it back in the water and let it float. Keep the water very hot. This will speed the evaporation of the gasoline, and eventually your float will be empty. In really bad cases it may be necessary to boil the float all night, but under no circumstances should you try to hasten the evaporation by heating it with an open flame. The resulting rapid evaporation can cause the float to explode, ruining a potentially repairable float and peppering your tender bod with shrapnel.

Once the gasoline is driven out, the holes can be sealed with solder. Use a hot soldering iron, not a torch. However, this should be considered only a temporary repair. Chances are good that there are other thin spots waiting to break through, so you had best order a replacement float in the near future.

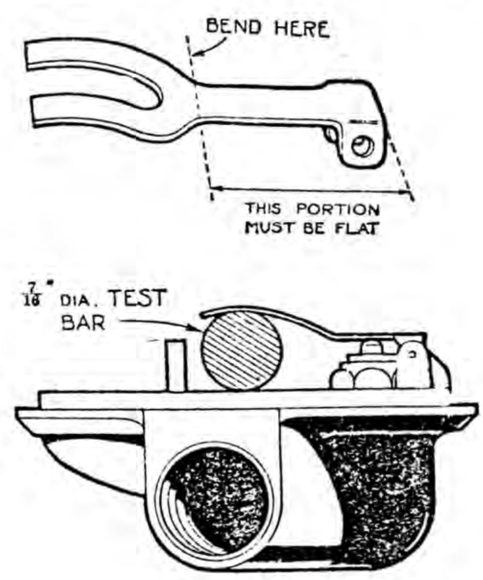



*Fig. 4: Measure float level as shown at bottom, bend lever to correct as shown at top.*

**CLEANING** Now examine the inside of the float chamber. Any grit inside the chamber indicates filtering problems, so check the condition of the wire mesh filters in the fuel pump and in the inlet union on the float chamber lid. Clean the filters if necessary, or install new ones if they are damaged or missing. Also consider cleaning out your fuel tank. If grit is present in the chamber, then it has probably also gotten into the small passageway which transfers fuel from the chamber to the main body of the carburetor. Remove the chamber by undoing the bolt which attaches it to the bottom of the carburetor. Don't lose the sealing washers! Rinse out the chamber thoroughly and attach it back to the carburetor.

**REASSEMBLY** Now the float chambers and lids may be reassembled. Drop the floats back into their chambers; it will be rather embarrassing later on if you leave them out. When you put on the lids, make sure all sealing washers are returned to their original positions. Use anti-sieze compound or grease on the banjo bolt and lid bolt threads to keep them from freezing in place. Tighten the bolts firmly, but don't overdo it as the threads in the diecast lid are easy to damage.

On all T and Y Types the carburetors are mounted in a "semi-downdraught" position, which means that they slope slightly downhill towards the engine. However, the mounting arms on the float chambers are arranged in such a way that the chambers are level, and this is the only position in which they will work properly. If your chambers are tilted just like the carbs, then someone has installed chambers meant for use on horizontally-mounted carburetors. Replace them with the correct type or you will have trouble with sticking floats, sticking needles, and fluctuating fuel level. Even with the correct chambers fitted, they will be exactly level only when the mounting arms are perpendicular to the carburetor body as viewed from above. This is easily adjusted by loosening the mounting bolt (fig.2, #12) under the carburetor body, rotating the chamber to the desired position, and retightening the bolt.

**THE SUCTION CHAMBERS & PISTONS**

The suction chamber assembly (fig.5) is the heart of the S.U. carburetor, and is the major design difference between the S.U. and most other types. It is the rise and fall of the piston under the influence of vacuum in the chamber which changes the size of the venturi and moves the needle in and out of the jet to tailor the fuel/air mixture to the engine's needs. If something goes wrong with this assembly, the carburetor won't work, so it should be cleaned and inspected every time the carbs are tuned, or at least once a year. The pistons are not interchangeable from one suction chamber to another, so I recommend that owners of dual-carb models work on one at a time.

**DISASSEMBLY & CLEANING:** To remove the suction chamber, first unscrew the cap at its very top. The cap may or may not have a rod and plunger assembly (the damper) attached to it. If it does, be careful not to bend the rod. Unscrew the two or three screws which secure the suction chamber to the main casting of the carburetor. If yours is a two-screw model, mark the chamber and the carb body so the chamber can be returned to the same position later on. This isn't necessary on three-screw models, since the screw holes will line up only when the chamber is in the proper position. Lift the chamber straight up, without rocking it, to avoid damaging the needle. As you lift, look underneath to see if there is a large coil spring (fig.1, #8) between the suction chamber and the piston. If so, don't let it fly away. Now lift the piston out of the carburetor body, again being careful of the needle. If you found a spring in the assembly, you may also find a steel thrust washer down inside the piston where the spring rests. Don't lose it.

Now examine the inside of the chamber and the outside diameter of the piston (Fig.6). Both must be spotlessly clean. If not, wipe them off with a rag dampened in gasoline. If the dirt seems to be baked on, use some of your carburetor cleaner to free it up, but use it sparingly and rinse it off quickly. Some types of cleaner will make the diecast aluminum "bloom" slightly if left on for too long. This isn't important on the outside of a carburetor, but can close up the critical clearance between the piston and the suction chamber.

When the parts are clean and dry, put a drop or two of oil on the steel piston rod (fig.6) and insert it into the suction chamber. Don't oil anything else! Move the piston in and out of the chamber slowly while spinning it, to distribute the oil evenly over the rod and its bore. While you do this, listen carefully for scraping sounds which indicate that the outer edge of the piston is rubbing on the chamber wall. If you do hear scraping sounds, try lining up the piston inside the chamber in its normal operating position, as determined by the keyway in the side of the piston and the original orientation of the chamber to the carb body. If the piston slides straight in and out in this position without scraping, then all is well. If not, you must look for the spots where interference occurs and correct them. Usually the problem will be a nick or burr on the surface of either the piston or the chamber, which must be worked down flush with the surrounding metal with a super-fine file or a scraper. Work only on the faulty area.

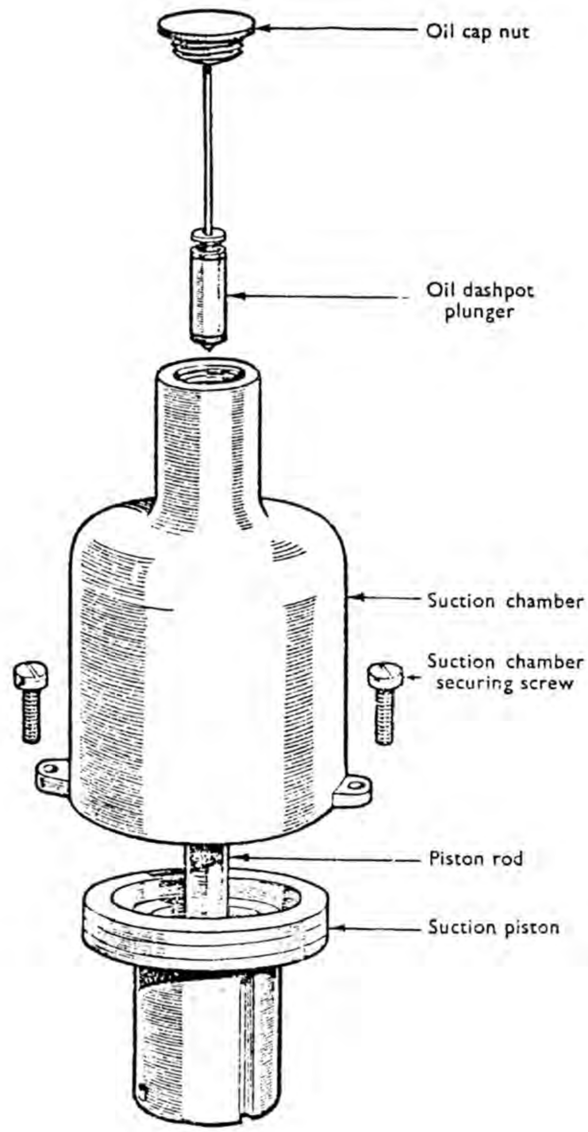



*Fig. 5: The suction chamber assembly. Some models have no plunger (damper) under oil cap.*

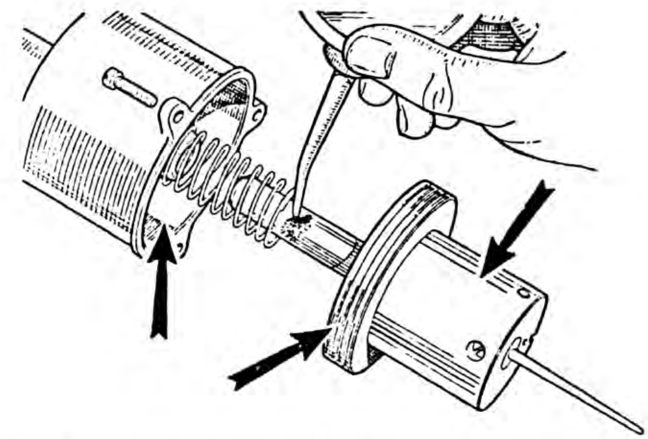


*Fig. 6: Oil only piston rod. Surfaces at arrows must be clean and oil-free.*

Wholesale rubbing with emory cloth or sandpaper over the entire surface will upset the clearance between piston and chamber, which will adversely effect the operation of the carburetor. On models with only two hold-down screws, try rotating the chamber 180° in relation to the piston, and test again. This may eliminate the scraping, precluding the need for work with scraper and file. Two-screw chambers will fit on the carb body in either position.

**THE NEEDLE:** When this is taken care of, again insert the piston into the chamber and spin it. This time watch the tip of the needle. If it wobbles as the piston spins, it is bent and should be replaced. If it seems to be straight, inspect it for shiny marks on one side. If there are any, this means that the needle has been scraping on the bore of the jet, usually due to an incorrectly centered jet assembly. This also calls for a new needle, since the scraping may have altered its diameter, upsetting its ability to meter fuel accurately. Ideally, you should also replace the jet, since the rubbing will have enlarged its opening, but we'll cover that later.

Now remove the needle by loosening the setscrew in the side of the piston near the bottom (fig.7). If the needle is stuck, you can grasp it with pliers, but only at the very tip (the last ⅛"). Pull straight out with a twisting motion, being careful not to bend it. You should see numbers and/or letters stamped on the shank of the needle (fig.7) where it fits into the piston. These indicate the size of the needle, and you should confirm that yours is the correct size for your car, as shown in table 1. If you find a non-standard needle, obtain the correct type unless you know there is a good reason for using a different type in your car. S.U. and M.G. provide recommendations for alternate weaker and richer needles for special conditions, but they are not normally needed. The richer needles are useful only for racing applications or when the car is driven without the air cleaner in place, and the weaker or leaner needles are required only if the majority of your driving is done 5000 feet or more above sea level. If you find yourself in either of these situations, see the shop manual for recommendations. Otherwise stick with the standard size for your car.

Now insert the needle into the piston so its shoulder is flush with the face of the piston, as shown in figure eight. Some older needles have a tapered or rounded shoulder as shown in the left hand example in that illustration, and this type is difficult to position correctly. All needles made in recent years have square shoulders and are easy to position in the piston. A straightedge held across the face of the piston for the square shoulder of the needle to but against will preclude the possibility of error. To prevent future sticking, it helps to put a very light smear of anti-sieze compound or grease on the shank of the needle before inserting it in the piston, and also on the threads of the setscrew. Tighten the screw firmly once the needle is in the correct position.

**REASSEMBLY:** Lower the piston into the carburetor body, being careful not to bend the needle or nick the outer edge of the piston. Install the spring and thrust washer, if your model requires them (see table 1). If one end of the spring has a smaller diameter than the other, then the smaller end should go towards the piston and a thrust washer should be used. If both ends are the same diameter, as is the case on most recently manufactured springs, then it doesn't matter which way the spring is inserted and no thrust washer is required. If, according to table 1, your car should have springs on the pistons but does not, then order some. The car will not run well without them due to an excessively weak mixture. Springs are color coded to indicate their strength, as shown in the table, so be sure to order the right ones.

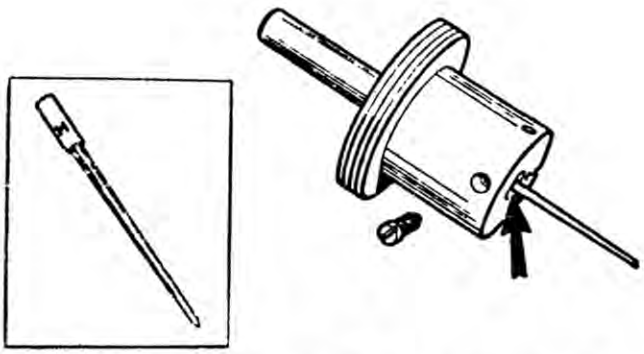


*Fig. 7: Needle shoulder must be flush with piston face (arrow) except under certain conditions explained in text. Identification symbol is on shank (inset).*

Put the suction chamber over the piston, being careful to align your index marks if it is a two-screw type. The chamber must be a good fit onto the carburetor body to prevent air leakage. No gasket or sealant is used, so make sure the mating surfaces are impeccably clean. Tighten the hold-down screws firmly, but don't get carried away. Overtightening can warp the chamber and cause the piston to rub.

**THE DAMPER:** Now turn your attention to the cap and damper assembly. The purpose of the damper is to slow down the rise of the piston when the throttle is opened suddenly. The resulting high vacuum over the jet enriches the mixture momentarily, serving much the same purpose as the acceleration pump found in most "normal" carburetors.

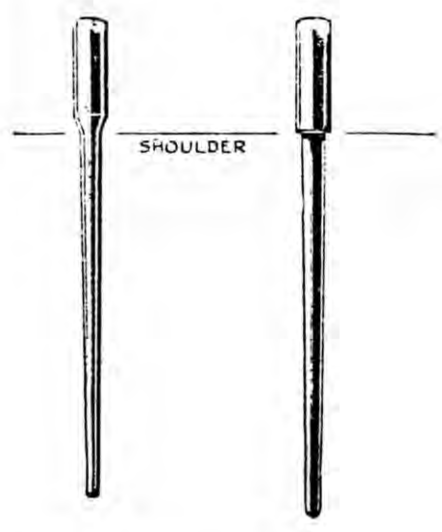



*Fig. 8: Shoulder is easy to identify on late needles (right), difficult on older ones (left).*

Dampers were used on all TDs, all Ys, and most TCs and most TFs, but not on TAs, TBs, early TCs and early TFs. The dampers improve acceleration from low speeds, so you may want to retrofit them to your carbs if you don't already have them. Damperless carbs are equipped with a plain brass cap at the top of the suction chamber.

Examine the cap to see if it has a small (1/16") vent hole in it, then examine the suction chamber to see if it has a 3/16" vent hole inside the small top section just below the threads for the cap. You must have one or the other, but not both. The carburetors used on most T and Y Types have no vent hole inside the chamber neck, and these must be fitted with vented caps. The TF carburetor is the so-called "dustproof" type with the vent hole in the chamber neck, and dustproof carbs may have been used as replacements on earlier models. Dustproof carbs must have non-vented caps. If you find yourself with the wrong type of cap, drill a 1/16" hole in the cap or plug up the existing hole, depending on which is required or order new parts.

Now fill the hollow piston rod to within ½" of the top with SAE 20 motor oil, as shown in figure nine. Insert the damper and screw down the cap firmly. These caps tend to loosen due to vibration and the action of the dampers, so don't be too gentle. Unvented caps must have a sealing washer under them, but check to see that it is really there, as they are easily lost. Washers are not required on vented caps, but it's a good idea to use them anyway.

If your car has two carburetors, as do all but the Y and YB, you must now repeat the whole procedure on the suction chamber assembly from the second carb. The mixing of needles, springs and dampers from one carb to the other is not critical, but under no circumstances should you switch the piston from one carb to the suction chamber of the other. Pistons and chambers are assembled into matched sets by selective fit to ensure the correct clearance between them. Don't mix them up. However, it is perfectly okay to switch the complete chamber/piston assembly from one carb to the other.

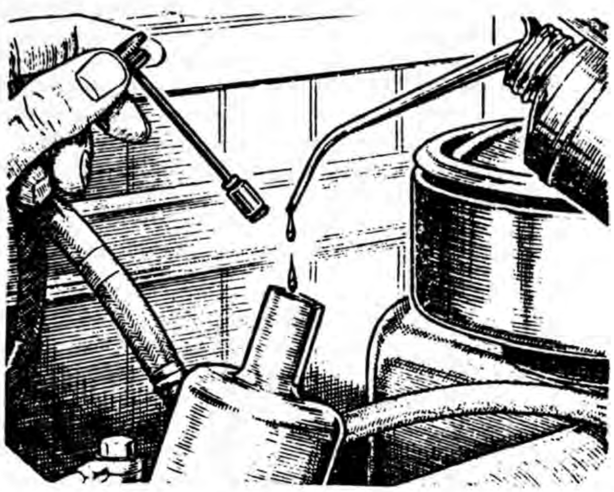


*Fig. 9: Fill piston rod to within ½ in. of top with SAE 20 oil.*

## CENTERING THE JETS

After the suction assembly has been cleaned and refitted to the carburetor, you must make sure the jet is centered in relation to the needle. The entire length of the needle must be able to enter the jet without touching the sides of the jet opening. If it does touch, the needle and jet will both wear at the point of contact. The resulting enlargement of the jet opening and reduction of the needle diameter will diminish the carburetor's ability to meter out fuel accurately, and in really bad cases the friction between needle and jet can cause the piston to get stuck in one position. Neither condition is desirable. The mounting of the jet assembly in the bottom of the carburetor is designed in such a way as to allow enough lateral movement for centering purposes. Once the correct position is found, the assembly is locked into place by a large nut.

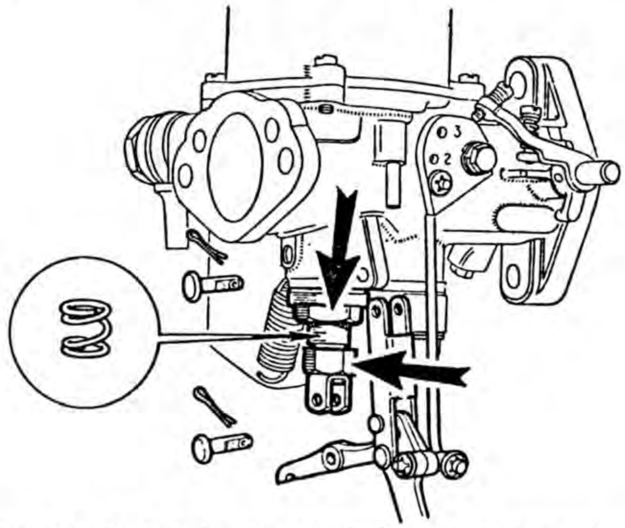


*Fig. 10: Parts to be disconnected prior to jet centering. Jet locking screw is at upper arrow, adjusting nut at lower one. Note cam-type fast idle control (not T Type).*

**PREPARATION & INSPECTION:** On dual-carb models, disconnect the linkage between the two jet levers by removing the clevis pin from one of its forked ends. The rod may be left hanging from the other jet lever. Disconnect the choke cable from the rear jet lever. Unhook the tension spring from the jet lever, remove the clevis pin which attaches the lever to the jet head, and swing the lever out of the way. Mark the side of the jet head facing away from the engine so it can be returned to the same position, then grasp the jet head and pull the jet straight down out of the carburetor. Unscrew the jet adjusting nut, remove the locking spring, and screw the nut back on as far as it will go (fig. 10).

Now inspect the jet. Its outside diameter should be smooth, with no sign of grooves or uneven diameter. If such defects are present, the jet should be replaced. If the opening at the top of the jet is abviously oblong instead of round, this too is reason for replacement. Think back to your earlier examination of the needle. If it was shiny on one side, indicating that it had been rubbing on the jet, then assume the jet is worn and replace it and the needle.

The standard jet for all T and Y Types has a .090 in. opening, but you will occasionally find that some misguided previous owner has mistakenly installed a larger jet (usually .100 in.). Jets are sometimes marked with a "9" on the jet head, identifying a .090 in. jet, or with a "1" to identify a .100 in. jet. If you can find no such markings on your jet, use a 3/32" drill as a crude gauge. It should be impossible to insert the shank of the drill into a .090 in. jet (don't force it). If the drill will fit into the jet, then the jet is either very worn or the wrong size. In either case, get a new one.

Put a very light smear of petroleum jelly on the outside of the jet, then insert it back into the carburetor. Push it up until the jet head abuts against the adjusting nut. Make sure the side you marked earlier is facing the right direction if you are re-using the old jet. If you are installing a new jet, just rotate it until the jet head is correctly positioned to accept the jet lever. In either case, keep the jet in that position throughout the rest of the tuning procedure. The opening in the top of the jet is not always exactly concentric with the body of the jet. If, after centering it, you rotate the jet 180°, you may find that it is no longer correctly centered on the needle.

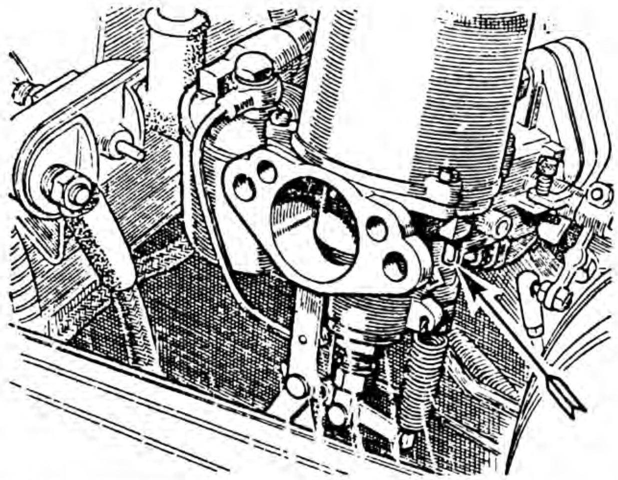


*Fig. 11: Piston is lifted by pushing up pin shown at arrow (TF) or by inserting wire through vent hole in same position (earlier models).*

**CENTERING:** If you still have the air cleaner ducting off, reach into the mouth of the carburetor, lift the piston a bit, and let it drop. If the air cleaner is in place, you can still lift the piston. The TF carbs have lifting pins in the flange under the suction chamber, as shown in figure eleven. Simply push the pin up as far as it will go, then let go. Earlier carburetors do not have lifting pins, but they do have vent holes in approximately the same position. Insert a nail or stiff wire into the vent hole to lift the piston.

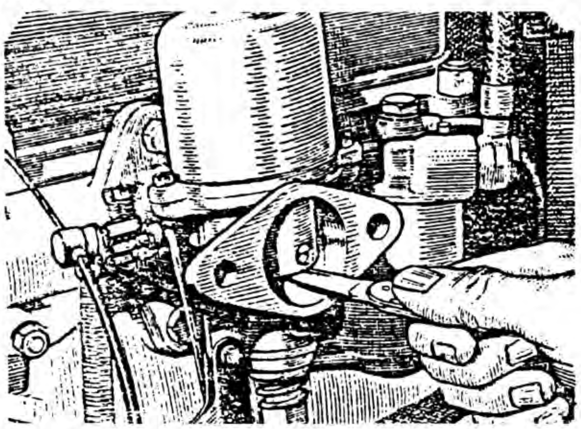


*Fig. 12: Piston may also be lifted with knife blade if air cleaner is removed.*

No matter how you go about lifting the piston, when you let it go it should drop against the jet bridge with a metallic click. Some pistons have spring-loaded bumper pins in their undersides to soften the impact of the piston hitting the jet bridge, but you will still hear a soft click. If you hear a click, then the jet is centered correctly and need not be fiddled with. If you don't hear the click, then the needle is rubbing on the jet and preventing the piston from dropping freely to the jet bridge. This jet needs to be re-centered.

Slacken off the large jet locking nut until it is just possible to rotate the bottom of the jet bearing (the threaded piece onto which the jet adjusting nut screws) by finger pressure. Insert a thin screwdriver or similar implement into the top of the suction chamber and push down gently on the piston rod (fig. 13). At the same time, wiggle the jet assembly gently to help it move, while keeping some pressure against the jet head to

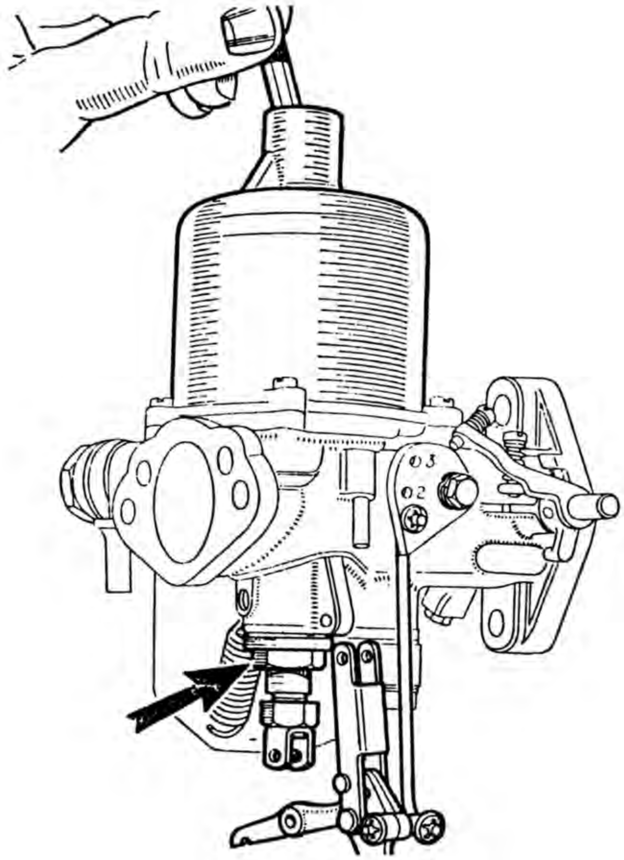


*Fig. 13: To center jet, loosen lock screw at arrow & wiggle jet assembly while pushing down on piston. Keep jet head tight against jet nut.*

prevent the jet from dropping. By pushing down on the piston and up on the jet, you will push the thickest portion of the needle into the jet opening, thus forcing the jet to assume a position concentric with the needle. Now tighten the jet locking nut to lock the jet in its new position.

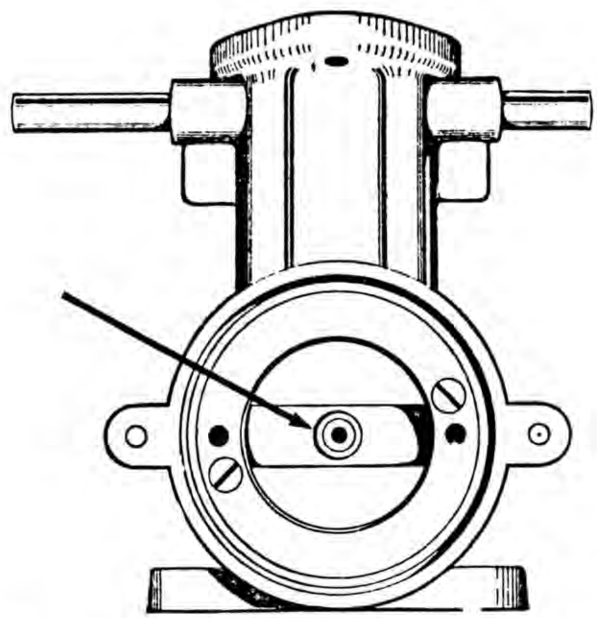


*Fig. 14: Jet may appear off-center even when correctly centered. Concentricity with needle, not with carb body, is goal.*

| M.G. Model | S.U. Type | Spec. No. | Needle | Spring |
|---|---|---|---|---|
| TA | two HV3 | AUC 374 | AC | — |
| TB/TC | two H2 | AUC 429 | ES | — |
| TD | two H2 | AUC 549 | ES | — |
| TD Mk. II | two H4 | AUC 578 | LS1 | red |
| TF/TF 1500 | two H4 | AUC 728 | GJ | blue |
| YA/YB | one H2 | AUC 456 | FI | — |
| YT | two H2 | AUC 480 | ES | — |

**M.G. T & Y-SERIES CARBURETOR SPECIFICATIONS**

*Table 1: T&Y Type carburetor specifications.*

Lift the piston again and let it drop to see if you get the necessary soft click, still holding the jet tight against the adjusting nut. If not, loosen the locking nut and try again. If you are unsuccessful after several tries, withdraw the jet, remove the adjusting nut, and reinsert the jet. With the adjusting nut removed, you will be able to push the jet up higher than before. This makes the centering action more positive. When you think you finally have it right, test your work by listening to the click with the jet in the fully up position and again with the jet fully down. If the click has a sharper sound when the jet is down, you have to try again. Repeat the whole procedure on the other carburetor if yours is a dual-carb model.

Now remove the jet again, unscrew the jet adjusting nut, replace the spring, and replace the nut. Screw the nut up as far as it will go, then back off one full turn, or six flats. This is a reasonable starting point for the final jet adjustment, which we will get to in a little while. Insert the jet again and push it up tight against the adjusting nut.

An explanation of the term "flats" might be in order here, since we have just used it and will use it more often as we proceed. The jet adjusting nut is six-sided, so we can say that it has six flats. If we begin with one flat facing us, then turn the nut $^1/_6$ of a turn so the next flat faces us, we will have turned the nut on flat. Thus one flat equals a sixth of a turn, three flats equals half a turn, six flats is a full turn, and so on. We will also speak in terms of so many flats up or so many flats down, not clockwise or counter-clockwise, in or out, or anything else equally fuzzy. Up means up towards the carburetor, and down means down away from the carburetor. You can't go wrong unless the car is upside down, in which case tuning the carbs won't do a bit of good.

You should go through this entire centering procedure if this is the first time you have given the carbs a thorough going over or if you are fitting new needles or jets, and then perhaps once a year after this if the car is used often. In between, it will be sufficient simply to raise the piston and listen for that all-important metallic click without going through all the bother of disconnecting the jet levers, removing the springs, and so forth.

## SYNCHRONIZATION

One of the major goals of a tuneup is to ensure that all cylinders are doing approximately the same amount of work. If the engine has two carburetors, this cannot be achieved unless both carbs are doing the same amount of work. The throttles must be set to operate in unison so that the same amount of air is drawn through both carbs. This is called synchronization of the carbs, and will be dealt with in this section. It is also necessary to ensure that both carbs mix the same amount of fuel with the incoming air. This is called mixture adjustment, and will be dealt with in the next section. Mixture strength is determined in part by the amount of air passing over the jet opening, and this airflow is controlled by the throttle setting, so it should be obvious that the throttles must be synchronized before the mixture can be adjusted. For reasons known only to their authors, several of the tuning manuals deal with synchronization and mixture adjustment in reverse order. The carbs must be synchronized first, regardless of what your favorite manual might seem to imply. Naturally, synchronization is unnecessary on single-carb engines, so Y and YB owners may skip this section and move right along to mixture adjustment.

Some tuning manuals recommend a very simple synchronization procedure which consists basically of starting with the throttles in the fully closed position and turning both adjusting screws down equal amounts. This ensures that both throttle butterfly valves are rotated the same number of degrees away from their fully closed position, but it does not guarantee that the flow of air past the butterflies will be equal even though that is the ultimate objective of synchronization. Even when a throttle butterfly is fully closed, there is always a small gap between its outside diameter and the inside diameter of the throttle bore. Thus a small amount of air can get past the butterfly even when it is closed. Unfortunately, the size of that gap (and therefore the airflow through the gap) is never identical on any two carburetors. For example, one carb might allow an airflow of 5 cfm (cubic feet per minute) past the closed butterfly, while the other may allow 20 cfm. If we then rotate both butterflies the same amount, say 5° from fully closed, the second carb will still flow more air than the first even though both butterflies were opened exactly the same amount. These carbs might be synchronized statically (engine at rest), but they are certainly not synchronized dynamically (in relation to actual airflow with the engine running).

Static synchronization can be used to obtain a preliminary setting if you are installing carbs and are tuning them from scratch, or if some previous tuner has really botched up the adjustment. The procedure is simple, so I'll describe it just in case you need it. However, if you are tuning a car which has been running reasonably well all along, you can assume the throttles are already synchronized reasonably well. If so, skip static synchronization and go on to the dynamic synchronization procedure which I will explain in a moment.

**STATIC METHOD:** Begin by loosening one clamp bolt on one of the flexible couplings on the short spindle which connects the two throttles (fig.15). You should now be able to open and close the throttle on one carb without affecting the other throttle. Back the fast idle or slow running control screw (fig. 19) on the front carb all the way out so it won't prevent the throttle from closing completely. Now unscrew the throttle adjusting screw (fig.15) on one carb out until it no longer touches the abutment on the carburetor body. Then screw it back in until it will just barely hold a piece of paper between its tip and the abutment. Finally, turn the screw in one additional full turn. Do the same on the other carburetor. Both throttle butterflies are now open approximately the same amount. If you were to retighten the spindle clamp bolt both butterflies would then open and close in unison, and would be statically synchronized. But, as I explained earlier, it is unlikely that equal amounts of air will flow past both butterflies. This must now be confirmed by dynamic testing.

**DYNAMIC METHOD:** As implied above, this method involves actual measurement of the airflow through both carburetors while the engine is running. Most S.U. tuning

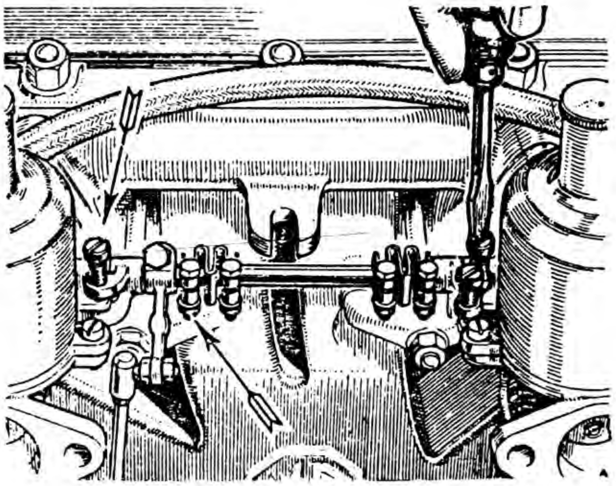


*Fig. 15: Synchronization & idling speed are adjusted by screws ahown at screwdriver & upper left arrow. Spindle clamp at lower arrow must be loosened prior to synchronization. (TD shown).*

manuals suggest that you use a piece of tubing as a crude stethescope. With the engine running, hold one end of the tubing to your ear and the other end at the intake of one carburetor (fig.16). You should hear a hissing sound caused by the air rushing past the end of the tube. Now move the tube to the other carb, being sure to hold it in the same position relative to the opening. If both carburetors are drawing the same amount of air, there should be no difference in the loudness or pitch of the hissing you hear through the tube as you move from one carb to the other. Unfortunately, many people find it difficult to discern small differences in volume, so this method may not work for you. Add to this the fact that you will also hear an assortmant of burbles, pops, sputters and other indecipherable sounds, all which make it difficult to gauge the loudness of the hissing accurately. I recommend that you use this method of testing only if you are unable to do better.

*Fig. 16: Synchronization may be tested using rubber tube as stethescope, but Uni-Syn is more accurate.*

There are several devices available which make the job easier and more accurate. The PSW tool kit includes a means of measuring the rise and fall of the pistons in the suction chambers. If both pistons are at the same level at any given engine speed, then both carburetors are drawing the same amount of air and are dynamically synchronized. The Uni-Syn and similar gauges fit over the intake end of the carburetor and measure vacuum at that point. When the readings are identical for both carbs, then both are drawing the same volume of air and are dynamically synchronized.

Regardless of which of these tools you use, it's hard to go wrong if you follow the manufacturer's instructions carefully. Loosen the throttle connecting spindle clamp bolt as described earlier and turn the throttle adjusting screws in or out as necessary to make any corrections which may be required. When you are satisfied that the airflow is identical through both carburetors, retighten the clamp bolt on the throttle connecting spindle. Finally, adjust the idling speed to between 700rpm and 800rpm by turning both throttle adjusting screws in or out exactly the same amount. Once the throttles are sychronized, any change in the setting of one adjusting screw must be duplicated exactly at the other screw.

## MIXTURE ADJUSTMENT

Now that the carbs are clean inside and out, the float levels are adjusted to specs, the jets are centered, and the throttles are synchronized, you are ready to adjust the mixture. This is the part of the S.U. tuning procedure which seems to baffle so many owners and which has contributed greatly to the S.U. carburetor's underserved bad reputation in this country. A large part of the problem may be the way the procedure is described in most workshop manuals. However, be warned that the procedure described in the manual is essentially correct, whether or not you understand it as written. Regardless of what you may have heard (usually second or third hand), there is no simple tuning secret discovered by a little old mechanic in Moosedip, Alaska, and whispered on his deathbed to an ancient trapper friend who disappeared into the tundra never to be seen again (or any of several variations on that same theme, some of which are even more absurd). There is nothing wrong with the method described in the manual, but there is a great deal wrong with the way it is described. I'll try to do better.

If you analyze the procedure carefully, you will find that it isn't really all that much different from adjusting the idling mixture on a "normal"fixed-venturi carburetor. The major difference is that on most other carbs you turn a screw to change the mixture, while on a S.U. you turn a nut. The S.U. has one very big advantage over other types in that it provides the means for testing the adjustment to make sure it is correct. There's no easy way to do this on most other carbs.

**PREPARATION:** Mixture adjustment may be accomplished with the air cleaners on or off, according to your preference, but there are advantages to leaving them on as you will learn later. Disconnect the choke cable from the rear jet lever, if you haven't done so already, otherwise a tight cable can prevent the jet head from butting against the jet adjusting nut. On dual-carb models also disconnect the linkage between the two jet levers by removing the pin from one of its forked ends.

If you didn't do so after centering the jets, screw the jet adjusting nuts to their topmost position, then lower them one full turn (six flats). Make sure the jet heads are right up tight against the adjusting nuts. This is a good preliminary setting for the jets, and ensures that both jets on dual-carb engines start off in the same position.

Now start the engine again and let it run until thoroughly warmed up. Adjust the idling speed if necessary to bring it into the 700rpm-800rpm range. Remember on dual-carb models to turn both throttle adjusting screws equally.

**ADJUSTMENT:** The jets must now be moved either up or down by turning their adjusting nuts until the fastest possible idling speed is achieved without altering the setting of the throttle screws (fig.17). The initial setting of six flats down will usually provide too lean a mixture, so begin by turning the jet adjusting nuts down one flat at a time to enrich the mixture. On dual-carb models turn both nuts exactly the same amount. The engine should gradually speed up as you enrich the mixture, but will eventually reach a point when it begins to slow down again due to an overly rich mixture. When it does, turn the nuts back up again until the highest idling speed is reached again.

In the rare case where the initial setting (6 flats down) is too rich, you will hear the idling speed start to drop pff immediately as you lower the jet nuts. In this case, screw the nuts back up evenly to weaken the mixture. The engine will speed up as you approach the correct setting, but continue to screw the nuts up until the speed starts to drop off due to a weak mixture. Now proceed as in the preceding paragraph. Not all tuners will agree on this, but I find that it is usually easier to start off with the mixture a bit lean, then work from there towards the correct mixture.

The mixture should now be approximately correct for the speed at which the engine is running. However, that speed will now be somewhat higher than the ideal 700-800rpm, so turn the throttle adjusting screws out a bit to bring the idle back down. The mixture may now be slightly too rich for the reduced idling speed, so raise the jet adjusting nuts a bit. As before, the aim is to adjust the jets for the highest possible idling speed at the new throttle setting. You may have to go back and forth between jet nuts and throttle screw several times, but in the end you will reach a point where the idling speed does not exceed the recommended range when you readjust the jet nuts.

This process may seem a bit tedious, but I recommend it if this is your first attempt at S.U. tuning because it forces you to become familiar with the functions of the throttle screws and jet nuts and their interrelationship. The experienced tuner may use a shortcut, which is simply to start off by adjusting the throttle screws until the engine is idling as slowly as possible without stalling. This should be somewhere around 500rpm or so. Then, as the jet nuts are adjusted for the correct mixture, the idling speed will not climb so far above the 700-800rpm range and not so much fiddling will be necessary.

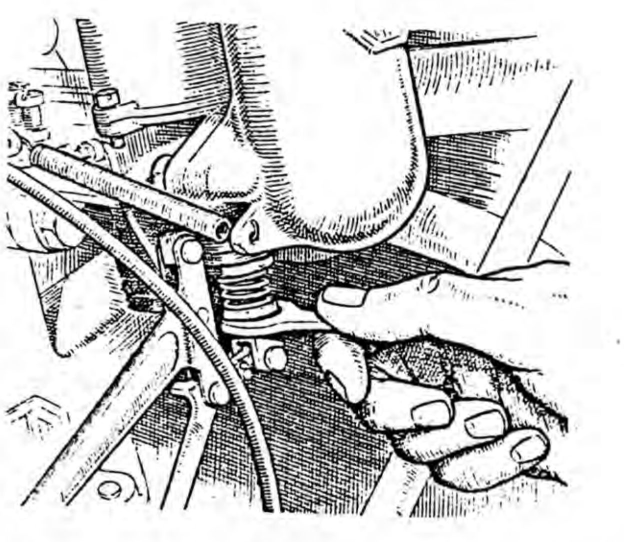


*Fig. 17: Raise jet nut to weaken mixture, lower it to enrich mixture. Nut can usually be turned with fingers, but may require wrench (Y/YB shown).*

As you go through the above procedure, keep several things in mind. On dual-carb models it is imperative that you move both throttle screws the same amount when you adjust the idling speed, and that you move both jet nuts the same number of flats when you adjust the mixture. It is also important to understand that it is the position of the jet relative to the tapered needle which determines the mixture strength, and it is the jet nut which determines the position of the jet. The jet must move up and down with the nut as you turn it, otherwise you will turn the nut all day without having any effect on the mixture. Normally the tension of the jet lever spring will keep the jet head tight up against the nut, but if not then you will have to help it along with your finger pressure. Refer to the last section of this article for several possible cures. If the springs are not able to pull the jets up against the adjusting as you tune the carbs, then neither will they do so when you push the choke knob back in after a cold start. This means trouble.

Often it is possible to turn the jet adjusting nuts with your fingers. If not, use the jet wrench supplied with the PSW tool kit or available separately from T Series and foreign parts suppliers. You may find it awkward to use the wrench with pancake-type air cleaners in place. If so, remove them. You may also find it helpful to remove the jet lever springs so you'll have more room to swing the wrench. If you remove the springs, you **must** use your fingers to hold the jets hard up against the adjusting nuts. It helps to have three hands, but few of us are so equipped.

If you were adjusting the mixture on a "normal" fixed-venturi carburetor, your job would be done at this point. In fact, even on the S.U. the mixture should be very close to correct if you have followed instructions carefully. However, the S.U.'s unique variable-venturi construction provides the means for testing your adjustment and fine-tuning it to a degree not possible on most other carburetors. This is particularly handy for owners of dual-carb models, as it allows you to ensure that both carbs are providing the same mixture strength.

**TESTING & FINE-TUNING:** Some manuals tell you to listen carefully to the sound of the exhaust while the engine idles. If the sound is uneven in a sort of non-rhythmical or "splashy" pattern, then the mixture is too lean and should be enriched by screwing the jet adjusting nuts down a bit. If the sound is uneven in a rhythmical pattern, and if the exhaust pipe throws out black smoke, then the mixture is too rich and the jet nuts need to be raised. Personally, I feel much the same about this as I do about trying to sychronize the throttles by holding a piece of tubing to the ear. It's too easy to misinterpret all the strange sounds you might hear. Also, on dual-carb models the exhaust can sound pretty good even though one carb is running lean and the other is running rich, thanks to the small degree of balancing which takes place between the two halves of the intake manifold.

The preferred method, which is considerably more accurate, is to lift the piston a specified amount and observe the effect of this on the idling speed. The lifting of the piston is carried out exactly as it was in the section dealing with jet centering. However, unless you have the air cleaners off and can actually observe the movement of the piston, you have to be very careful. Probe upward with the lifting pin, nail or whatever until you feel it actually come into contact with the bottom of the piston, then push farther to actually lift the piston. Learn to differentiate between pin (or nail) movement and piston movement, because the two are not necessarily the same. This is particularly important if your carbs have lifting pins, because you have to take up a lot of free play in the pin before the piston actually starts to move.

Now we will have to deal with single-carb and dual-carb models individually, because the rest of the testing and fine-tuning procedure varies slightly depending on which setup you have.

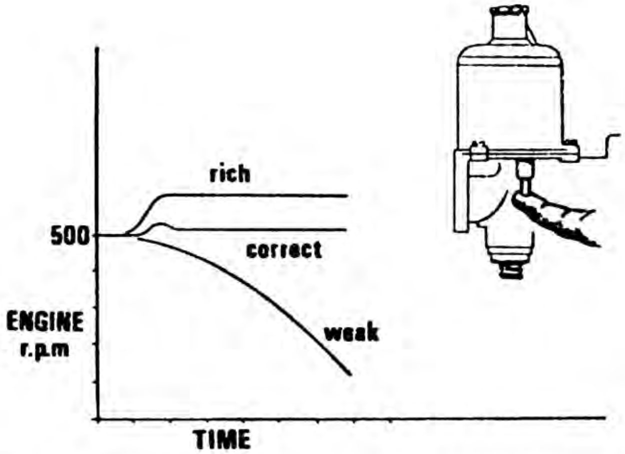



*Fig. 18: Engine speed should react as shown when piston is lifted $^1/_{32}$ in.*

On single-carb models, use your lifting pin, nail knife blade or whatever to lift the piston about $^1/_{32}$ of an inch (0.8mm). This need not be by precise measurement, but be aware that it amounts to only a slight nudge upwards. Lifting the piston increases the size of the venturi. The throttle is still in the closed position, so the actual airflow through the venturi is unchanged. The resulting decreased vacuum at the jet opening weakens the mixture slightly. If you have adjusted the jet position correctly, the engine should speed up for a moment, but should almost immediately settle back to only veryslightly above the original idling speed. If the jet setting is too low, giving a rich mixture, the idling speed will increase noticeably and stay there without dropping off. If the setting is too lean (jet too high), then the idling speed will drop off and the engine may stall. Figure eighteen depicts these reactions graphically. Adjust the jet up or down as indicated by the results of the test. Move the nut one flat at a time, testing again after each change, until you get the correct response when you raise the piston.

A variation on this theme is possible, and can be used to confirm your findings if you are unsure of yourself. Lift the piston very slowly to a height of ¼ inch. By the time you reach $^1/_{32}$" the engine should have reacted as described above for a correct setting: a slight increase in speed followed by settling back almost to the original idling speed. As you continue to lift the piston, thereby weakening the mixture even more, the engine should begin to slow down. By the time you have lifted the piston the full ¼", the engine should stall. If it begins to slow down or stalls after only $^1/_{32}$", then the mixture is too lean. If it continues to run at ¼", then the mixture is too rich.

For dual-carb models the procedure is essentially the same, but the reaction to lifting the piston on one carb of the pair is not as dramatic because only two cylinders are affected. Also, because of the balancing effect of the mainfold, a change in jet position on one carb may necessitate a change on the other carb as well. even though the second carb may have tested out okay the first time you tried it.

It doesn't matter which carb you begin with, but for the sake of labeling convenience we'll call them "first" and "second". Lift the first carb's piston $^1/_{32}$" as described earlier and listen for a change in idling speed. If the setting is correct, the rpms will either remain unchanged or will rise very slightly before dropping back to normal. If too rich, the engine will speed up and stay speeded up. If too lean, the speed will drop off and the engine will run very rough, although it probably won't die unless the mixture is extremely weak. Again, refer to figure eighteen. Before you make any adjustments, go on to the second carburetor and test it.

If both carbs react in the same way, with both testing out either too rich or too lean, then adjust both jet nuts one flat at a time in the same direction until the engine reacts correctly to your lifting of the piston. If one carb test out too rich while the other is too lean, adjust the nuts one flat at a time in opposite directions. Remember, you must move the nut and jet up to weaken the mixture, down to enrich it. In either case, test after each adjustment.

By turning both jet nuts equal amounts you may be lucky enough to reach a point where both carbs are just right. If so, stop. Don't fiddle with them any more. However, it is more likely that you will come to a point where one carb tests okay but the other is still a little bit off. In this case, leave the good one alone for the time being and continue adjusting and testing the other one. When it finally tests okay, go back to the first carb and test it agian. You may have to make a minor adjustment to compensate for the adjustments made to the other carb.

In any event, the goal is to get exactly the same reaction from both carbs when you lift the pistons individually. The key to success is to work slowly, moving the adjusting nuts equal amounts and testing after every adjustment until at least one of the carbs tests okay, then make whatever minor adjustments are necessary to bring the other carb up to snuff. If you try to adjust one carb all at once, then go to the other one, you will probably waste a lot of time going back and forth correcting the setting on the first carb to compensate for changes made on the second, which were made to compensate for changes made on the first, and so on *ad infinitum*.

**CLOSING UP:** When you are satisified that the mixture is set correctly, install the jet lever return springs and any other miscellaneous parts you removed in the course of the tuning procedure. On dual-carb models leave the rod which connects the two jet levels disconnected for the time being. If you had the air cleaner off while you tuned, put them back on now. Most air cleaners restrict airflow at least slightly, so the mixture may now be a bit too rich. This can be determined by lifting the pistons as already described, then adjusting the jet nuts accordingly. It will usually be necessary to raise the nuts a flat or two after installing the air cleaners. This isn't necessary if you tuned the carbs with the air cleaner in place.

## CHOKE & FAST IDLE ADJUSTMENT

TA,TB and TC carburetors have two separate controls to aid in cold starting: the choke or "mixture control" which provides an enriched mixture when the dashboard knob is pulled, and the hand throttle or "slow running control" which increases the idling speed when its dashboard knob is turned. The TD, TF and Y Types have only one control knob combining both functions. The jet control lever and fast idle rocking lever (front carb only on dual setups) are interconnected in such a way that when the choke knob is pulled the mixture strength and idling speed are increased simultaneously. The adjustment of both types is essentially identical.

**CHOKE:** On dual-carb models the connecting rod which links the two jet levers must be adjusted so that both jets are lowered simultaneously. First make sure both jet heads are tight up against their adjusting nuts, then adjust the length of the connecting rod so the clevis pin can be inserted without altering the position of the lever. Pull back the rear jet lever and release it slowly to see if the return springs are able to pull both jet heads tight up against the adjusting nuts. If not, figure out why. A drop of oil on each of the clevis pins (three per carb) often helps, and should be applied in any event to prevent wear. For obvious reasons, there is no jet lever connecting rod to adjust on single-carb models, but you should still lubricate the clevis pins and make sure the jet head returns tight against the adjusting nut when the jet lever is released. The choke cable is designed to pull the jet levers to the choked position, not to push them back to the normal running position. It's up to the return springs to do that.

Now reconnect the choke cable to its jet lever, leaving enough slack to allow the knob to be pulled out about ⅛" before the jet lever begins to move. If the cable is connected without any slack, it can prevent the jet levers (and therefore the jets) from returning to their normal running positions when the knob is pushed in. Operate the choke knob several times to make sure everything works smoothly. If you find that the choke knob slips out of the detents which hold it in intermediate positions, loosen the cable connection at the jet lever, twist the stranded wire inner cable one turn clockwise (as viewed from the engine compartment end of the cable), and retighten the grub screw. The resulting torsional tension on the cable will tend to keep the knob locked into the detents. Make sure you still have adequate slack in the cable after you've done this.

**FAST IDLE:** To adjust the slow running control on early models or the fast idle linkage on later cars, turn the adjusting screw until there is about .016 in. (.4mm) clearance between the screw tip and the rocking lever. Make sure you turn the right screw, or you will upset the synchronization on dual-carb models or the idling speed on single-carb models. On the TA, TB and TC the screw you want is the rearmost one on the front carb. On the TD, TF and YT it's the screw closest to you as you face the side of the engine, again on the front carburetor (fig.19). On the Y and YB it's also the screw closest to you, but on the only carb. The purpose of the small gap is to ensure that the fast idle mechanism can't hold the throttle slightly open even when the knob is in full off position.

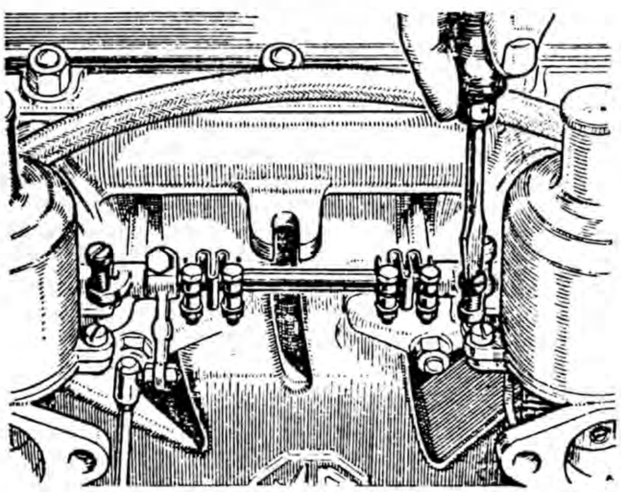


*Fig. 19: Allow .016 in. clearance between tip of fast idle screw and rocking lever (TD shown).*

The adjustment isn't critical on early models with a separate slow running control knob. The gap should be no less than .016 in. for the reason just stated, but it may be a great deal more than .016 in. if you don't mind having to twiddle the control knob a lot before anything happens. If you find that you have too much gap even with the adjusting screw turned down hard, then turn it back out a bit and take enough slack out of the slow running control cable to give you a useful range of adjustment at the screw. Conversely, if you can't get a wide enough gap even with the screw all the way out, then add a bit of slack to the cable. On later models with a single knob controlling both functions, the gap should not vary very much from .016 in. if the mixture and fast idle functions are to be properly coordinated. If your car has been retrofitted with carburetors manufactured much after the T Series era, you may find that the fast idle is controlled by a snail-shaped cam rather than by the older rocking lever. On this type the gap between the adjusting screw tip and the cam should still be .016 in., but in this case a slightly wider gap will do no harm.

## COMMON PROBLEMS

There are a number of problems that can crop up as you tune your carburetors, some of which will make accurate tuning dificult or even impossible. While it is beyond the scope of the "Back To Basics" series to instruct you in a complete carburetor overhaul, I feel I should at least point out some of the more common problems and their remedies.

**INABILITY TO ACHIEVE SLOW IDLE:** You may find it impossible to slow the idling speed down to the recommended 700-800rpm range no matter how far you back off the throttle adjusting screws. This is usually caused by air leaking into the induction system somewhere between the throttle butterflies and the valves. Grasp the ends of the throttle spindles where they protrude from the carburetors and try to wiggle them around. If they seem to be loose in their bores, then you have found at least part of the problem. New spindles should be installed, and in bad cases it may even be necessary to install bushings in the carburetor body to bring the spindle bores back to standard. The correct (new) clearance between spindle and bore is only .0025 in. Wear occurs rapidly if the spindles aren't oiled frequently enough. It helps to oil them while the engine is idling, so the oil will be sucked into the spindle bores by manifold vacuum.

Defective gaskets between the manifold and the carburetor or between the manifold and the cylinder head are another common source of air leakage. To test for this, brush or squirt oil all around the joint sealed by the gasket. When (or if) the oil fills the leaking area of the gasket, the idling speed will slow down for a moment. A much less messy method is to direct the flow of gas from an unlighted propane torch all around the joint. When you find the leaky spot, the gas will be sucked in by manifold vacuum and the idling speed will increase.

In rare instances one of the core plugs at the ends of the balance tube on the manifold may come loose, allowing air to be sucked into the system. Leaks at the plugs can usually be sealed with silicone sealant or hardening gasket cement, but the only permanent cure is to install a new plug.

Regardless of the source, any air leaking into the system without being controlled by the throttle will make it impossible to adjust the carbs correctly. To compensate for the extra air, you will have to adjust the jet nuts down an abnormal distance to get a smooth idle. Unfortunately, the effects of manifold vacuum on those leaks at different engine speeds and under different load conditions almost guarantees that the mixture won't be right at any speed except idle. The consequences of this can be far more devastating than the simple annoyance of not being able to get the engine to idle slowly.

If you find any leaks, don't try to cure them by tightening the manifold nuts or carburetor flange bolts unless they are obviously loose. Overtightening can strip or break the manifold clamp studs, which are none too strong, and will almost certainly warp the carburetor mounting flanges. The only sure cure for a leaking gasket is a new gasket.

It sometimes happens when a new throttle spindle is installed that the throttle stop arm is pinned on in the wrong position. Normally there is plenty of clearance between the arm and the abutment on the carburetor body, but if the arm is incorrectly positioned there may be no clearance with the result that the throttle cannot close far enough to achieve slow idle. The only proper cure for this is to fit another new spindle, this time being more careful (or more knowledgeable) about the positioning of the throttle arm. Not only does this arm serve to hold the idle speed adjusting screw, but the end opposite the screw also serves as a stop (against the bottom of the same abutment) when the throttle is fully open. The arm should be positioned on the spindle so the throttle butterfly is perfectly aligned with the throttle bore (in other words, wide open) when the end of the arm opposite the adjusting screw is hard up against the underside of the abutment.

If the throttle arm is the cause of your problems you can still use the engine without fear of damaging it. You may not be able to achieve a slow idle, but at least in this case all the airflow is controlled by the throttle. The mixture setting will remain satisfactory throughout the whole range of throttle openings, unlike the situation caused by leaky gaskets.

**INABILITY TO ACHIEVE LEAN ENOUGH MIXTURE:** If you discover that it is impossible to achieve a lean enough mixture even with the jet nut screwed up as far as it will go, suspect either an incorrectly positioned needle, incorrectly adjusted float level, a leaky float valve, or a leaky upper jet cork gland washer. The first three items have already been discussed, but go through those procedures again if you are unsure of yourself.

Jet leakage is not likely to affect both carburetors equally on a dual-carb engine, but it can happen. If the lower spring-loaded gland washer leaks, the errant fuel drips out around the bottom of the jet assembly. This wastes fuel and is a potential fire hazzard, but has no effect on the mixture except in unusually bad cases. If, on the other hand, there is leakage past the upper spring-loaded cork washer or past the copper washer which fits between the upper half of the jet bearing and the carb body, then the excess fuel is sucked into the airstream to enrich the mixture. This is most pronounced at idling speeds when vacuum at the jet opening is highest, and can make it impossible to achieve a lean enough mixture. Even if you are able to position the jet nut high enough, the mixture at higher speeds will then be too lean, with serious consequences in severe cases. If fuel drips from the bottom of the jet assembly (mere surface dampness may be disregarded), then the top washer is probably also bad. Both should be replaced. See figure 20 for an exploded view of the jet assembly, which may be removed from the carburetor by unscrewing the large jet locking nut. Be sure to recenter the jet before you tighten the locking nut again.

If the carburetors are impossible to set lean enough, and if none of the faults mentioned above are in evidence, then it is permissible to change the position of the needle in the piston. As explained earlier, the standard position is with the squared shoulder of the shank flush with the surface of the piston. If you can't get a lean enough mixture, set the neddle (both of them on dual-carb models) so the shoulder protrudes $^1/_{32}$ in. beyond the face of the piston. This enables you to lower the jet adjusting nut by about the same amount, which will usually provide a satisfactory range of adjustment.

**JET NUT POSITION NOT EQUAL ON BOTH CARBS:** Although we began the mixture adjusting procedure with both jet nuts six flats down from their topmost position, by the time the mixture is correct you will probably find that the final positions are not the same for both nuts. For example, one may be two turns down from the top and the other three turns down. This is perfectly okay. Even with new carburetors there can be a difference of as much as one turn (6 flats) between the two nuts, due usually to slight differences in needle position or internal tolerances. On older carbs the factor comes into play, and the variation in nut position may be even greater. As a rule of thumb, all is okay as long as the difference amounts to no more than two full turns (12 flats). If the final setting results in a difference greater than that, then suspect incorrect float level, incorrect needle setting, or a leaky jet as described earlier. If none of those conditions exist, it is probably just a matter of extreme old age or extreme neglect, and the only cure is to rebuild the carburetors.

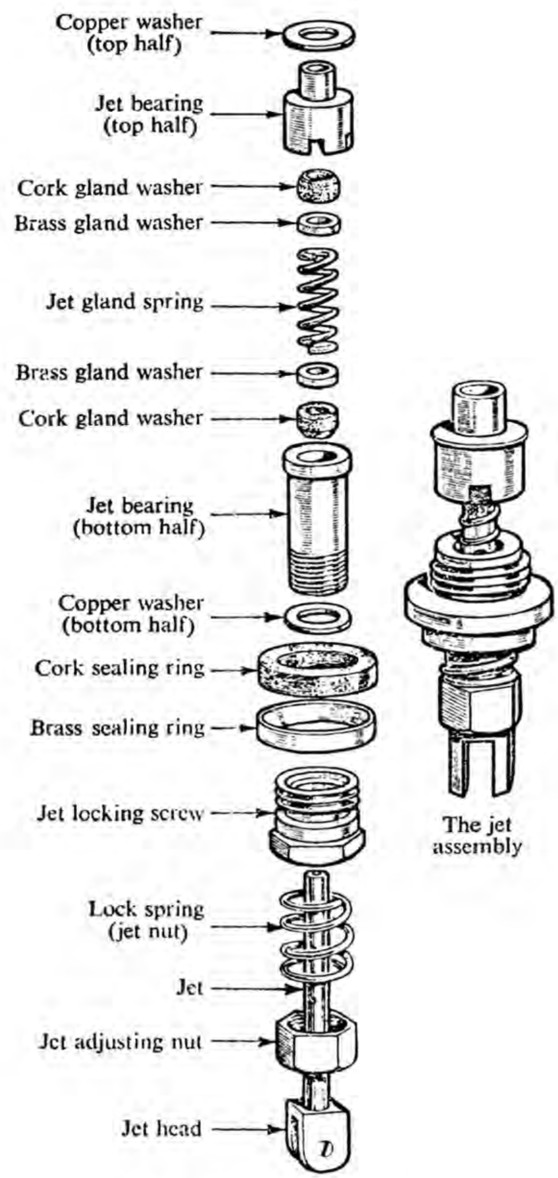



*Fig 20: The Jet Assembly*

**STICKING JET:** If, while you were adjusting the mixture, you found that the return spring was unable to keep the jet head tight up against the adjusting nut, then something is causing that jet to stick. This often can be cured by pulling the jet lever back as far as it will go, smearing a dab of petroleum jelly on the shaft of the jet, then working the lever back and forth to distribute the grease evenly. If that doesn't do the trick, unhook the jet lever and withdraw the jet. If there is a burr or similar blemish on the shaft of the jet, work it down with a very fine file, crocus cloth, or 600 grit sandpaper. Don't remove a lot of material from the jet, or the seals will no longer be able to do their job. Lubricate the jet as described above and all should be well. It's also possible that some misguided former owner has substituted weaker return springs, or that the original springs have lost their tension.

**POOR COLD STARTING:** If your M.G. is difficult to start in cold weather, make sure the ignition equipment is in good order before you start fiddling with the carburetors. At least 99% of all cold starting problems are caused by the ignition system, not by the induction system, so make sure the points and plugs are adjusted correctly and that you have a good fat spark. If the ignition system is okay, then examine the jets and jet linkage. The rich mixture required to start a cold engine is provided for on the S.U. carburetor by the moveable jet. When the choke knob is pulled, the lever lowers the jet in relation to the tapered needle. This creates a larger jet opening and thus a richer mixture. When the jet lever is pulled back to the fullest extent of its travel, the jet head should drop away from its adjusting nut between 5/16 in. and 3/8 in. If it doesn't, your problem may be that the carburetor isn't able to supply a rich enough mixture at full choke.This usually occurs when the jet nut is set quite a way down from its topmost position, say four or five full turns. The "fully choked" position of the jet lever is controlled by a lug on the lever which hits the pressed steel link on which the lever pivots. The "unchoked" position is controlled by the jet head hitting the jet adjusting nut. Thus, the lower the setting of the jet nut, the less the available jet movement and the weaker the mixture in the fully choked mode.

If, when you adjust the mixture, you find that the final position of the jet nut is quite far below its topmost position, then measure the available jet travel as described above. If it is less than 5/16 in., you may increase it by repositioning the needle as much as 1/16 in. deeper into the piston. This allows the jet nut to be raised as equal amount, which in turn increases the available jet travel. On dual-carb models it is best to set both needles the same way even if one doesn't seem to need it. One needle set with the shoulder flush with the piston and the other recessed by 1/16 in. or so will not have any effect on the tunability of the carbs, but this can conceal other faults (jet seal leakage, improper float level, etc.) which might later be brought to light by large differences in the heights of the adjusting nuts.

If recessing the needle into the piston still doesn't provide the required amount of jet travel, screw the jet adjusting nut as far up as it will go. Now the total available travel should be about 7/16 in. If not, you may as a last resort file a small amount off the lug on the jet lever where it contacts the pressed steel link. This will allow the lever to be pulled farther back, but don't get carried away with this cure or the jet may be pulled too far out of its bearings in the full choke position.

Owners of very early TAs and earlier models should note that jet assemblies manufactured prior to 1937 provided a maximum jet travel of only 5/16 in. with the jet nut screwed all the way up. With the jet nut in the normal running position, the available jet travel for cold starting is quite small on these early models.

**TESTING ABNORMALITIES:** On dual-carb models a certain combination of errors in or omissions from the tuning procedure can lead you down a path so frustrating that you will want to swear off S.U. carburetors forever. The tale of woe begins when you either neglect to synchronize the throttles or don't do it correctly, so that one throttle is open quite a lot more than the other. It is possible under these conditions to adjust the jet nuts in such a way that the idle will be fairly smooth, but only by setting the jet in a very lean position on the first carb (the one with the wider throttle setting) and in a very rich position on the second carb (the one with the small throttle setting). The resulting smooth isle will fool you into thinking these settings are correct, when in fact they are very wrong.

Then, when you lift the piston to test the first carburetor, the engine speed will not change even though the mixture supplied by that carb is in fact extremely lean. Again you are fooled into thinking the mixture is correct. In reality, lifting the piston does not weaken the already excessively lean mixture enough to have any effect on the engine. On the other hand, when you lift the piston on the second carb the engine will slow down dramatically, perhaps even stalling, which leads you to believe the mixture is set too lean even though it is in fact very rich. Your natural reaction is to try to enrich the apparently weak mixture by lowering the jet even more, making things worse instead of better. The farther down you turn the nut, the worse the situation becomes, leading you to lower the jet even more to correct what still tests out as a weak mixture. Seem impossible? Try it some afternoon when you have nothing better to do.

The obvious way to avoid this particular path to insanity is never to attempt mixture adjustment without first confirming that the throttles are synchronized. Never rely on the static method of sychronization by itself, as it isn't accurate enough. Dynamic synchronization is the only accurate method, even if your only measuring gauge is a piece of rubber hose. The use of a Uni-Syn or similar vacuum gauge designed for the purpose is highly recommended.

## SHORTCUTS

I hope that by following the instructions layed out earlier the rock-bottom beginner will be able to tune his much-neglected carburetors. Once you are familiar with the procedure, and once the carbs are properly tuned, subsequent tuneups should go considerably faster. As long as you resist the tempation to fiddle with them between tuneups, they should perform satisfactorily for a long time. At the next tuneup they should require only cleaning, testing, and possibly very minor adjustment. The procedure should go something like this:

**CLEANING:** Always clean the exterior of the carbs as described earlier, if for no other reason than to keep your hands from getting too grimy and transferring some of that grime to the carb's delicate innards.

**FLOAT CHAMBERS:** Blow through the fuel inlet as described to test the seating of the valve, then use your test rod to confirm the float level setting. It shouldn't need adjustment; anything between 7/16 in. and 3/8 in. is acceptable. Shake the float to test for leaks, and clean out the chamber.

**SUCTION CHAMBERS:** Clean and test for free piston movement as described earlier. Inspect the needle for wear as described, but don't remove it unless it needs to be replaced. If you did your first tuneup right, you should know what size it is and should have positioned it correctly.

**JET CENTERING:** Unless you left the jet locking screws loose during your previous tuneup, or unless you have just had to replace the needle and/or jet, the jet should still be properly centered. Test it just to make sure. Screw the jet nuts all the way up, but count the number of flats so you can return them to their original positions. If you hear that telltale click as the piston drops, screw the nuts back down the correct number of flats and go on to the next step. If not, center the jets as described earlier.

**SYNCHRONIZATION:** Unless you have fiddled with the throttle screws since your last tuneup, the throttles should still be synchronized. Test with your rubber hose, Uni-Syn, or whatever. If okay, go on to the next step, If not, loosen the spindle clamp and twiddle the adjusting screws until the throttles are again synchronized. In any event, they should still be close enough that you can omit the routine with the piece of paper and go straight to the rubber hose or Uni-Syn. Set the idling speed to 700-800rpm.

**MIXTURE:** The mixture should still be close to perfect unless you fiddled between tuneups or unless you had to adjust the float level, jet centering or synchronization in one of the steps above. Test it by lifting the pistons, making sure the jet heads are tight against the adjusting nuts. If okay, go on to the next step. If not, disconnect the choke cable and jet lever connecting rod and proceed as described under "Mixture Adjustment: Testing and Fine Tuning". If you have trouble getting it right, go through the complete mixture adjustment procedure as if you were starting from scratch.

**CHOKE & FAST IDLE:** These settings won't need attention unless you altered the throttle screw settings or had to adjust the mixture. Check the choke cable slack, the fit of the jet lever connecting rod, and the fast idle screw gap, but don't bother to change them unless necessary.

# TECHNICALLY SPEAKING

**By F. E. Old, III**
**Technical Editor**

Quite a long time ago I began working on an article dealing with improving the much-maligned TC steering, but for a number of reasons it never progressed beyond the rough draft stage, and the incomplete article has languished in my files for a couple of years. Since I promised the article so long ago and was beginning to feel more than a little guilty about the delay, I was greatly relieved to receive an excellent article on the same subject from long-time member Doug McCowan. Doug's offering will be found immediately following these introductory remarks, followed in turn by portions of my own almost-forgotten article. I've eliminated most parts of my article which duplicate what Doug has already covered, with the exception of some duplications left intact where I felt a particular point required extra emphasis. Although both articles were written with the TC owner in mind, most of the content is equally applicable to the TA, TB and earlier models.

In addition to describing the general renovation of the steering system, both articles also describe several modifications which have been performed quite successfully on a large number of cars. To the best of my knowledge these modifications are well thought out and have never been directly responsible for personal injury or damages to the car. Nevertheless, you must understand that such modifications are to be undertaken at your own risk. Since we have no control over the quality of the parts, tools or workmanship you might employ to perform these modifications on your own car, neither Doug McCowan, the Technical Editor, or the New England MG 'T' Register can accept responsibility for any damages or personal injury which might occur.

## HOW TO GET YOUR TC TO STEER RIGHT (AND LEFT)
**by Doug McCowan, #105**

For many years in sports car circles the mention of the M.G. TC brought vivid recollections of bad steering. The car was so known for this frailty that the Nuffield Organisation actually admitted the steering box was one of the worst designs ever fitted to their cars. Unfortunately, there are two implications here that are just not true. First, and perhaps most obvious, is the fact that the steering box is only partly to blame. The basic cause of bad steering usually lies elsewhere. Secondly, the cars as delivered did not steer all that badly, as anyone knows who has restored a TC to original condition. They did, however, begin to steer badly as soon as any wear developed in the front end components. There is a lesson for the patient enthusiast in these two misconceptions. To get your TC to steer properly you must first restore the front end to specs by eliminating the years of wear and neglect, then take the appropriate steps to forestall further wear.

Fortunately there is a golden lining to TC steering troubles, for, in the process of restoring the front end there is the opportunity to make a few genuine improvements which experience has stumbled upon. It should be remembered that no amount of modification will make the car steer like one of its modern counterparts. It simply is not in the cards. The vintage geometry and hard suspension preclude miracles. Instead, your car can be made safe and pleasant to drive at highway speeds without resorting to the well-known white knuckles technique.

Restoring the front end to specs means just that: correcting all steering dimensions and clearances to their standard values. Logically the first place to start is the chassis frame. If there is any possibility that your TC was ever hit, either by another car or in a simple front-end impact, then the frame should be checked. There is a dimensioned line drawing of the frame on page nine of the TC owner's manual. If there are any discrepancies then the frame **must** be straightened. This can be done by an auto frame shop equipped with hydraulic rams. While working on the frame, check the dumb iron tips. These will frequently loosen up with age. If they are loose, drill out the rivets securing them and replace with high-quality bolts.

The front axle beam is another cause for concern when the car is suspected of having been in an accident. It can be checked by the method given in **The Restoration of Antique And Classic Cars** by Wheatley and Morgan. The

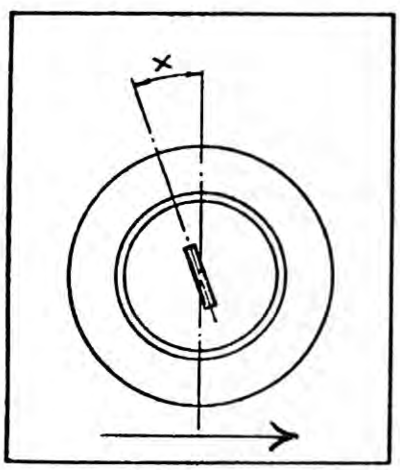



*Fig. 1: Tilt of king pin from vertical (X) is called caster. If tilt is to rear as shown, caster is positive.*

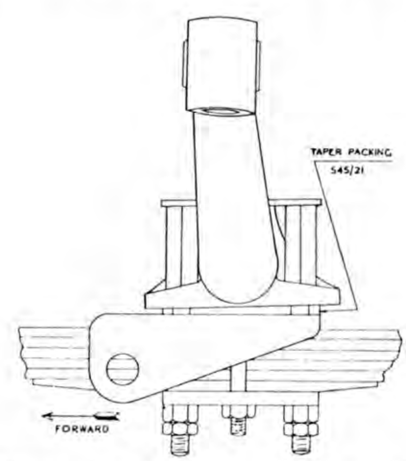



*Fig. 2: Commencing at TC 4251, tapered packing was inserted between axle & spring to reduce caster. Recommended for all TCs, but not TA or TB. Thick end of packing must face rear of car, as shown.*

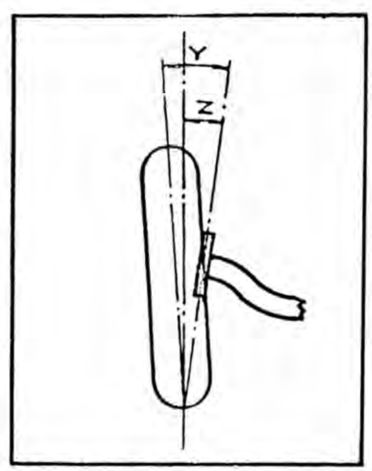



*Fig. 3: Steering knuckle angle (Y) & king pin angle (Z) determine camber. When top of wheel tilts out as shown, camber is positive.*

beam is mounted on a dead plate with ¾" rods inserted in the king pin bores. Then, by tying strings to the various parts, the angles can be easily measured. The correct values are: caster 3° to the rear, king pin inclination 7½° to the inside. Any discrepancies **must** be corrected. This calls for bending, which again should be entrusted to a frame shop. Check the fit of the king pins in their respective bores. They should be snug with no discernable wobble. If there is any wear in the bores, it should be corrected by sleeving, or possibly by welding and re-machining.

A simple drawing will show that, for a beam-axled car to traverse a corner, the inside front wheel must turn a tighter circle than the outside wheel. This is known as the Ackerman steering principle. How it is accomplished in practice necessitates a complicated geometric argument involving the three steering angles, caster, camber and toe-in, as well as the angle of the steering arms. The latter is known as the Ackerman angle, and is generally expressed by requiring a line through the king pin and steering ball joint to also pass through the car's differential. If it doesn't then something, somewhere is bent. This could be the chassis frame, the axle beam, or the steering arm. Obviously, it must be diagnosed and corrected.

Of the three steering angles caster is the most important, and is usually the one farthest from specification. This is rarely due to bent components but, most commonly, is caused by sagging front springs. The total caster for early TCs is an 8° tilt of the king pin towards the rear of the car. This was accomplied by a 3° tilt of the king pins on the axle beam and a 5° tilt of the axle beam relative to the chassis. Clearly any sagging of the front springs will reduce the caster angle. During the TC production run it was realized that 8° was too much caster, so beginning with TC 4251 tapered plates were inserted between the axle beam and the front springs. This reduced the caster to 5½°: 3° on the beam and 2½° on the chassis. These caster plates are a very desirable feature on all TCs. If you car is lacking them, they are now available from major T-Series parts suppliers. Correct installation is shown in figure two.

To understand what caster does, you should project the king pin axis down to the ground. There it will be seen that the point of contact of the wheel on the ground will always trail behind the projection of the king pin axis if the king pin is castered backwards. The result of this situation is a servo effect in the steering which tends to keep the front wheels traveling in a straight line. The wheels tend to straighten out automatically after small deflections, thereby steadying the car. The early TCs had too much of this servo effect, which made it difficult to turn the wheels away from a straight line. Hence the tapered plates, which help to reduce steering effort.

If the front springs on your car have sagged, this reduces the caster. There will then be too little servo effect and the car will tend to wander all over the road. The solution is obvious: replace the front springs. They are among the best buys available from the parts suppliers. This also provides the opportunity to replace the front spring pins, eliminating yet another source of looseness.

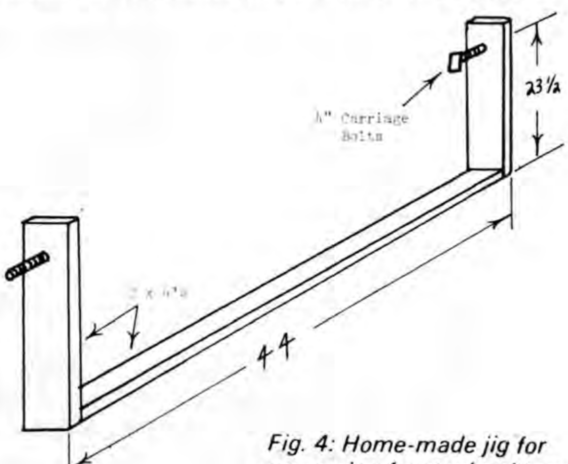



*Fig. 4: Home-made jig for measuring front wheel toe-in.*

The two other steering angles are basically corrections for the disadvantages of caster. Camber is the tilting of the top of the wheel outward to aid in cornering and to compensate for the effect which a crowned road surface has on steering. The camber angle for all TCs is 3° tilt of the wheel toward the outside. The king pins are inclined 7½° inward to bring the point of contact of the wheel with the road nearer to the projected line of the kingping axis in the horizontal direction. Finally, a castered and cambered front tire tends to wear rapidly if it is not toed-in. This last angle for a TC is ¼" measured on the wheel rim and is the only steering angle easily adjustable. The distance between the wheel rims at the front of the axle should be ¼" less than the distance between the rims at the rear of the axle. This can be easily measured by making up the wooden jig shown in figure four. Toe-in is adjusted by lengthening or shortening the track rod.

The joint between the steering knuckle and the king pin is a bushing pressed into the top and bottom of each knuckle. The description on page twenty-one of the TC owner's manual is incorrect, as the flanged type of king pin bushing was discontinued before the TC went into production. Instead, the weight of the car is supported on a flat bronze thrust washer, about ⅛" thick, fitted between the bottom of the axle and the steering knuckle. As stated in the manual, the clearance here should be 0.004". This is somewhat of a joke, because there is nary a surviving car with this little clearance. Wear of either the axle beam or the steering knuckle thrust faces has, most likely, increased this value considerably. The standard answer is to custom fit new thrust washers by either machining or hand grinding. The author doesn't envy anyone choosing this route. The modern answer is to fit Torrington NTA 1220 needle thrust bearings, which also eliminate the lion's share of friction in the king pin assembly.

The NTA 1220 thrust bearings are supplied as only a retainer containing the needle bearings. The bearing races, which must be purchased separately, consist of hardened steel washers placed on either side of the bearing. The thinnest washers available (TRA 1220) gives a total bearing thickness (needle bearing plus two washers) of 0.141". This is slightly greater than the 0.125" standard thrust washer, but axle and steering knuckle are almost always worn to such an extent that the thicker bearing is easily accommodated. In the unlikely event that the needle bearings are too thick to fit on your car, the steering knuckles or axle beams will have to be trimmed slightly. This will seldom be necessary, and in fact wear is sometimes bad enough to require the next thicker size washer (TRB 1220). These thrust bearings are highly recommended: they are cheaper than standard replacements, should last the life of the car, and they eliminate substantial friction in the steering. The last point here is most important as excessive friction in the king pin assemblies causes rapid wear in the steering box. (See next article for another way around this problem - Tech Ed)

If there is much discernable wear in the king pin bushings themselves, they and the king pins should be replaced. To feel this wear, jack the front wheels clear of the ground and, with your finger on the steering knuckle - axle beam joint, deflect the wheel in a top to bottom direction. Anything more than barely noticeable motion here is cause for action. The re-bushing of the steering knuckles is well described in the TC owner's manual. All one has to do is follow the procedure.

While the front wheels are jacked up, the wheel bearings can be checked for wear by placing a finger on the crack between the brake drum and the backing plate and, again, deflecting the wheel in a top to bottom direction. There should be no "feelable" motion here if the wheel bearings are good. Obviously, if there is motion the bearings should be replaced. Remember, a seized wheel bearing will tear up the steering knuckle, which brings about a costly replacement.

The original TC wheel bearings are single row ball bearings which do not stand up well to lateral impacts. This is unfortunate since, because of camber, this is a constant lateral force on the bearings. Hard cornering or an occasional curb impact produce forces which will ruin even the highest quality bearings over a period of time. The answer is to fit tapered roller bearings, in keeping with modern practice. Fag 30205A and 30304A replace the inner and outer wheel bearings without any machining. The hub is assembled just as if the original ball bearings were being installed, but the distance tube between the bearings is omitted. The bearings should be adjusted by tightening the nut until there is no play. If the cotter pin hole doesn't line up, grind the face of the nut rather than having too much or too little play in the bearings. These bearings will likely outlast the car itself if they are cleaned and packed with grease every year. Since they are an "off the shelf" item, it is difficult to see why they were not fitted as original equipment.

The front wheels should be at least as true as they were when new. The tolerances are: 0.060" maximum radial and axial runout. This can be measured with a dial indicator. Remember, bent or dented rims will obscure the measurement. This work can be farmed out to a wire wheel expert with the added advantage that he can balance the wheels after truing them. Properly aligned and balanced front wheels make a big difference in TC steering. With everything else in good order, your car can be steered at highway speeds using one finger with no noticeable shimmy or wander.

The ball joint assemblies on the drag link and track rod are adequately explained in the TC owner's manual. Any worn parts should, of course, be replaced. When assembling these joints, screw the cap up tight and then back off ½ to ¾ of a turn. Much less clearance than this adds friction to the steering effort, and much more produces excessive play.

Now at last to the steering box itself. There are two areas of concern here: the sector shaft bore and the top plate. Since, as originally fitted, there was no bearing material in the sector shaft bore, wear here is unusually rapid. In some extreme cases the front wheels can be deflected a matter of inches with no movement of the steering wheel. All the slack is caused by a sideways motion of the bottom of the sector shaft in its elliptically-worn bore. A common cure for this malady in the early days was to fit flathead Ford wrist pin bushings. Nowadays the preferred method is to use king pin bushings, the best of which are the Vandervell white metal type. Bronze bushings are too hard; they cause undue wear of the sector shaft.

To fit the bushings, take your box to a competent machinist and have him enlarge the sector shaft bore to accept the king pin bushings. Since these are precision fit items, there is a standard reamer which will produce a hole having the correct press fit. Of course the new hole should be concentric to the old one and perpendicular to the worm gear. This is accomplished by clamping the box, top end down, to the bed of a milling machine and lining up the milling head with a wobble indicator. You should insist that this is done right, otherwise your steering box will be ruined beyond repair.

Press in the bushings one at a time and ream them in line to fit the ¾" sector shaft. The fit should be snug, but with no sign of binding. Next, the outside bushing surface adjacent to the worm gear must be cut away to match the indent in the box casting. This can be done with either a sharp circular file or a Dremel tool. Last, cut a cork seal to match the recess at the bottom of the sector shaft bore in the steering box. Without this seal the lubricant will quickly leak out thus producing the same problem all over again.

The idea of constraining the axial movement of the sector shaft by a direct sliding contact on the steering box top cover is sheer folly. Although it may have been satisfactory for the run from the factory to the export docks the friction here, which is high to start with, soon became intolerable as the top plate becomes even slightly scored. Furthermore, the inconvenience of having to remove the cover to remove shims for adjustment borders on lunacy. Consequently needle or tapered roller thrust bearing kits have traditionally been a popular TC improvement. These are highly recommended. If, however, the owner is inclined to tinker, he can produce an equally satisfactory substitute by welding a nut to the top cover as shown in figure six. Either of these cures removes the objectional friction and also makes adjusting the box a rapid and simple procedure.

While the steering box is out of the car, check the joint between the steering column tube and the casting. Originally this was a press fit. As this joint loosens up with age, play and leakage develop. The joint should be welded up to eliminate both of these problems. Since the tube is steel and the box cast iron, heliarc welding is the best bet, but the joint can be brazed if both parts can be gotten sufficiently clean. Now, with a new seal at the bottom of the sector shaft bore and the steering column to steering box joint welded, lubricant leakage from the box should be negligible.

The last matter of concern in the steering box assembly is the archaic felt bearing at the top of the steering column. This can swell up with age and produce considerable friction. It should be replaced with a Torrington B1416 needle bearing. If a shim is needed between the needle bearing and the inside of the steering column tube, cut one to fit from brass shim stock. Incidentally, this needle bearing along with a suitable shim is supplied in one of the popular top cover bearing kits.

After everything is assembled in the car and adjusted as per the instructions in the TC owner's manual, the big moment arrives for the first road test. Try driving the car on a flat uncrowned road. There should be no tendency to wander in either direction. Try releasing the steering wheel after a corner. The wheels should return to the straight ahead position rapidly and smoothly without any noticeable overshoot. Last, drive the car at highway speeds over a smooth raod. Any wheel shimmy or unusual vibration in the steering means back to the drawing board. If the car fails these simple tests and you have correctly measured the suspension angles and found them to be within specs, then the next diagnostic test is tire wear. The trouble is that tire wear patterns take time to develop.

Tire wear is a combination of two static and two dynamic effects. The static effects are due to incorrect suspension angles or incorrect tire pressures. The dynamic effects are due to shimmy or unbalanced wheels. Since what eventually develops is, generally, a non-linear combination of all four effects, determining the causes can be difficult. It might be advantageous to consult a tire expert or peruse a book with pictures of tire wear patterns. Hopefully, if you correct all the deficiencies in your car's suspension and steering components, you won't have to resort to this last-ditch measure.

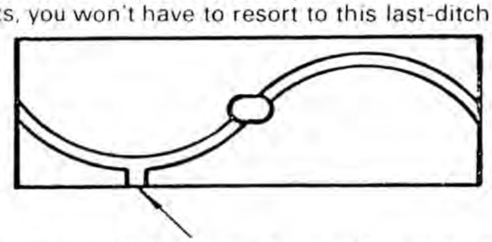


*Fig. 5: King pin bushings must have lubrication grooves, as shown in this view of bushing before being rolled. Short groove indicated by arrow must face thrust surface of axle.*

Your car should be driveable even on the New Jersey Turnpike (take that, Jackson!).

Good luck!

## REFLECTIONS ON A WOBBLY HUB NUT
**by the Technical Editor**

I am a member of that small group of unusual (demented, perhaps?) people who happen to **like** the way a **good** TC steers, but even I will admit that the average TC on the road these days is a real pig in the steering department. This is more often than not the result of years of abuse and neglect, and it is not unusual to find the frame bent, caster and camber far off specs, and the steering system horribly worn. It is impossible to overemphasize the importance of correctly set-up steering geometry on the TC. Even with the steering box and king pins rebuilt to as-new condition, we cannot expect the car to steer properly unless the frame is straight, the axles are aligned on the frame, the springs are good, and caster, camber, and toe-in are set according to specifications. Unfortunately, these points are often neglected in even the most meticulous restoration project, but the blame for poor steering is almost always put unfairly on the original design.

**FRAME, AXLE & SPRINGS:** As Doug has already said, chassis frame alignment is the first thing to check, and this must be done with the car sitting on a flat and level surface. First drop a plumb bob from each reference point shown on the diagram in the TC owner's manual, and mark the floor directly below each point. Then measure between the marks and compare your results to the specifications given on the diagram to determine whether your frame is out of whack. After all these years most of them are, even if only slightly.

To check for axle alignment, measure from the same spot on each end of the axle to a convenient reference point on each side of the frame, preferably at least half way back the length of the frame. If the two measurements differ by more than ¼", loosen the axle on the springs and try to shift it a bit. There is a small amount of leeway in the axle mountings; not much, but usually enough to let you get the axle back in proper alignment. This should be done for both axles. Don't neglect the rear; it has more effect on steering quality than you might think.

If for any reason the axle is removed from the car, be careful to remount it right way 'round. The top ends of the king pin bores should tilt 3° to the rear with the axle resting on a flat surface. This is difficult to determine by simply eyeing the empty bores, but it can be done if you insert a king pin or other ¾" rod partway into the bore. If the axle is installed backwards the caster will be far enough off specs to cause serious steering problems.

Spring sag is difficult to measure precisely on the car, but if you have never replaced the springs chances are good that you should. Sag or no sag, new springs are in order if a leaf shows much wear where the end of the leaf above or below rubs against it. Unless you are really poverty stricken, opt for new rather than re-arched springs. Old springs will have lost some of their temper; this may make the ride a bit softer, but it has a negative effect on the steering. Besides, re-arched springs never seem to hold their arch as long as new ones, so the initial lower expense will be offset sooner or later by return trips to the spring shop.

**KING PINS:** After the frame and axles are properly aligned and the springs are judged satisfactory, check the king pins, king pin bushings and thrust washers for wear and replace if necessary. The quality of replacement parts is generally good, but examine the bushings to make sure they have lubrication grooves cut into the inner diameter as shown in figure five. Some rebuild kits come with solid bronze bushings lacking lubrication grooves. This type does not distribute grease around the bearing surface particularly well. In fact, with the bushings reamed to the correct fit on the king pins, you may find it impossible to force grease into the bearings. The result is rapid wear due to underlubrication. Some owners ream this type of bushing slightly oversize to provide adequate grease clearance, but if you choose this approach you might as well leave the old worn bushings in.

The grooved bushings must be pressed into the steering knuckles so that the short open-ended branch groove faces the axle. This ensures adequate lubrication of the thrust surfaces between the steering knuckles and the axle, another good reason why ungrooved bushings are not desireable. Also make sure the lubrication holes in the sides of the bushings are aligned with the grease fittings.

The new bushings must now be reamed to fit the king pins, and a point often overlooked here is that both bushings must be reamed in line. This requires either a reamer long enough to do both bushings at once, or one which pilots in one bushing while reaming the other. Make sure your machinist understands this. Now that all domestic cars use ball joints instead of king pins, the fine art of king pin fitting is fast disappearing.

As you insert the new king pins, align the slot in the side of the pin with the hole for the locking pin (cotter pin) by turning the king pin. A square bar or other suitable lever inserted in the slot at the top of the king pin will facilitate this. The locking pin must be inserted from the rear of the axle, because its head serves as a stop to limit and adjust steering lock. At full lock the head of the locking pin abuts against the head of a bolt protruding from the back of the steering knuckle. Washers are inserted or removed from under that bolt to adjust steering lock.

Now check the end play of the king pin assembly, either with a dial indicator or with feeler gauges inserted under the thrust washer, and ajust it to about .004 in. by inserting shim washers. Occasionally one finds a great deal of excess end play, so much so that one of the Torrington TRA or TRB 1220 steel washers mentioned in Doug's article can often be used as a shim. If the TRA 1220 washer is too thick, then you must make your own from shim stock. Insert all shims above the axle, not below it next to the bronze thrust washer. In the unlikely event that there is too little end play, work down the thickness of the thrust washer by rubbing it on a piece of emory cloth placed on a dead flat surface. If the washer is way too thick, have it machined to the correct dimension.

**TRACK ROD ENDS:** The track rod ends are very long-lived if kept clean and well lubricated, which is surprising considering the fact that they are not sealed against water and dirt. Dismantle, clean, and inspect them anyway. They pass inspection if the springs are not broken and the cups are not grooved. The balls over which the track rod ends fit take a terrific beating and have quite an effect on smooth

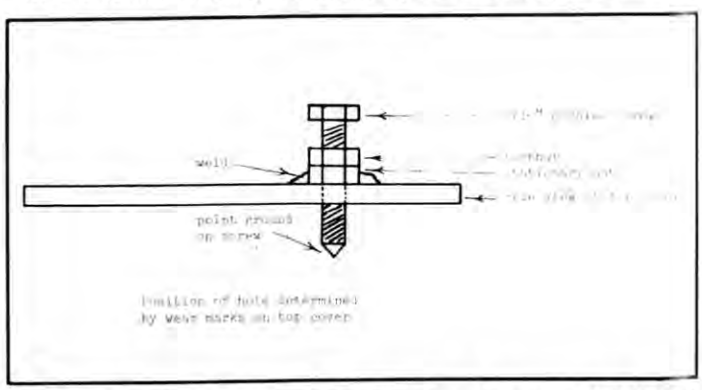



*Fig. 6: Modified steering box top cover. Flat-tipped ⅜" bolt can be used in place of pointed 5/16" bolt shown. Use extra shims under modified cover so sector arm does not touch cover.*

steering, so replace them if they show signs of wear (which they almost always do).

**STEERING BOX:** As Doug has already mentioned, wear at the bottom of the sector shaft bore is terrific. Every time you turn the steering wheel, and every time the front wheels are deflected by a stone, pothole, curb or whatever, most of the load is taken on the lower part of the sector shaft bore. In the original design the shaft runs directly in the cast iron of the steering box rather than in separate bushings, for the simple reason that soft bushings cannot take all that pounding as well as cast iron. However, once the bore wears we have no choice but to enlarge it and press in king pin (or similar) bushings as Doug described. A cast iron sleeve may be made up and fitted, but this is probably worth the extra expense only if you drive your car more than most. An even better solution is to fit needle bearings, as will be described later.

While the box is apart, inspect the sector shaft itself for wear, as well as the worm follower peg at the end of the sector arm. Shaft wear is best remedied with a replacement shaft, but if they become unobtainable the old one can be machined undersize, built up by hard chroming, then ground back to standard. Peg wear is usually easy to allow for by adjusting the number of shims under the top plate, but if it is really bad the pin should be replaced by a new one. If, as is often the case, new pegs are not available, press out the old one, rotate it 90°, and press it back in. This provides an unworn surface where the peg rides in the worm.

The top plate almost always requires replacement, since it becomes badly scored rather quickly. The end plate sometimes will show wear where the worm bearing race bears against it; if this is true of yours, then fit a new one. Even when the top and end plates are not worn, they occasionally develop a slight bulge due to the forces working against them. This, too, is reason for replacement. Do not try to grind them down to remove the scoring; this reduces their thickness too much and cuts through the surface hardness, so future wear and bulging will occur all the more rapidly.

While you are at it, fit new ball bearings on either end of the worm gear. These bearings seldom fail, but they are inexpensive so why take a chance. Also check the inner shaft of the steering column for straightness, and make sure it is in perfect alignment with the worm gear. Discrepancies here are a major cause of lumpy steering action, but are difficult to diagnose when the box is assembled. Incidentally, you may find a rubber bushing or grommet around the shaft, about halfway along its length. Its purpose is to prevent the inner shaft from rattling against the tube of the steering column. This rattle can be very annoying, so make sure the bushing is in place. If yours is missing or deteriorated, a fat neoprene O-ring may be used as a replacement, but it must fit snugly around the shaft to keep it from slipping down towards the worm.

Assembly and adjustment of the steering box is fairly straightforward and is explained in the TC owner's manual. It should be emphasized, however, that adjustment should be performed before the box is filled with oil, otherwise the heavy oil will act as a cushion between the parts and give you false readings. If a smear of thin oil is applied during assembly to all bearings and friction points, this will provide adequate lubrication as you make the necessary adjustments. After the correct number of shims for the top plate has been determined, then you can remove the plate and fill the box with SAE 140 gear oil. A small dollop of molybdenum disulfide additive intended for use in gear oil might help to reduce friction a bit, but this is unproven. Under no circumstances should grease be used in the steering box, as it does not provide adequate lubrication of the sector shaft.

**FRONT END ALIGNMENT:** Your last step in this steering overhaul should be to take the car to a reputable alignment shop. Most automobile alignment shops are no longer equipped to handle beam front axles, so you may have to look for a shop equipped to align truck axles. The technicians at the shop have equipment and expertise which enable them to measure caster and camber and make the appropriate adjustments much more quickly and accurately than you can do it on your own. Toe-in can be measured and adjusted easily enough at home, but the shop might as well do it while they have the car. Camber is adjusted by bending the axle beam, so don't bother to paint it before you visit the shop. Caster is equalized on both sides by twisting the axle, then it is brought to the correct final dimension by inserting tapered shims between the axle and the springs. According to M.G. Service Information Sheet No. 10, the axle should not be heated if it can be avoided, because heating tends to destroy the heat treatment applied when the axle was manufactured. Ask the shop to bend the axle cold, if they can. If heat is required, it should be applied only to the area between the spring mounts, never to the outer ends of the axle.

Many owners skip front end alignment under the mistaken assumption that nothing short of a full scale wreck could throw that hefty steel axle out of whack. Don't believe it! A pothole in the road or a good whack against the curb is all it takes, and steering accuracy goes down the drain.

**MAINTENANCE:** Now that the steering system is completely rebuilt, the only way to keep it that way for an acceptable length of time is to clean, lubricate and adjust the various components regularly. The owner's manual recommends lubrication of the king pins and track rod ends every 500 miles, and this is essential even though it is an absurdly short lubrication interval by modern standards. These steering joints are not sealed on the TC, so they are at the mercy of dirt and water, hence the need for frequent lubrication. The steering box and track rod ends should be adjusted once a year, or more often if play develops in the steering.

**MODIFICATIONS:** In his article Doug mentions modifications to the front wheel bearings, the king pin thrust washers, and the top plate of the steering box. Each of these contribute to lighter and more durable steering, but there is even more that can be done by the enterprising owner. Several years ago former Technical Editor Woody Wood made available instructions for several modifications intended to decrease friction in the TC steering, consisting of the use of needle bearings through the steering box and king pin assemblies. A number of cars have been modified according to Woody's instructions, and enough time has elapsed to allow fairly thorough evaluation of these modifications. Let's consider the how-to aspects first, then discuss the pros and cons.

**KING PIN CONVERSION:** This is a reasonably simple modification involving the use of Torrington needle thrust bearings as already described by Doug, and the substitution of Torrington B 1212 OH needle bearings for the standard bronze king pin bushings.

To fit the needle bearings, first knock out the old bushings, then have the steering knuckles bored out to 0.9995-1.0005 in. diameter. The two bores in each knuckle **must** be perfectly aligned with each other, since the bearings themselves cannot be reamed in line like the old bushings. Make sure your machinist understands this. Press the B 1212 OH bearings into the new bores, with the lettered ends out and the oil holes aligned with the grease fittings.

Grease the new bearings thoroughly, then assemble the front end using Torrington NTA 1220 thrust bearings sandwiched between TRA or TRB 1220 hardened washers instead of the original bronze washers. Adjust end play to about 0.004 in. as described earlier. Install the grease nipples, using flat washers under the upper ones to prevent them from screwing in far enough to pinch the bearing shells. Friction is now almost completely eliminated from the king pin assemblies.

**STEERING BOX CONVERSION:** Conversion of the steering box to needle bearings is also fairly simple, but it can be slightly more expensive. First the box is disassembled, cleaned, and inspected, with special attention to the attachment of the steering column tube as already described.

Now have your machinist enlarge the sector shaft bore to 0.9995-1.0005 in. diameter. As has already been said, it is essential that the new bore be concentric to the old one and perpendicular to the worm gear. Into the top of the enlarged bore press a Torrington B126 needle bearing. It should be pressed in until it is flush with the top of the bore, but no farther, otherwise it may interfere with the worm gear. Now flip the box over, and into the bottom of the bore press a Torrington JT 1213 bearing, with its oil seal at the outer end. Because of the seal built into this bearing, the old felt seal and its retainer are no longer necessary, but you may keep them as a second line of defense if you wish.

According to Woody, the sector shaft must be ground slightly undersize, hard chromed, then ground back to standard diameter (.7495-.7505 in.) to ensure durability in the needle bearings. This step is highly recommended, as it will indeed ensure extremely long shaft life. It is, however, an expensive operation, so several people have chosen to run unchromed shafts in the needle bearings. As far as I know none of these cars have been driven far enough to test the durability of the unchromed shafts. If you want to try this approach, the shaft must be in as-new condition: no wear and no scoring.

If this conversion is used in conjunction with a Torrington B 1416 needle bearing at the top of the column (see Doug's article) and a Thompkins Kit in place of the standard top plate, the only serious friction point remaining in the box is where the follower peg runs against the worm gear. It might even be possible to arrange for the peg to rotate in a needle bearing pressed into the sector arm, but as far as I'm aware this has never been done.

Moss Motors' Thompkins Kit is a bargain at its price, but if yours is to be a low budget conversion you can achieve fairly good results with an adjusting bolt installed in the original top cover. Instead of the pointed 5/16" bolt suggested in Doug's article, I prefer a plain ⅜" bolt. The top end of the sector shaft is center-drilled during manufacture, and in order for the smaller pointed bolt to operate properly the point must register precicely in this drilling. This is not easily accomplished, and the result is sometimes more drag in the box than before. The larger flat-ended bolt spans the center drilling and bears directly on the flat top of the shaft. With this arrangement the location of the bolt relative to the centerline of the sector shaft is not quite so critical, although you should still try to get it as close to dead center as possible. To allow more sensitive adjustment, use a fine-threaded bolt (BSF or UNF) rather than a coarse-threaded one. Done properly, this modified top plate will eliminate quite a lot of friction, but not as much as the needle bearing thrust washer used in the Thompkins Kit.

**FRONT HUB CONVERSION:** Doug suggested converting to Fag tapered roller bearings, but in my area and many others Timken bearings are more readily available. Parts required are four 07204 cups, two 07097 cones, and two 07079 cones, plus two new standard grease seals. Note that in the part numbers for the Timkin bearing cones the last two digits are reversed, the numbers being othersie identical. This is **not** a mistake, so be careful to order the right parts.

After removing the old seals and bearings, clean the hubs thoroughly. One 07204 cup, which forms the outer race for the bearings, is then pressed into each end of the hub. If the cups are a loose fit, then bed them in Loctite Bearing Mount. If this doesn't tighten them up, then the hubs are too worn for further service. Now test the fit of the cones on the steering knuckle. They should slide on fairly freely without resorting to force, but there must be no discernable play between inner race and steering knuckle. Grease the inner bearing cone and insert it into the hub, then press in a new seal until it is flush with the end of the hub. Now slide the hub onto the steering knuckle, insert the outer bearing cone, and secure the assembly with the original washer and nut. Do not insert the old spacer tube between the bearings, as this will make adjustment impossible.

To adjust these bearings, first torque the nut to about 10 ft. lb. while rotating the hub slowly. This will settle the bearings into their final positions. Do not tighten more than this or you may damage the bearings. Now back the nut off slightly. Correct axial play for this type of bearing should be in the 0.001 - 0.005 in. range. This can be measured with a dial indicator, but there is an easier way which is surprisingly accurate despite its apparent crudeness. Starting with the nut just barely finger tight, tighten it gradually until it is no longer possible to move the washer sideways with the tip of a screwdriver. Now back off slowly until the washer will just barely move when you push on it. Try it several times to make sure you have it right. Carefully done, this will provide the right amount of play in the bearings. Some of you may recognise this as an old Volkswagen trick, which it is, but it works equally well when tapered roller bearings are used in the TC. If the cotter pin hole does not line up properly, do not tighten or loosen the nut until it does. Instead, grind the thrust face of the nut until the hole lines up without over-tightening. It is extremely important that the correct axial play be maintained in these bearings, otherwise their life will be as short as that of the original ball bearings.

**PROS & CONS:** By modifying both the steering box and the king pins as described above, the majority of the friction is removed from the steering system. The effort required to turn the steering wheel is reduced dramatically. Indeed, parking and low-speed maneuvering can be done with very little exertion, quite unlike the original. There is, unfortunately, one rather serious drawback.

Not many TCs have been given the full conversion treatment, but in every case that I know of high-speed controlability and directional stability have actually been worse than the original. At highway speeds the front wheels dart this way and that in violent reaction to every imperfection in the road: every bump, dip, pothole, rock, ripple, and every change in road camber and banking. High speed shimmy also becomes a serious problem, especially if the wheels are not perfectly true and balanced.

Assuming that the chassis and axles are straight, steering geometry is properly adjusted, moving parts and unworn, and the wheels are trued and balanced, this strange behavior would seem to indicate that something inherent in the modifications is at fault. The tapered roller bearings in the front hubs are not to blame. If they are kept properly lubricated and adjusted these bearings will last many miles beyond the life expectancy of the original ball bearings, thus preventing shimmy-inducing looseness in the hubs. In the course of the modifications we have not altered any of the critical steering dimensions (caster, camber, king pin inclination, toe-in, etc.), so the modifications cannot be faulted on this account. This leaves only one other possibility: the great reduction in friction. As it turns out, this is the culprit. The owner who goes the full conversion route to eliminate the arch-enemy friction will discover that by removing so much of it he has created a steering system even worse than the original. How is this possible?

Many years ago it was fairly common for the steering systems of higher-quality cars to be relatively friction-free, with ball, roller and needle bearings used in liberally in attempt to keep steering effort down. The fact that steering effort remained high was attributable mainly to the fact that steering geometry was crude by modern standards and the steering was often extraordinarily quick. Steering box gearing was often such that only one turn (or less) of the steering wheel would move the front wheels from lock to lock. These relatively friction-free steering systems were reasonably effective as long as the poor roads and low-powered engines of the day kept road speeds low. However, as road conditions improved and power increased, the resulting higher speeds brought to light serious problems in the form of wander and high-speed shimmy.

Steering geometry was improved somewhat in an attempt to find a cure, but there was not much room for improvement within the limitations of the solid beam front axle, and few manufacturers were willing to experiment with the revolutionary new independent front suspension concept. Eventually it was discovered that the tendency to dart and shimmy could be controlled to some extent by incorporating some sort of dampening action in the system. On some cars this took the form of a hydraulic or friction damper added to the steering linkage, but in most instances it was sufficient to simply do away with some of the frictionless bearings and go back to plain bushings. The friction provided by these bushings was not terribly high if they were kept lubricated, but it was sufficient in most cases to dampen out the oscillations of the wheels which caused shimmy, and to prevent the wheels from reacting so violently to changing road surfaces.

Ever since the early 1930's the normal approach has been to use a steering box and steering linkage made as friction-free as possible, within the economic limitations of the manufacturer, but to use plain bushings and thrust washers in the front end. In this respect the TC is nothing unusual, bearing in mind the implications of those words "economic limitations". Remember, the M.G. has always been a relatively inexpensive sports car, and although it is remarkably well-built for a car in its price range, some short-cuts were inevitable if the price was to be kept low. The much-maligned Bishop Cam steering box is probably an excellent example. As used in more expensive cars, the Bishop Cam box usually had frictionless bearings throughout, sometimes even at the peg. In this form the steering box was about as good as most of its contemporaries, if not slightly better. For our inexpensive M.G.s, however, a cheaper version was chosen which has frictionless bearings only on the worm gear. Because of this, internal friction is relatively high and durability is rather poor.

Getting back to our original discussion, it seems clear that the all-out needle bearing conversion does not work due to insufficient dampening characteristics, and we have seen how this problem was approached by other manufacturers. How far, then, can we go toward eliminating friction, and where is the best place to eliminate it? There are two schools of thought here. The first maintains that it is best to concentrate friction-reducing efforts on the king pins, leaving the steering box more or less standard. The second prefers to leave the king pins standard, but to make the steering box as friction-free as possible. There is a certain amount of merit to each of these approaches, as well as certain disadvantages.

Most owners seem to prefer the first approach, that of eliminating friction only at the king pins. The reason usually given is that this makes the steering box's job easier, resulting in decreased wear. This is true up to a point; because friction is greatly reduced at the king pins, less effort is required to turn the steering wheel, and this means less strain on the steering box. What is not taken into account, however, is that the wheels still react to road conditions. Since the dampening effect of the old king pin bushings is now gone, this reaction is transmitted with greater intensity via the steering linkage straight back to the steering box. The standard box is not designed to withstand this extra pounding, so the bottom of the sector shaft bore and the worm follower peg wear out just as rapidly as before. As the wear increases, steering quality deteriorates, and pretty soon we're right back where we started from. In all fairness, however, it should be pointed out that this will take a long time to happen on the average "sit still and look pretty" TC of today.

There is another possible disadvantage to the modified king pin approach, although I hesitate to mention it because it is largely theoretical and not yet proven in practice. Several years ago a TC-driving engineer friend told me that he and his associates analyzed the comparative strengths of the standard and converted steering knuckles. In their opinion the amount of material removed from the bored-out modified knuckle is such that the knuckle is only marginally strong enough to withstand the loads placed on it. I have never heard of a converted steering knuckle breaking, but this does not mean that we should dismiss the possibility altogether. A converted knuckle might hold up beautifully for mile after mile of normal use, only to break when subjected to unusually high cornering loads or the pounding of a really bad road. Then again, it might not. Who wants to be the first to find out?

In my opinion, the second approach to steering modification is the more desireable of the two. By retaining the standard king pin bushings and thrust washers, we also retain the necessary amount of dampening action at the front end, where it does the most good. Although this may mean that strain on the steering box remains high as we turn the streeing wheel, it also means that less strain is put on the box as road conditions attempt to deflect the front wheels this way and that. The problem of steering box wear is nearly eliminated, except at the worm follower peg, by the use of needle bearings on the sector shaft and by installing a Thompkins Kit or similarly modified top cover. As a pleasant by-product a great deal of friction is removed from the steering, which is noticeably lighter. If the king pin bushings are lubricated as frequently as called for in the manual, if the steering box is topped up and adjusted regularly, and if the wheel bearings and track rod ends are cleaned, lubricated and adjusted regularly, then the steering will stay reasonably light and accurate for a very long time even on a car driven daily.

As a further demonstration of the desireability of this approach, consider the fact that this is similar to the approach used on most modern cars. The typical modern car has a steering box which makes liberal use of frictionless bearings, resulting in even less internal friction than can be achieved in a fully converted TC steering box. However, at the front end even the modern ball joint arrangement is less free of friction than TC king pins running in needle bearings. I suspect that manufacturers would use relatively inexpensive needle bearings in the front end if they thought it was the way to go, but instead they leave the front end alone and concentrate on the development of relatively expensive power steering units to make steering easier. There must be a lesson for us here, unless, that is, we are foolish enough to think we know more about steering design than the pros do.

There are two disadvantages to this approach, one real and the other theoretical. The real disadvantage is that it is more expensive than the king pin conversion. This is due to the extra machining and hard-chroming required to make the sector shaft durable in the needle bearings. This expense is balanced, however, by the fact that the sector shaft will now be really bullet proof, and after all this is what we're after. The theoretical disadvantage is due to the way the Thompkins Kit or modified cover plate take the thrust at the top of the sector shaft, rather than out on the sector arm directly above the peg. This obviously puts more strain on the sector arm, since the action of the worm gear constantly tries to push the peg out of the worm, and it is possible that the sector arm might eventually break under the strain. On the other hand, there are literally hundreds of these Thompkins Kits in use, and even more modified top plates running around, and I do not know of a single case where the sector arm has broken. Nevertheless, it makes good sense to have the arm magnafluxed before you install it, whether or not the box is to be modified.

The preferred course of action, then, would seem to be as follows. Make sure the frame is straight, the springs are good, the axles are aligned with the frame, and the wheels are true and balanced. Rebuild the steering box, king pins and track rod ends to standard as-new condition. Install tapered roller bearings in the front hubs. Finally, have caster, camber and toe-in adjusted by a professional alignment shop. Assuming that your steering was as bad as most before you started, you will probably be amazed at how much better it is with all components brought to as-new condition.

If you are still unsatisfied with the effort required to turn the steering wheel, then modify the steering box as described earlier. If this still is not enough, then try needle bearing thrust washers at the front end. If this improves matters, all well and good. If, on the other hand, the car becomes hard to control, you can easily convert back to standard bronze thrust washers since no machinework has been done. If you take the final step of converting the king pin bushings to the needle bearing type, remember that this step is not easily reversable. If it should be necessary to do so, friction can be added back into the system only by obtaining new steering knuckles, since the machinework done in the course of the conversion precludes the possibility of refitting standard bushings.

As Doug has already said, don't expect miracles. The TC can be made to steer very nicely with a bit of work, but it will never steer as easily as a modern car. The archaic geometry of the front axle is partly responsible, and very little can be done about this. Also to blame is the extremely quick steering ratio. Only one and a half turns of the steering wheel take the front wheels from lock to lock, and this puts the TC driver at a mechanical disadvantage compared to the driver of a more modern sports car. The only cure for this is to install a steering box from another car. This has been done, but it is not easy to do nor is it a modification to be lightly undertaken.

| Model | TA/TB | TC |
|---|---|---|
| Caster On Axle | +3° | +3° |
| Caster On Frame | +3° | +5° |
| Packing | Nil | -2½° |
| Total Caster | +6° | +5½° |
| King Pin Angle | -7½° | -7½° |
| Knuckle Angle | 10½° | 10½° |
| Camber | +3° | +3° |
| Toe-In | 3/16" | 1/4" |

*Table shows all important steering angles for TA, TB & TC. Alignment shop needs to know specs for total caster, camber & toe-in. Other specs are for checking & rebuilding individual components only.*

## BOLTS AND NUTS M.G. STYLE

Another question which has come up with increasing frequency concerns the threaded fittings (bolts, nuts, studs, etc.) used on our M.G.s from the pre-BMC era. Some of the questions are real doozies, such as "Some idiotic former owner re-tapped all the threaded holes in my engine to accept metric bolts. How can I convert back to Whitworth?". Or how about "I thought all foreign cars used metric bolts and nuts. How come my metric wrenches won't fit most of the bolts and nuts on my M.G.?". Or "Why is it that most of the bolts on my M.G. are British Standard Fine, but the ones in the engine are British Cycle Standard?" Most of the questions are not quite so far fetched as these but it is obvious that much confusion and misinformation exist concerning the types of bolts and nuts found on these cars.

Most of what follows is simply a re-write of an article I wrote for **The Chesapeake Square Rigger** about four years ago, and which was reprinted in TSO shortly thereafter.

Most of you are probably familiar with the thread forms used on most American bolts and nuts in automotive applications, and now that American industry is slowly converting over to metrics you might also be familiar with the modern ISO Standard (International Standardization Organization) metric fittings. Unfortunately, with very few exceptions you will not find either of these types in or on your M.G. There are four basic thread forms used on T-Series and earlier cars:

**1. WHITWORTH FORM:** This thread form was originally proposed by Sir Joseph Whitworth in 1841, and was adopted as the standard of British industry a few years later. The original Whitworth threads were roughly equivalent (**very** roughly) to our modern American National Coarse threads, and although the name had been chaged to **British Standard Whitworth (BSW)**, this thread form was still in use when our T-Types were manufactured. In the early part of this century a need was felt for threads with a finer pitch than the original Whitworth form, so a new type called **British Standard Fine (BSF)** was devised. This type is roughly equivalent (again, only **very** roughly) to our own American National Fine thread form. The Whitworth Form also includes two pipe thread types: **British Standard Pipe (BSP)** whih has straight threads, and **British Standard Pipe Tapered (BSPT)** which has tapered threads. These pipe threads also have rough American equivalents.

American systems use coarse and fine threads for applications where coarse or fine are needed, and both types are measured in inches. The similarity ends there. On Whitworth fittings, the angle formed by the vee between two adjacent threads is 55°, while on American National fittings this angle is 60°. On Whitworth threads, the top (crest) of each thread and the valley (root) between threads is rounded off, while on American National threads the crests and roots are flattened off. Also, except for a few of the coarse-pitched sizes (BSW & ANC), the number of threads per inch on bolts of the same diameter will be found to be very different when the British and American forms are compared.

Most of the bolts and nuts used in the chassis and body are BSF, but you will occasionally find a BSW fitting thrown in to confuse things. All fuel, oil and brake line fittings use BSP threads.

**2. BRITISH ASSOCIATION FORM:** This thread form was originally developed by the Swiss for very small watch and clock screws, and you will therefore sometimes hear the type referred to as the "Swiss Small Screw Standard". The British adopted this thread form in 1903 and call it the **British Association (BA)** thread. The crests and roots of BA threads are rounded as in the Whitworth form, but the angle formed between adjacent threads is only 47½°. BA sizes are designated by the numbers OBA through 16BA, similar to our American machine screws, but in the BA system the larger numbers designate the smaller screws. Odd-numbered sizes (3BA, 5BA, etc.) are seldom used, and nothing smaller than 8BA is normally used in automotive work.

You will find many 2BA machine screws and nuts used in your chassis and body where bolts smaller than ¼BSF are required. Smaller BA sizes are used in instruments and electrical componants.

**3. LORD NUFFIELD'S MAD METRIC FORM:** This is a made-up name, since I know of no official name for the weird assortment of bolts, nuts and studs used in the XPAG/XPEG engines and transmissions. Morris, Wolseley and M.G. engines and transmissions were made in the Morris Engines plant, which until 1923 had been a Hotchkiss munitions plant. Hotchkiss was a French company, and their Coventry plant was built in 1915 when it seemed that the home plant would soon be overrun by the advancing German army. When Morris bought the Coventry plant in 1923, he decided to retain all the metric tooling. For some reason the tooling never was converted over to British standard, even though the original French Standard taps, dies and so forth must have worn out long before the era of the T-Series. For this reason all threaded parts in the XPAG/XPEG engine use the French Metric thread form.

To add more to the confusion, the old French Standard metric form differs somewhat from the modern I.S.O. Standard form. The thread angle is 60° in both forms, but the thread pitch is sometimes different. For example, a modern 8mm bolt normally has a pitch of 1.25mm, while an 8mm French Standard bolt had a pitch of 1mm. The majority of the bolts and nuts used in the XPAG/XPEG are 8x1mm, but since this is an obsolete type you won't find them at the local Volkswagen parts counter.

As a concession to the British motorist, and to further confound later generations, Morris decided to use Whitworth hex heads on his French Standard bolts and nuts so that Whitworth wrenches could be used to turn them. As if that were not enough, there seems to be no standardization of hex head sizes on these fittings. For example, some of the 8x1mm bolts in the XPAG/XPEG have 3/16W heads, while other 8x1mm bolts in the same engine will be found to have 1/4W heads. All these odd-sized nuts and bolts had to be made to special order for Morris, so one would think that it would have been less expensive in the long run to have converted the tooling at the engines plant over to Whitworth sizes. Sir William Morris (who later became Lord Nuffield) was a great one for cutting costs, though, so he must have known what he was doing. Still, it does cause one to wonder.

**4. UNIFIED FORM:** Some time during World War II, Great Britain, Canada and the U.S.A. got together to decide upon a standard thread form for all three countries to use, and the Unified Form was the result. What actually happened was that we Americans were manufacturing great quantities of war materials for Great Britain, and had found that the cost of converting our factories to Whitworth tooling was rather high. To prevent this problem from arising in the future, we more or less said "Adopt our thread standards or else". The result was that the new Unified threads were almost identical to our American National threads. The differences between the two are almost nonexistant, in fact they are so close that they can be used interchangeably. The official names in the U.S. for this thread type are now Unified National Fine (UNF) and Unified National Coarse (UNC), although in common usage they are more often referred to by the older names, American National Fine (ANF) and American National Coarse (ANC), or by the even older names SAE and USS.

I have heard claims to the effect that you can sometimes use American bolts (UNF or UNC) with Whitworth nuts (BSF or BSW) or vice-versa. It is true that some of the coarse threads (UNC & BSW) can be screwed together, since the pitch of the threads is the same in some sizes, but it should not be done. For one thing, the thread angles are not the same: 55° for BSF and BSW, as opposed to 60° for UNF and UNC. You might be able to screw some BSW and UNC nuts and bolts together, but the difference in thread angle will prevent the threads from making full contact. You run the risk of galled or stripped threads, and the resulting joint will be a weak one. Luckily there are very few BSW fittings used in the T-Types, so this problem should never come up. Most T-Type bolts and nuts are BSF, and since BSF and UNF threads do not have similar pitches you couldn't screw them together if you wanted to. Examine the tables accompanying this article and you'll see what I mean.

I seem to have gotten a bit carried away here, since Unified fittings play a very small part in the T-Series scene. Unified nuts and bolts are found only in the rear axle, driveshaft, front and rear wheel hubs and spare tire carriers of cars beginning with chassis number TD12285. The Unified form was officially adopted by Great Britain during the war, but it took a while for the changeover to get under way. It's really just as well; the Whitworth thread form is actually a bit stronger than the Unified thanks to the rounded shape of the threads. Maybe that's why our cars have held together so long!

So much for the threads; now let's talk about the wrenches you need to turn them. You can use American Standard and Metric wrenches, but you will need a set of each. Some American wrenches will fit some British bolts, and some Metric wrenches will fit others, but neither type by itself will fit all British fittings. Also, none of the American or Metric wrenches will fit the British hex heads really well, so the eventual result will be rounded-off heads or sprung wrench jaws. To do the job right you will need wrenches made to fit the bolts and nuts you want to turn. You need two types for pre-Unified cars and three types for the later cars.

**1. Whitworth or British Standard Wrenches:** These wrenches will fit all bolts and nuts on the car except for the small BA fittings and the Unified fittings found on later cars. These are usually called Whitworth wrenches, but actually there are two types: Whitworth and British Standard. Don't let that worry you, since the only difference is the way the sizes are designated. They all fit the same bolts and nuts. British Standard wrench sizes correspond with the diameter of the bolts they fit. In other words, a 1/4BSF or 1/4BSW bolt is turned by a 1/4BS wrench. However, if you are using wrenches with Whitworth size markings, the same ¼" bolt will be turned by a 3/16W wrench. The reason for this is a bit obscure, but it has something to do with the fact that the hex head sizes originally used on Whitworth fasteners were once somewhat larger than they are now. A set of British Standard or Whitworth wrenches is needed for all pre-1956 M.G.s.

**2. British Association Wrenches:** These fit the BA bolts and nuts used in various parts of the car. They are numbered OBA through 8BA, just like the bolts and nuts they fit. Needed for all pre-1956 M.G.s.

**3. American Standard Wrenches:** These are needed only if you have a late TD or TF with Unified fittings in the rear axle, or if you or wome previous owner has substituted Unified bolts and nuts for some of the original British Standard ones in earlier cars.

There are several good souces for Whitworth, British Standard and British Association wrenches. At one time you could order very nice Craftsman wrenches in Whitworth sizes from your nearest Sears catalog store, but those days are long gone. Snap-On, which has distributors in most areas, sells an excellent selection of open-end, box-end, combination and socket wrenches in BS and BA sizes. Snap-On wrenches are considered by many professional mechanics to be the best available, and they are recommended for anyone who expects to give his tools many years of long hard use. Moss Motors, Abingdon Spares and most of the other T-Series parts suppliers also carry good selections of high-quality wrenches to fit your M.G., and in most cases their prices are a bit lower than Snap-On's.

There are also a number of good sources for replacement bolts and nuts for your car. If you will be needing a large supply of BSF or BA fittings, possibly in preparation for a complete restoration, then you will do well to contact Metric & Multistandard Componants Corporation, 198 Saw Mill River Road, Elmsford, N.Y. 10523. They offer a large selection of British bolts and nuts, plus wrenches, taps and dies in British sizes, and their prices are the lowest I've found provided your order is for $5 or more. If you need only a few pieces, then Moss Motors, Abingdon Spares and the other T-Series parts suppliers are your best bet. Their prices are generally a bit higher for individual nuts and bolts, but ordering from them is much more convenient. Thanks to the gradual demise of the British motocycle industry, motorcycle shops specializing in British bikes are becoming hard to find. However, if you still have one in your area you might find it a convenient local source of British Standard bolts, nuts and tools. Most British motorcyles continued the use of British Standard fittings until the mid to late 1960s, so many British motorcycle shops still carry stocks of these now-obsolete items.

If you need "Mad Metric" fittings for your engine and transmission, then you will have to go to Moss, Abingdon et al. These bolts and nuts are peculiar to older Nuffield products, and cannot be obtained anywhere else. If you sift through the Metric & Multistandard Componants catalog you will find a few metric sizes with threads matching the Nuffield types, but they are only in lower-quality grades and the hex heads are suited to modern metric wrenches. Unless you really enjoy rummaging through several different sets of wrenches to find one which fits, stick to the original type from a T-Series parts house.

That covers the subject well enough for the time being, I think. Happy wrenching!

The following tables show the diameter, pitch and wrench size of the threaded fittings used on your M.G.

**BRITISH STANDARD WHITWORTH & BRITISH STANDARD FINE**

| Nominal Diameter | Pitch (Threads/In.) BSW | BSF | Wrench Size Whit. | BS |
|---|---|---|---|---|
| 1/4 in. | 20 | 26 | 3/16 W | 1/4 BS |
| 5/16 in. | 18 | 22 | 1/4 W | 5/16 BS |
| 3/8 in. | 16 | 20 | 5/16 W | 3/8 BS |
| 7/16 in. | 14 | 18 | 3/8 W | 7/16 BS |
| 1/2 in. | 12 | 16 | 7/16 W | 1/2 BS |
| 9/16 in. | 12 | 16 | 1/2 W | 9/16 BS |

**BRITISH STANDARD PIPE**

| Nominal Size | Actual Diameter | Pitch (Threads/In.) |
|---|---|---|
| 1/8 BSP | .383 in. | 28 |
| 1/4 BSP | .518 in. | 19 |
| 3/8 BSP | .656 in. | 19 |
| 1/2 BSP | .825 in. | 14 |

Wrench size will vary depending upon whether the fitting is used on a pipe, as a plug, or whatever.

**BRITISH ASSOCIATION**

| Size | Diameter | Pitch (t.p.i.) | Wrench |
|---|---|---|---|
| 8BA | .87 in. | 59.1 | 8BA |
| 6BA | .110 in. | 47.9 | 6BA |
| 4BA | .142 in. | 38.5 | 4BA |
| 2BA | .185 in. | 31.4 | 2BA |
| OBA | .236 in. | 25.4 | OBA |

**NUFFIELD'S MAD METRIC**

| Diameter | Pitch | Wrench (Whitworth) | Wrench (BS) |
|---|---|---|---|
| 5 mm | .75 mm | 1/8 W | 3/16 BS |
| 6 mm | 1.00 mm | 3/16 W or 1/4 W | 1/4 BS or 5/16 BS |
| 8 mm | 1.00 mm | 3/16 W or 1/4 W | 1/4 BS or 5/16 BS |
| 10 mm | 1.50 mm | 5/15 W or 3/8 W | 3/8 BS or 7/16 BS |
| 12 mm | 1.50 mm | 7/17 W or 1/2 W | 1/2 BS or 9/16 BS |

**UNIFIED NATIONAL (or AMERICAN NATIONAL)**

| Nominal Diameter | Pitch (Threads/In.) UNC | UNF | Wrench Size |
|---|---|---|---|
| 1/4 in. | 20 | 28 | 3/8 U.S. |
| 5/16 in. | 18 | 24 | 1/2 U.S. |
| 3/8 in. | 16 | 24 | 9/16 U.S. |
| 7/16 in. | 14 | 20 | 5/5 U.S. |
| 1/2 in. | 13 | 20 | 3/4 U.S. |
| 9/16 in. | 12 | 18 | 7/8 U.S. |

Unified nuts sometimes require a larger wrench than the bolts they fit. Example: A nut which fits a 1/4 UNC bolt may require a 7/16 wrench instead of a 3/8 wrench.

# PRODUCTION DATES

## TA

| | 1936 | | 1937 | | 1938 | | 1939 | |
|---|---|---|---|---|---|---|---|---|
| Jan. | | | 6 | TA/1016 | 19 | TA/2044 | | |
| | | | 18 | TA/1063 | 26 | TA/2083 | 30 | TA/3073 |
| Feb. | | | 8 | TA/1064 | 2 | TA/2084 | 6 | TA/3074 |
| | | | 23 | TA/1095 | 23 | TA/2143 | 27 | TA/3143 |
| Mar | | | 1 | TA/1096 | 1 | TA/2144 | 6 | TA/3144 |
| | | | 31 | TA/1205 | 29 | TA/2284 | 28 | TA/3238 |
| Apr. | | | 2 | TA/1206 | 4 | TA/2285 | 3 | TA/3239 |
| | | | 29 | TA/1259 | 26 | TA/2374 | 17 | TA/3253 |
| May | | | 4 | TA/1260 | 2 | TA/2375 | | |
| | | | 19 | TA/1411 | 23 | TA/2459 | | |
| Jun | 25 | TA/0253 | 1 | TA/1412 | 1 | TA/2460 | | |
| | 26 | TA/0272 | 29 | TA/1547 | 28 | TA/2509 | | |
| Jul | 2 | TA/0273 | 6 | TA/1548 | 5 | TA/2510 | | |
| | 29 | TA/0386 | 27 | TA/1628 | 26 | TA/2549 | | |
| Aug. | 18 | TA/0387 | ? | TA/1629 | 15 | TA/2550 | | |
| | 26 | TA/ 490 | ? | TA/1723 | 31 | TA/2612 | | |
| Sep. | 1 | TA/ 491 | 9 | TA/1724 | 5 | TA/2613 | | |
| | 30 | TA/ 685 | 29 | TA/1765 | 27 | TA/2712 | | |
| Oct. | 5 | TA/ 686 | 6 | TA/1766 | 3 | TA/2713 | | |
| | 28 | TA/ 820 | 27 | TA/1865 | 31 | TA/2857 | | |
| Nov. | 3 | TA/ 821 | 3 | TA/1866 | 1 | TA/2858 | | |
| | 30 | TA/ 955 | 30 | TA/1980 | 29 | TA/2962 | | |
| Dec. | 8 | TA/ 956 | 7 | TA/1981 | 6 | TA/2963 | | |
| | 23 | TA/1015 | 20 | TA/2043 | | | | |

## MG — TB

| | 1939 | |
|---|---|---|
| May | 11 | TB/0253 |
| | 25 | TB/360 |
| Jun | 7 | TB/361 |
| | 28 | TB/425 |
| Jul | 4 | TB/426 |
| | 25 | TB/505 |
| Aug. | 23 | TB/506 |
| | 31 | TB/532 |
| Sep. | 1 | TB/533 |
| | ? | TB/610 |

## MG — TC

| | 1945 | | 1946 | | 1947 | | 1948 | | 1949 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | | | 1 | 0352 | 1 | 2052 | 5 | 4412 | 5 | 7503 |
| | | | 31 | 0432 | 31 | 2281 | 29 | 4667 | 31 | 7775 |
| Feb. | | | 5 | 0433 | 3 | 2282 | 2 | 4668 | 1 | 7776 |
| | | | 28 | 0512 | 10 | 2341 | 26 | 4902 | 25 | 8038 |
| Mar. | | | 5 | 0513 | 5 | 2342 | 1 | 4903 | 3 | 8039 |
| | | | 27 | 0600 | 31 | 2490 | 31 | 5140 | 31 | 8335 |
| Apr. | | | 1 | 0601 | | 2491 | 1 | 5141 | 1 | 8336 |
| | | | 30 | 0711 | 30 | 2681 | 30 | 5397 | 28 | 8571 |
| May | | | 1 | 0712 | 1 | 2682 | 4 | 5398 | 2 | 8572 |
| | | | 31 | 0871 | 30 | 2881 | 28 | 5608 | 31 | 8858 |
| June | | | 3 | 0872 | 2 | 2882 | 1 | 5609 | 1 | 8859 |
| | | | 28 | 1031 | 30 | 3101 | 30 | 5911 | 30 | 9127 |
| July | | | 7 | 1032 | 2 | 3102 | 1 | 5912 | 1 | 9128 |
| | | | 25 | 1181 | 24 | 3281 | 23 | 6150 | 22 | 9329 |
| Aug. | | | 12 | 1182 | 11 | 3282 | 10 | 6151 | 8 | 9330 |
| | | | 29 | 1301 | 29 | 3451 | 31 | 6374 | 31 | 9566 |
| Sept. | 17 | TC/0252 | 3 | 1302 | 1 | 3452 | 1 | 6375 | 1 | 9567 |
| | 28 | TC/0272 | 28 | 1501 | 30 | 3681 | 30 | 6701 | 30 | 9845 |
| Oct. | 16 | TC/0273 | 2 | 1502 | 1 | 3682 | 1 | 6702 | 3 | 9846 |
| | 30 | TC/0285 | 31 | 1711 | 30 | 3951 | 29 | 6976 | 27 | 10065 |
| Nov. | 1 | TC/0286 | 1 | 1712 | 3 | 3952 | 3 | 6977 | 1 | 10066 |
| | 26 | TC/0315 | 29 | 1887 | 26 | 4171 | 26 | 7244 | 29 | 10251 |
| Dec. | 6 | TC/0316 | 2 | 1888 | 1 | 4172 | 1 | 7245 | | |
| | 21 | TC/0351 | 31 | 2051 | 31 | 4411 | 24 | 7502 | | |

## MG — TD

| | 1949 | | 1950 | | 1951 | | 1952 | | 1953 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | | | 2 | TD/0349 | 1 | TD/5170 | 1 | TD/12580* | 1 | TD/23635 |
| | | | 31 | TD/0612 | 31 | TD/5799 | 31 | TD/13374 | 30 | 24631 |
| Feb. | | | 1 | TD/0613 | 2 | TD/5800 | 1 | TD/13375 | 2 | 24632 |
| | | | 28 | TD/0338 | 28 | TD/6391 | 28 | TD/14064 | 27 | 25623 |
| Mar. | | | 1 | TD/0839 | 1 | TD/6392 | 3 | TD/14065 | 2 | 25624 |
| | | | 31 | TD/1173 | 30 | TD/6948 | 31 | TD/14797 | 31 | 26487 |
| Apr. | | | 3 | TD/1174 | 3 | TD/6949 | 1 | TD/14798 | 1 | 26488 |
| | | | 28 | TD/1469 | 2727 | TD/7467 | 30 | TD/15561 | 30 | 27285 |
| May | | | 1 | TD/1470 | 1 | TD/7468 | 1 | TD/15562 | 1 | 27286 |
| | | | 31 | TD/1846 | 31 | TD/8041 | 30 | TD/16746 | 29 | 28127 |
| June | | | 1 | TD/1847 | 1 | TD/8042 | 4 | TD/16747 | 3 | 28128 |
| | | | 30 | TD/2320 | 29 | TD/8701 | 30 | TD/17646 | 30 | 28964 |
| July | | | 3 | TD/2321 | 2 | TD/8702 | 1 | TD/17647 | 1 | 28965 |
| | | | 28 | TD/2722 | 26 | TD/9362 | 25 | TD/18606 | 24 | 29723 |
| Aug. | | | 14 | TD/2723 | 13 | TD/9363 | 11 | TD/18607 | 10 | 29724 |
| | | | 31 | TD/3058 | 31 | TD/9928 | 29 | TD/19345 | 17 | 29915 |
| Sept. | | | 1 | TD/3059 | 3 | TD/9929 | 1 | TD/19346 | | |
| | | | 29 | TD/3592 | 28 | TD/10655* | 30 | TD/20433 | | |
| Oct. | | | 2 | TD/3593 | 1 | TD/10656 | 1 | TD/20434 | | |
| | | | 31 | TD/4123 | 31 | TD/11322 | 31 | TD/21576 | | |
| Nov. | 10 | TD/0251 | 1 | TD/4124 | 1 | TD/11323 | 3 | TD/21577 | | |
| | 25 | TD/0273 | 30 | TD/4724 | 30 | TD/12100 | 28 | TD/22612 | | |
| Dec. | 5 | TD/0274 | 1 | TD/4725 | 3 | TD/12101 | 1 | TD/22613 | | |
| | 20 | TD/0348 | 22 | TD/5169 | 20 | TD/12577 | 31 | TD/23634 | | |
| | | | | *Oct. 4 | | TD/10347 | *Jan 2 | TD/12578 | | |
| | | | | Oct 4 | | TD/10374 | | TD/12579 | | |

## MG — TF

| | 1953 | | | 1954 | | 1955 | |
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| Jan. | | | | 4 | HDE 43/2178 | 4 | /8644 |
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| Feb. | | | | 1 | HDC 46/2943 | | |
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| Mar. | | | | 2 | HDP 26/3626 | | |
| | | | | 31 | HDA 46/4552 | | |
| Apr. | | | | 2 | HDA 16/4552 | 4 | /10100 |
| | | | | 30 | HDE 23/5226 | | |
| May | 12 | Home | 0250 | 3 | HDE 23/5227 | | |
| | PROTOTYPE | | XPAG/TD 3/26849 | 31 | HDC 46/5946 | | |
| June | | | | | | | |
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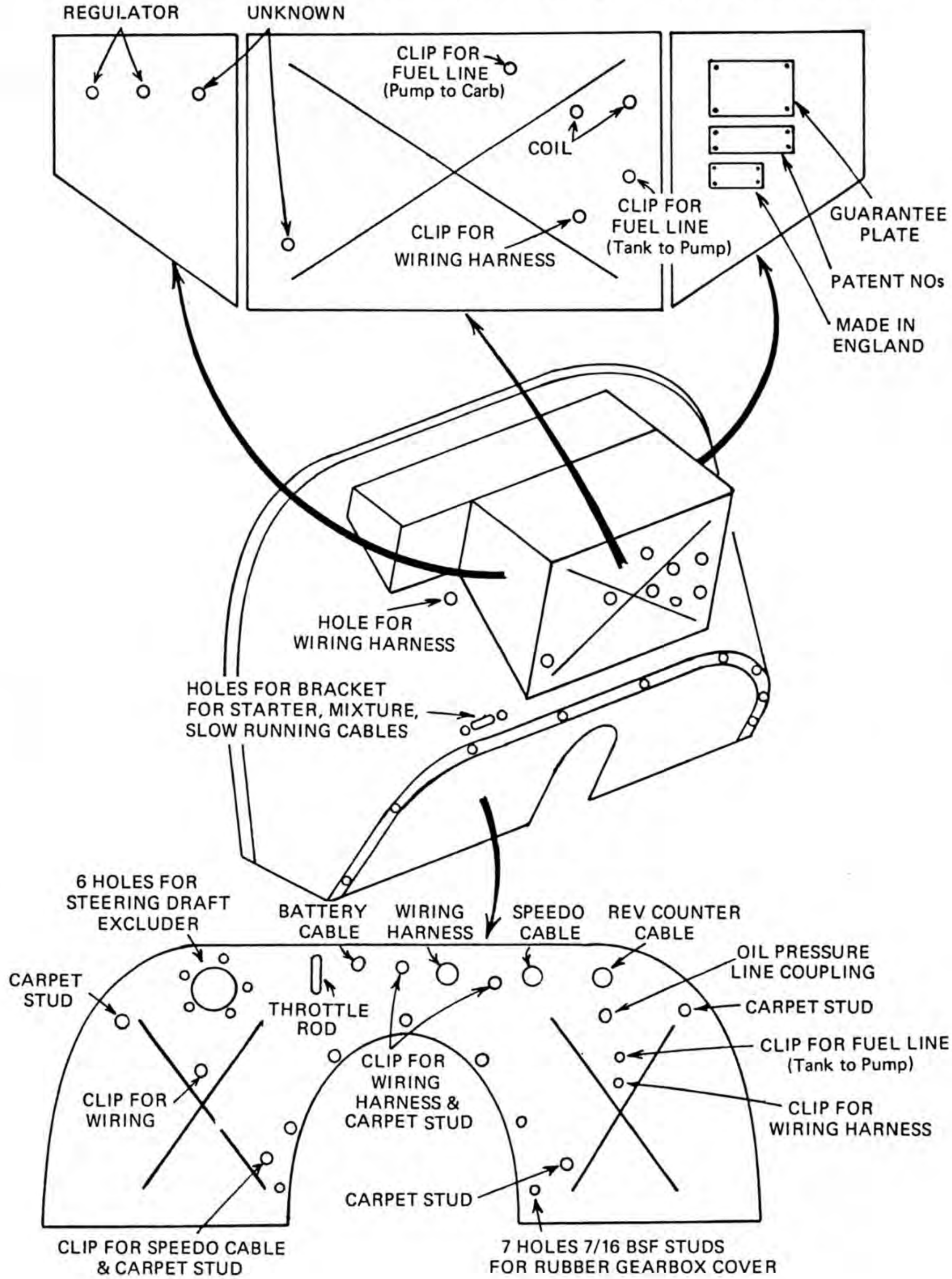
| Aug. | 12 | | 0251 | | | | |
| | | | XPAG/TD 2/29748 | | | | |
| Sept. | 17 | HDA 13/501 | | | | | |
| | 28 | HDB 46/574* | | | | | |
| Oct. | 5 | HDP 46/575 | | | | | |
| | 29 | HDE 43/901 | | | | | |
| Nov. | 3 | HDE 43/902 | | | | | |
| | 30 | HDB 26/1419 | | | | | |
| Dec. | 2 | HDB 26/1420 | *(HDP 43/587-90-9-28-53) | | | | |
| | 31 | HDE 43/2177 | HDC 13/600-01-9-28-53 | | | | |

MG TECH TALK

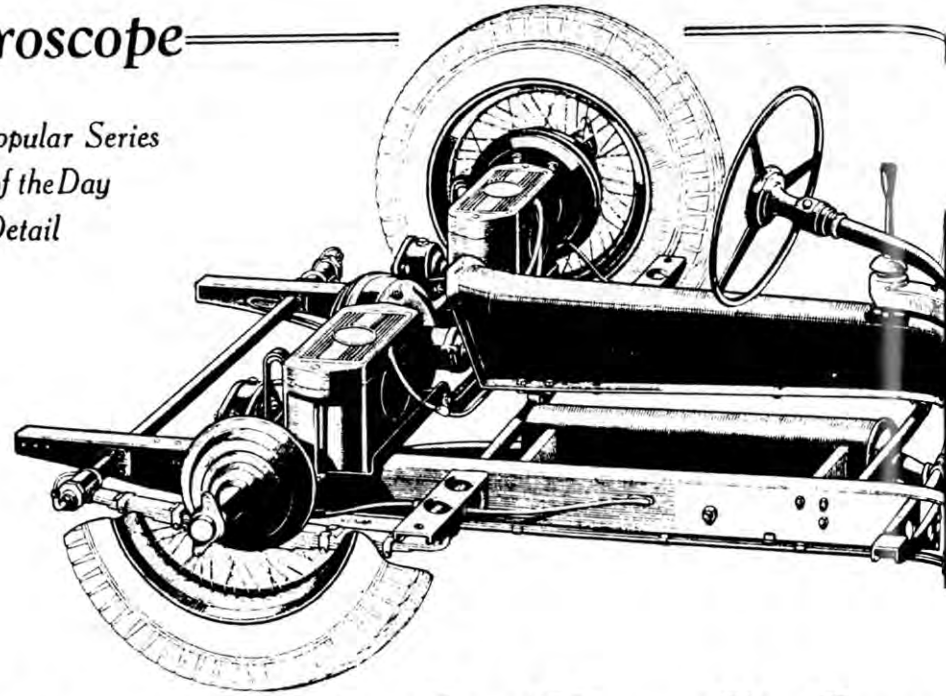
By R. JAY GIFT

# MG-TC Bulkhead-Hole Indicator



# Under the Microscope

*A New Article in Our Popular Series in Which Successful Cars of the Day Are Described in Minute Detail*



***This specially prepared drawing by a staff artist shows at a glance the business-like layout of the T-type M.G. chassis. It will be noticed that the design, although essentially up to date, is perfectly straightforward and embodies features which the makers have proved successful in their wide experience of strenuous competition work.***

# The T-TYPE M.G. MID

## Part I—General Design of the Chassis

INTRODUCED during the latter part of 1936, the T-type M.G. Midget is, without doubt, one of the most popular and successful small sports cars ever placed on the market. It is also one of the most reliable. Indeed, bearing in mind its maximum speed of about 80 m.p.h., its snappy acceleration, first-class road-holding and powerful brakes—all features which simply ask for hard driving—its freedom from trouble is little short of remarkable.

When one comes to examine the chassis with a view to describing it in this "Under the Microscope" series, however, this reliability is not so surprising. In neither the engine nor the chassis does one find any startling examples of the unconventional.

Instead, one discovers a design based on principles that have been well tried and proven by the M.G. concern, both in its extensive experience of racing and competition work, and in its experience as a commercial concern turning out sports cars in large numbers; and that, no doubt, accounts both for the trouble-free nature of the design and the few changes that have been made during the course of the past 2½ years.

A point to be noted about this M.G. is the fact that the designers set out with a very clear idea of what they wanted—a chassis large enough to take a body with really comfortable room for two and luggage, an 80 m.p.h. maximum speed and . . . reliability.

Taking the first two requirements as a basis, the third could obviously be achieved better by ignoring any arbitrary limits such as 1,100 c.c. and fitting a high-efficiency but not ultra-tuned engine. Actually, a 10 h.p. four-cylinder push-rod-operated o.h.v. engine of 1,292 c.c. (63.5 mm. bore and 102 mm stroke) was chosen, and the advantages of the policy are to be found not only in the manner in which the engine keeps its tune for long periods, but also in its flexibility and low-speed pulling powers; in these respects the M.G. Midget is superior to many touring cars, despite its snappiness if the gearbox is used to the full.

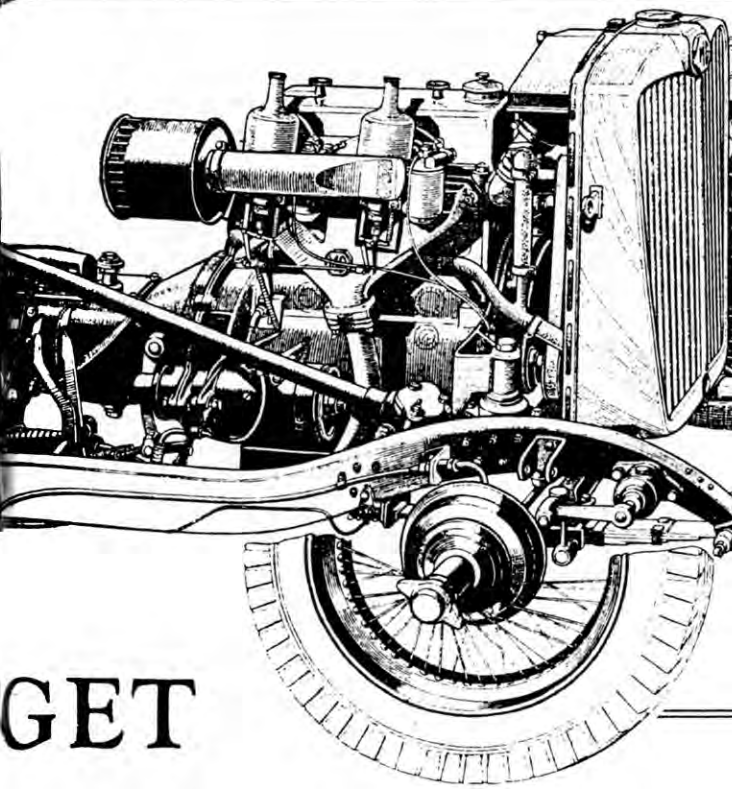
Built in unit with a single-plate cork-insert clutch and a four-speed synchromesh gearbox, the engine is mounted in a box-section chassis frame, underslung at the rear, with semi-elliptic suspension all round. The axles are of conventional type with knock-on wire wheels and Lockheed hydraulic brakes are used. The wheelbase and track are 7 ft. 10 ins. and 3 ft. 9 ins.

That, in brief, is the make-up of the T-type Midget. Let us now examine the design in more detail.

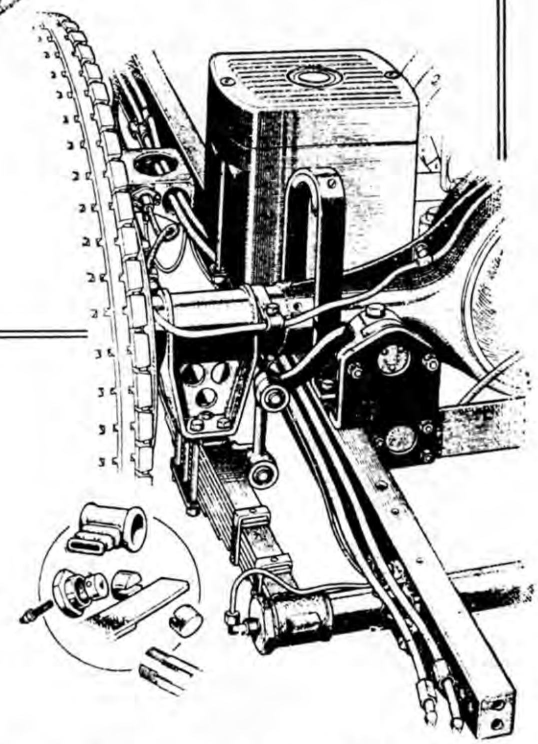
The chassis frame is of simple but very effective design. The basis is a pair of parallel channel-section side-members, which run perfectly flat from the rear, where they pass under the back axle, to a point coinciding with the rear ends of the front springs, where the frame members sweep up to clear the front axle. For part of their length the open side of the channel section of these members is reinforced by a welded plate to form a very strong box-section, and resistance to frame twist is provided by the use of tubular cross-members.

### Wide Spring Track.

These are five in number; the first forms a tie-bar between the front ends of the dumb-irons, the second serves to carry the radiator, the third is located just behind the gearbox and supports the tail end of the unit, whilst the remaining two coincide with the ends of the rear springs and are continued through the side-members to give a wide spring track. Actually, the springs are alongside and parallel with the side members.



*The sketch below shows details of the rear suspension and underslung chassis frame. Note how sliding trunnions (the exact arrangement of which is illustrated in the inset) are used instead of the more usual shackles; a similar arrangement is employed at the rear ends of the front springs.*



# GET

Another point of considerable interest concerning the springs is the elimination of the conventional form of shackle. At their front ends, normal swivel pins are used, but, at the rear, the master leaves pass through slots in the tubular cross-members or, more correctly, through bronze trunnions which fit into the ends of the cross-member.

The advantage of the system is that although the effective length of the spring can change as its camber alters when the wheel passes over bumps—the master leaf slides in the trunnion bearing when this happens—the spring is located much more positively in a lateral direction, and the resistance to twist is also greater. As a result, road-holding is very materially improved. These trunnion bearings are protected by moulded-rubber covers which retain lubricant and keep out dirt. Exactly the same principle is followed for the rear ends of the front springs.

**Grouped Nipple Lubrication.**

In the interests of easy maintenance, the lubricators on the trunnion bearings are connected by copper piping to accessible nipples mounted on the engine bulkhead, whilst the forward swivel pins of the rear springs are mounted in Silentbloc bushes which require no attention. Conventional nipples are used for the front swivel pins, as these are very easy to reach with a greasegun.

Vane-type Luvax shock absorbers are employed all round, those at the front being bolted direct to the dumb-irons, and those at the rear being mounted transversely on special brackets just behind the axle. Additional damping is given by the use of rebound leaves, which are incorporated in each spring assembly. These leaves, two of which are used for each spring, are similar to the ordinary leaves except that they have a slight reverse camber and, therefore, tend to restrain undue spring flexing.

The front axle is of the usual H-section with upswept ends of oval section terminating in eyes which accommodate the king pins; the latter are located rigidly by cotter pins. The steering knuckle is formed in one with the hub spindle, and the eyes through which the king pin passes are provided with bronze bushes, whilst interposed between the underside of the axle beam eye and the lower portion of the knuckle is a thrust washer. Grease nipples are provided to lubricate each of the bronze bushes, and the upper assembly is protected at the top by a felt washer and metal cap held in place by a bolt, which screws into a hole tapped in the top of the king pin.

Bolted to a flange on the steering knuckle is the brake-drum backplate, which carries the brake shoe assembly, including the operating cylinder. The hub itself runs on two ball bearings separated by a distance piece and retained by a washer and nut which screws on to the threaded end of the hub spindle. This nut is of the castle type, locked by a split pin, and provision for removal of the latter is arranged by a plug in the hub shell. Lubrication is effected by packing the hub shell with grease, escape of which on to the brake shoes is prevented by a special leather washer retained by a spring ring.

The brake drum is separate from the hub shell and is attached to the flange of the latter by six studs, the nuts of which are accessible when the wheel is removed. The latter slides on to splines on the hub shell and is retained by the usual knock-on hub cap.

The general arrangement of the brake drums, back plates and so on of the rear hubs is similar, but, in this case, the three-quarter floating construction of the axle calls for only one ball race, which fits over the end of the axle casing, where it is retained by a nut and locking washer. The outer portion of the hub shell slides over the splined end of the axle half-shaft, which, of course, transmits the drive via the hub to the wheel.

### The Braking System.

Lockheed hydraulic brakes are employed and, as the system has been described on many occasions, there is no need to deal with it in full here. For the benefit of those who are not familiar with this type of brake, it may be mentioned that the basic principle underlying the system is the fact that liquids are virtually incompressible. Instead, therefore, of coupling up the brake pedal to a series of rods or cables connected to a cam which expands the shoes, the pedal in the Lockheed system is connected to a piston working in a cylinder filled with special fluid. This cylinder, in turn, is connected by piping to smaller cylinders located between the movable ends of the brake shoes.

It follows, therefore, that when the pedal is pressed, fluid is forced out of the master cylinder into the pipe lines, and the pressure set up is thus communicated to the smaller cylinders, where it forces the opposed pistons apart and so expands the brake shoes. The system has the advantage that the pressure is equal throughout the entire system and, therefore, the brakes are self-compensating.

In the case of the M.G., larger cylinders and pistons (1 in. diameter) are fitted to the front brakes than the rear (⅞ in.), so that the front wheels take a greater share of the braking pressure, the ratio being approximately 57 per cent. on the front and 43 per cent. on the rear.

Adjustment is extremely simple. The shoes are returned to the "off" position by the usual pull-off springs, and stops are provided which prevent them from returning more than a predetermined amount. These stops take the form of snail-shaped cams and, when the clearance between the linings and the drums becomes excessive, it is necessary only to turn these cams so that the shoes cannot return quite so far. The cams are connected to hexagons which project from the inner side of the brake back plates, and are easily reached with a spanner.

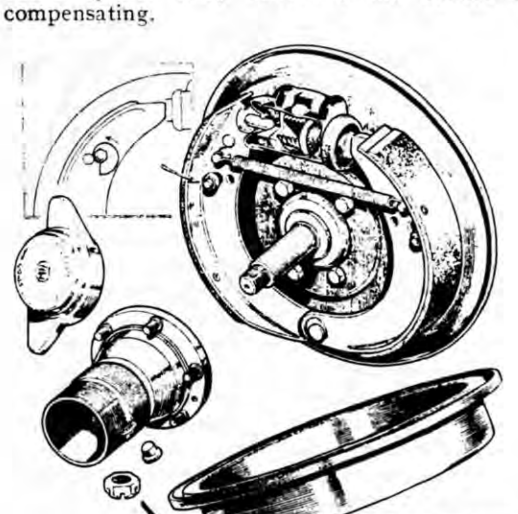
To comply with the law, the hand brake, which works on the rear wheels only, is provided with cable operation. The lever is mounted on a crossbar, drop arms on the ends of which are attached to cables of the Bowden type which actuate the shoes in the rear drums via an internal lever system. The control has a racing-type ratchet, which works only when the button at the top of the lever is depressed (just the opposite of the normal system), and a wing nut adjuster, which can be turned from the driving seat, is arranged at the base of the lever.

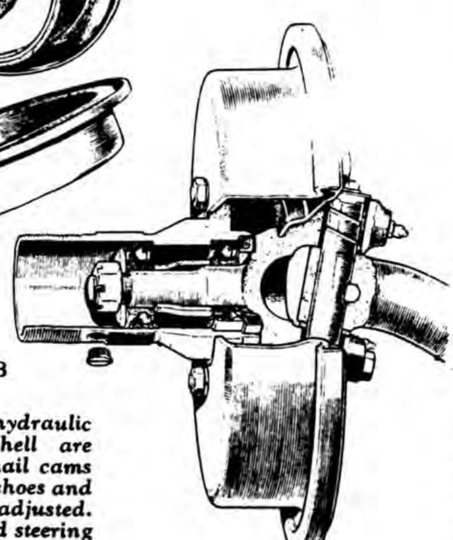
### High-geared Steering.

Steering is by means of the Bishop cam system, and the makers have taken advantage of the easy action of this design to provide high-geared operation. The actual steering box ratio was 8 to 1 on early models and is 11 to 1 on the latest type.

A cutaway view of the steering box is shown in one of the accompanying illustrations, and it will be seen that the steering column terminates in a helical cam. Fitting into the groove of this cam is a follower mounted on a rocker shaft, so that rotation of the column also rotates the rocker shaft. Mounted on splines on the end of this shaft is the drop arm, which operates a transverse drag link through the medium of a conventional ball joint. Similar ball joints are also used for the track rod ends. The steering column is adjustable for both rake and length (by means of a telescopic column), whilst a large three-spoke spring wheel is fitted.

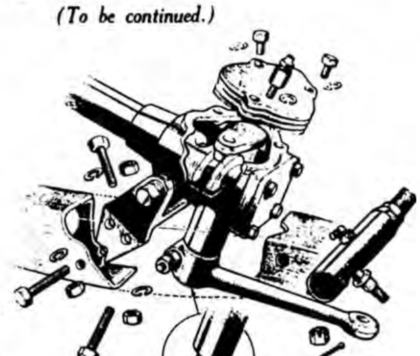
*(To be continued.)*



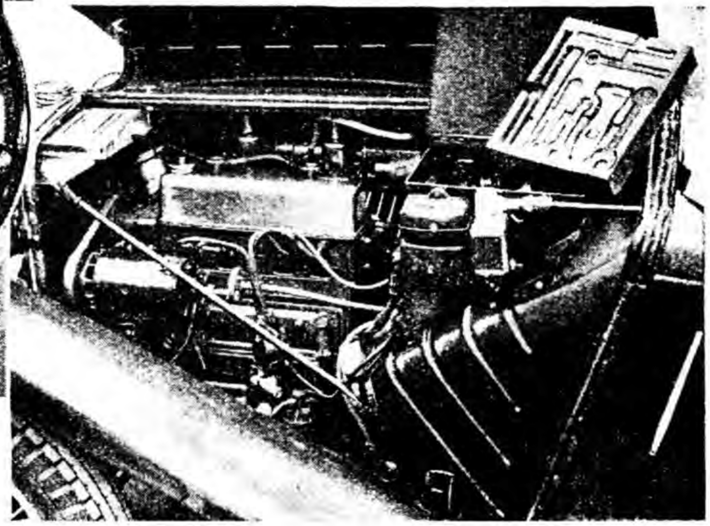


**T-TYPE M.G. FRONT HUB AND BRAKE DESIGN**

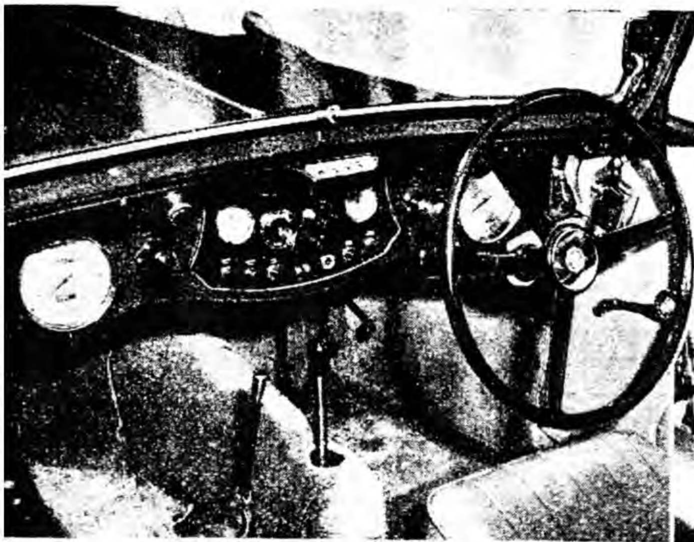
***(Above)* How the brake-shoes, hydraulic operating cylinder and hub shell are arranged. Inset is one of the snail cams which act as return stops for the shoes and enable the clearance to be adjusted. *(Right)* A sketch of the hub and steering knuckle, showing the bearings.**



***(Above)* Details of the Bishop cam steering box. Amongst the points which will be noted are the shims under the cover plate (removal of which enables play in the rocker shaft to be eliminated) and the manner in which the drop arm is secured.**



(Below) *Near-side view of the 1,292 c.c. push-rod o.h.v. four-cylinder engine. The dash-pots of the twin S.U. carburetters are visible above the valve cover. Note the moulded rubber tool tray.*



(Above) *The facia panel of the Midget drop-head. Cleanliness of the occupants is assured by the well-protected gear lever and hand brake. The steering wheel, unlike the open Midget, is of the telescopic type.*

Continued from page 83

however, keeping the engine turning over unnecessarily fast; in the country, it is ideal for rapid climbs of main-road hills and for overtaking. The fact that the car will reach the mile-a-minute mark before the engine reaches peak revs. in this gear gives an idea both of its scope and of the wide overlap in the gear performances. The actual ratios are 4.875, 6.44, 9.95 and 16.84 to 1.

It remains to add that bottom and second are very quiet, that third is almost inaudible and that the change (with synchromesh applied to third and top) makes the conveniently placed remote-control lever a delight to handle.

The hand brake, too, is a most convenient control. It has a spring-off racing-type ratchet and, in contrast to the corresponding control on many modern cars, is really powerful—no doubt the result of M.G.'s wide experience of competition work.

### Road-holding.

On the score of road holding and cornering, there's really nothing in it between the two cars; both allow you to do things that would be frankly dangerous on some cars without in any way feeling that you have been a naughty boy—as, indeed, you haven't. Brakes go to match—the combination of Lockheeds and a chassis that does not twist into funny shapes under their well-known efficiency; need one say more?

So having reassured any who have their doubts as to whether this new body has "spoilt" the T-type, we can get down to considering the town carriage aspect; and, in spite of what the coupé does on cross-country runs, it certainly has great attractions as a refined motor carriage.

The photographs on these pages give an excellent idea of the lines of the car with the top in any of the three positions at the disposal of the owner. All have their special attractions: fully closed for bad weather or occasions when one desires saloon comfort and convenience; fully open when the idea of *real* motoring seems attractive; half-way for days when one is in an open-car mood and the weather is obliging only at intervals.

As an open car, the coupé is inferior to the two-seater only in so far as the windscreen frame is a little thicker and the occupants do not enjoy the advantages of cut-away doors. Against the latter must be set the added protection and better vision of glass windows compared with celluloid side screens, together with the extra convenience of having that protection instantly available on the mere twiddling of a winder.

In closed car form, the coupé is, quite naturally, incomparably superior to the two-seater with the hood erected—a very snug little machine in which the miles are reeled off with surprisingly little effort and no discomfort whatever the weather.

Two questions always asked about bodies of this type are (a) is the head difficult to raise lower and (b) can you see out of the car when you are in it? The answers are "No" and "Yes" respectively, but a little amplification will do no harm. The entire open-to-closed operation occupies just a little more time than furling the hood of the two-seater, but not so long as coping with quite a number of open-car hoods.

As for visibility, both side lamps and wing tips are well in sight from the driving seat, the screen pillars form little more obstruction than the combination of pillar and side-screen frame on the open model and an external mirror gives a good view to the rear. The back window is not deep, but as it is much nearer to the driver than in most coupés, the view astern is much better than is usual with this type of body.

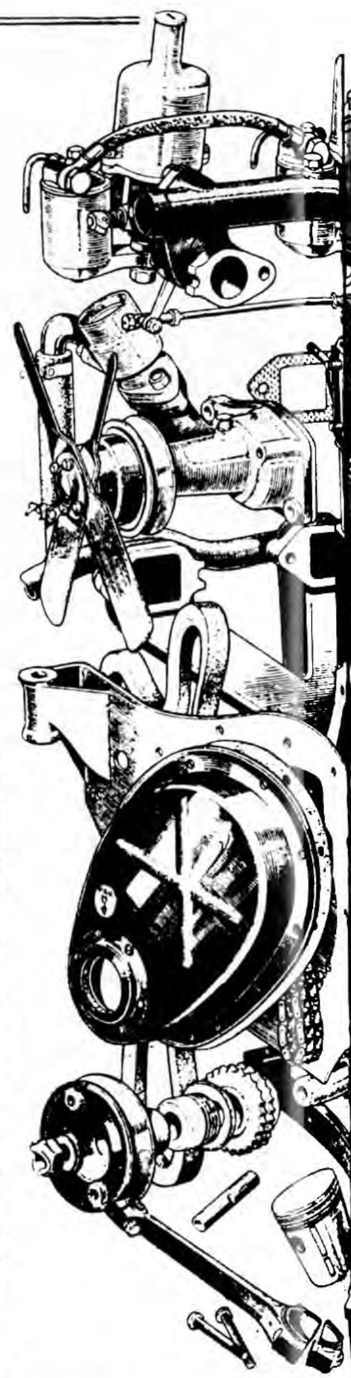
Interior refinements not found on the two-seater include a telescopic steering column, direction indicators, an ashtray, separate adjustable bucket seats, a roof light and an under-scuttle mounting for the dual screen wiper. But there is no need to go deeply into matters of that kind; as I said at the beginning, this is not intended to be an ordinary road test report—simply a few random remarks inspired by a few days at the wheel of one of the new coupés.

I enjoyed those few days and, although I am at the moment waiting for my new two-seater to emerge from the assembly line, I will freely admit that if ever a car came near to converting me from my present 100 per cent. open-car enthusiasm, the latest M.G. Midget drop-head coupé is that car. For those whose enthusiasm for open-air motoring is not quite 100 per cent. . . . well, need I say more?

# *Under the Microscope*

# *The* T-TYPE M.G. MIDGET

## Part II—Engine Design in Detail. How the Lubrication System Works



*This special drawing by a staff artist will repay careful study. It not only gives an excellent idea of the general layout of the T-type M.G. engine but also provides technical details on various points such as the big-ends, main-bearings, pistons, valve gear, lubrication arrangements and so on.*

A BRIEF outline of the engine specification was included in the first part of this article, and in this instalment one may, therefore, pass straight on to a detailed consideration of the various features.

In accordance with current practice, the cylinder block and top half of the crankcase are cast in one, the cylinder head which carries valves and rocker gear is detachable, and at the base there is a large-capacity aluminium alloy sump.

A three-bearing crankshaft balanced statically and dynamically is employed, and runs in steel-backed white-metal bearings with the shells dowelled in their caps. An interesting point about the centre bearing is that it is flanged to take end thrust. The big-end bearings are also of white-metal, but, in this case, the bearing material is run direct into the con. rods and the bearings are of the full ring butted type, which require no scraping when being fitted. The M.G. concern has a replacement service for these rods; when the bearings are worn, owners can exchange them for re-metalled rods supplied ready for fitting.

The rods themselves are of the usual H-section steel type, and the little ends are split and provided with a clamping bolt, so that the gudgeon pins are held rigidly in the rods and float in the bosses of the aluminium pistons. On the latest models Aerolite aluminium alloy pistons with two compression rings and one slotted scraper ring are employed, the piston skirt being absolutely plain, except for the reinforcing ribs. Early models (previous to engine No. MPJG 697) were fitted with pistons incorporating an additional scraper ring in the skirt.

#### Driving the Auxiliaries.

Mounted direct on the nose of the crankshaft is a twin sprocket which drives the camshaft by means of a Duplex roller chain. The camshaft itself is carried in the near side of the cylinder block and runs in white-metal bearings at each end, whilst there is an additional white-metal bearing in the centre. The latter is a twin bearing, with one portion on each side of the skew gearing which serves to drive the oil pump. A further skew gear provides a drive for the ignition distributor.

The only other auxiliary drive is for the combined water impeller and fan unit, and for the dynamo. A single endless rubberized fabric belt provides a triangulated drive for these components from a pulley mounted on the nose of the crankshaft.

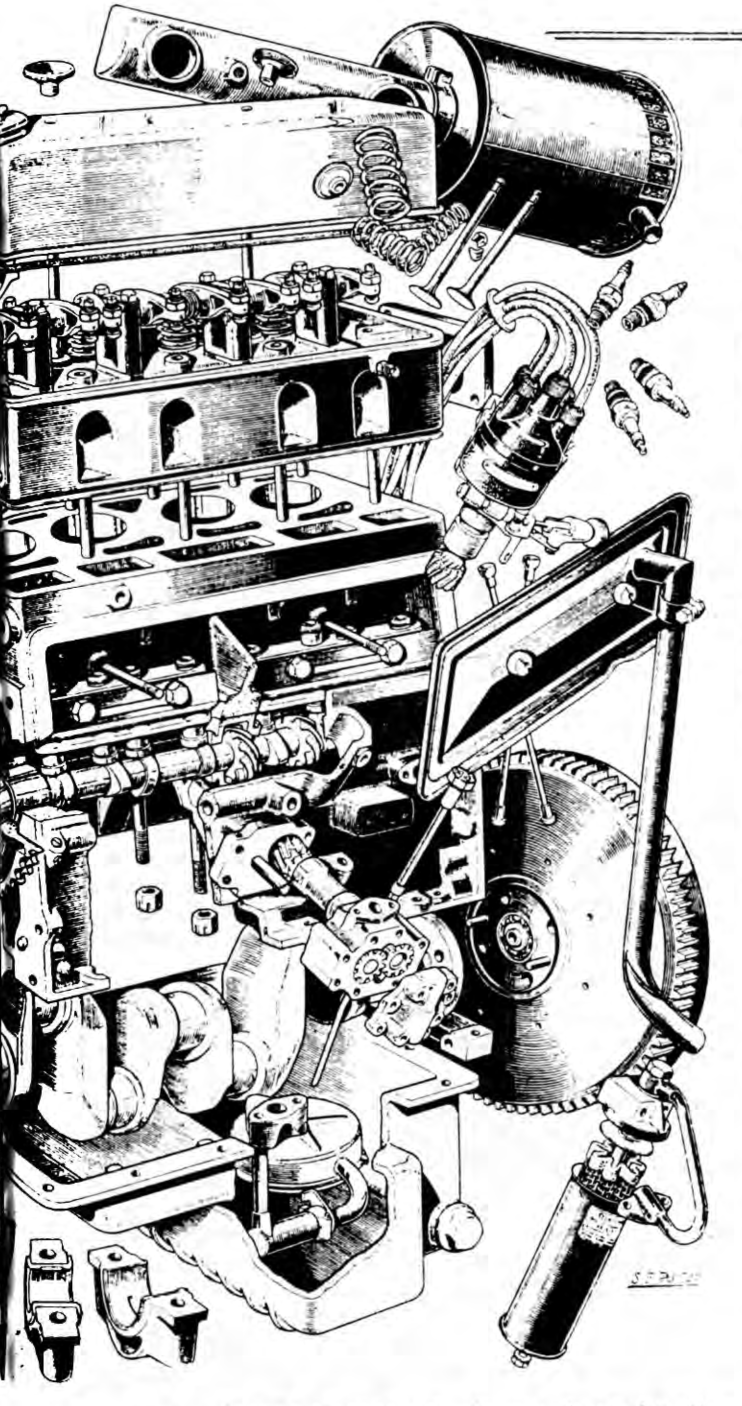
The engine lubrication system is interesting both for the precautions taken to ensure a supply of clean oil, and for the thought devoted to seeing that the oil reaches all the parts requiring it in copious quantities. The oil pump is of the usual gear type, in which two meshed gears, running in a closely fitting casing, serve to draw a supply of oil from a port on one side, and, carrying the lubricant round by the paddle action of their teeth, force it out under pressure via another port on the opposite side of the casing.

Instead of the inlet port being connected in the usual manner to a pipe dipping into the oil and terminating near the base of the sump, the M.G. design incorporates a special pivoted float which remains near the surface of the oil no matter what its level may be. The obvious advantage of this system is that the supply is always drawn from the upper portion of the oil, well clear of any sludge which has settled in the base of the sump.

The float itself, moreover, is fitted with a gauze which provides preliminary filtration. An unusually large-capacity sump, incidentally, is used (it holds 1⅜ gallons), and is deeply ribbed for cooling.

Built into the body of the pump casing is a non-adjustable relief valve of conventional type, in which a ball is held on its seating by the pressure of a spring. When the oil pressure in the pump exceeds a predetermined figure, it lifts the ball off its seating against the pressure of the spring, and allows the surplus to return to the sump. Actually, it is set to by-pass the oil at between 60 lb. and 80 lb. per sq. in.

From the pump, the oil passes via an external copper pipe to a Tecalemit filter, where it passes down the hollow central spindle, which is surrounded by a filtering element composed of special felt encased in wire



gauze. Passing through this element, it reaches the outer casings and emerges through another external pipe to a gallery running along the side of the engine crankcase. One end of the filter element, incidentally, is open, and is closed by a spring-loaded disc; should the pressure in the filter become excessive owing to the element being choked, this disc lifts and allows the oil to pass straight to the engine.

The gallery pipes in the crankcase are connected by further passages communicating with the camshaft and crankshaft bearings. These passages are three in number, and the first of them (counting from the front) feeds the front main bearing and also the front camshaft bearing. From the front main bearing a feed is taken to No. 1 big-end via a ring cut in the white-metal, which communicates with a hole drilled up the crank web.

An interesting detail which applies to all the big-ends may be explained at this point. In the off side of the big-end a special hole is drilled which, once every revolution, coincides with an oil passage in the journal, where the oil is, of course, under pressure. This happens when the con-rod is on the up-stroke, and the combined effect of the oil pressure and the motion of the crankshaft results in a spurt of oil being directed straight on to the cylinder bore. The latter, therefore, has a direct supply of lubricant in addition to the oil mist which is always present in the crankcase and is normally relied upon to supply the bores.

This is one of the reasons why the T-type engine enjoys such freedom from bore wear; as owners can testify, mileages of 40,000 and upwards are quite normal before a rebore becomes desirable. For the little ends, crankcase oil mist provides the necessary lubrication.

To return to the oil circulation system, surplus lubricant from the front camshaft bearing passes via a specially arranged "leak" to a hole drilled diagonally through the boss of the chain sprocket. This leads the oil on to the forward face of the sprocket, where centrifugal force flings it to an annular groove arranged in the rim. Holes are provided at intervals which allow the oil to pass through the rim direct on to the teeth, so lubricating them and the roller chain.

The centre passage from the gallery feeds the centre main bearing and also the centre bearing of the camshaft, together with the skew gearing for the oil pump and distributor drives. The centre main bearing supply also feeds Nos. 2 and 3 big-ends and the cylinder walls in the manner already described.

**Oil Supply to Clutch.**

Finally, the rear passage feeds the rear main bearing and the rear camshaft bearing. As in the other cases, a supply for No. 4 big-end and cylinder wall is taken from the main bearing, but, in this case, a further supply is taken from the bearing; by means of a drilled passage in the crankshaft a supply is fed to the centre of the clutch plates, which run in oil. The surplus passes through gauze windows in the clutch cover plate into the clutch housing: here it is picked up by the teeth of the starter motor ring on the flywheel and thrown into a gallery on the near side of the housing, whence it drains back into the sump.

Also connected with the oil gallery are two external copper pipes. One is connected to the pressure gauge and the other carries oil to a passage drilled in the cylinder head which registers with a hole in the rear overhead valve rocker-shaft support. In this way oil is led to the inside of the hollow rocker shaft, from which it passes out of holes to lubricate each rocker, and finally passes down the push-rod passages back to the sump.

Ignition is by means of a 12-volt coil, and the sparking plugs are of the normal 14 mm. size. The distributor head is provided with the usual Lucas automatic advance and retard, and, in addition, the distributor head has a micrometer adjustment, controlled by a thumbscrew, by which the timing range may be varied to suit the fuel used and the state of the engine.

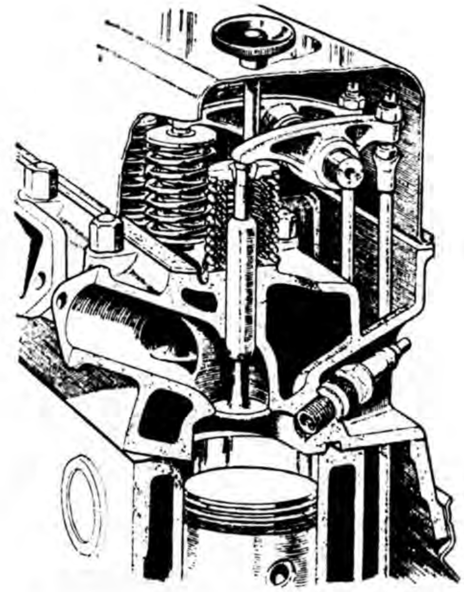
One division on the scale is equivalent to 4 degrees of crankshaft movement, and as the thumbscrew "clicks" 16 times to each division, an alteration of ¼ degree is possible.

*(To be continued.)*

# *The* T-TYPE M.G. MIDGET

## PART III

## Further Details of the Engine—The Overhead Valve Gear—Carburation and Manifold Design—The Cooling System



***This cut-away drawing of the cylinder head gives a good idea of the combustion chambers and valve gear. Note the triple valve springs.***

THE overhead valves of the T-type M.G. Midget engine are operated by push-rods from the chain-driven camshaft on the near side of the engine. Hollow tappets working in detachable guide blocks are interposed between the camshaft and the push-rods, these guide blocks being situated in a chamber on the near side of the engine, accessible by removal of a pressed-steel cover plate.

This cover plate, incidentally, also carries the engine breather pipe, which serves to relieve crankcase pressure. The pipe is extended downwards to the base of the engine so that the crankcase fumes are carried away in the air stream passing the sump.

Each guide block carries four tappets and is held by two bolts and also located by dowels. The tappets have detachable hardened cups into which the ball ends of the push-rods fit, and circlips are fitted to the upper ends of the tappets, so that they shall not drop through into the crankcase if the blocks are removed.

Composite push-rods with hardened ball ends at their bases and cups at their upper ends are used, and adjustment of the valve clearance is effected by turning the screwed ball ends in the rockers. The adjustment is, of course, maintained by lock-nuts in the usual manner.

A single central rocker shaft is used, and the eight valves are arranged vertically in line down the centre-line of the combustion spaces. Four bearings support the rocker shaft, and the rockers are located by distance pieces and silencing springs. The valves themselves are retained by split cone cutters and run in detachable guides pressed into the cylinder head.

### Triple Valve Springs.

With all high-efficiency engines, the question of preventing valve bounce is important, and, in the case of the Midget, three springs are used for each valve. These are of the usual helical type and fit concentrically round the valve stem. The outer and inner springs have their coils wound in one direction, and the middle spring is wound the reverse way so that there is no risk of the coils of one spring becoming trapped between the coils of its neighbour as would happen if the springs were wound in the same direction.

Inlet valves of slightly larger diameter than the exhausts are used, and the combustion chambers are perfectly symmetrical when viewed in cross section, but overlap the ends of the bores slightly when the engine is viewed in longitudinal section. The pistons are flat-topped, and, in standard form, the engine has a compression ratio of 6.5 to 1. For competition work an increase in the ratio can be effected by machining the head, and a ratio of 7.3 to 1 can be used with any of the well-known anti-knock pump fuels, such as Benzole Mixture, Discol or an Ethylized petrol.

The valve timing, incidentally, provides for an overlap of 35 degrees, the actual timing being as follows:—Inlet opens 11 degrees before T.D.C. and closes 59 degrees after B.D.C. Exhaust opens 56 degrees before B.D.C. and closes 24 degrees after T.D.C. Thus, the inlet period of opening is 250 degrees and the exhaust period 260 degrees.

### No Hot Spot.

Both the induction and the exhaust manifolds are located on the off side of the engine, and an interesting point is the fact that the two are quite independent with no hot-spot provided. The inlet ports are siamized, and one carburetter supplies each pair, but the two are connected by a large-diameter balance pipe.

The carburetters are S.U.s of the inclined or semi-downdraught type, and work on the well-known S.U. constant-vacuum principle. As most readers are aware, this design incorporates a dashpot or piston under the control of inlet depression (or suction). The extended portion of the piston controls the choke area; thus the latter is automatically varied in accordance with the depression in the engine, and the speed of the air passing the choke is constant. Attached to the piston is a tapered needle passing into the jet, the effective orifice of which is thus varied in size in accordance with the movements of the piston and the corresponding variations in choke size.

An air cleaner is provided and is connected by a special manifold to the carburetter intakes. Of A.C. manufacture, it is of the type in which oil-wetted woven mesh is employed to extract dust or dirt from the incoming air and it serves the additional purpose of a silencer. Various chambers are arranged in the interior of the device in such a way that any sound waves produced by the carburetter pass into the resonating chambers which set up counter-waves that damp the original sound waves.

The carburetters are supplied with fuel by an S.U. electric petrol pump connected to a two-way tap mounted on the engine side of the dash and operated by a rod which passes through the dash to a remote control on the facia panel. From this tap duplicated pipelines lead to the 13½-gallon rear tank, one of the pipes (the main) terminating some distance from the bottom of the tank. As a result, the supply fails so soon as the petrol drops to the level of the bottom of this pipe, so warning the driver of the need for replenishment. The tap can then be turned to the reserve position, when the remainder of the fuel (3 gallons) will be drawn through to the carburetters.

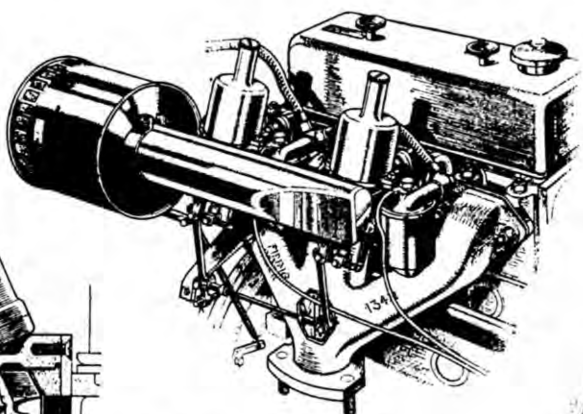
The exhaust manifold is of the three-branch type, the centre branch taking the gases by a siamized port from Nos. 2 and 3 cylinders, whilst the two outer branches deal with the exhaust gas from Nos. 1 and 4 cylinders respectively. Connected to the exhaust manifold by means of a flexible pipe is a Burgess straight-through silencer.

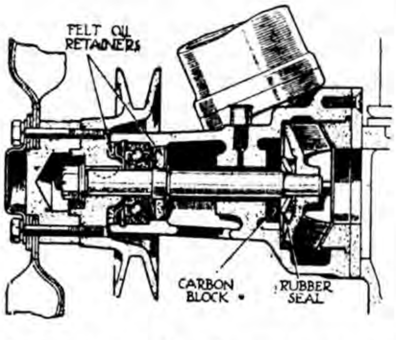
### Firing Order.

At this point it may be of interest to readers to note that the order of the valves, reading from the front of the engine, is:—Exhaust, inlet, inlet, exhaust, exhaust, inlet, inlet, exhaust, whilst the firing order of the engine is 1, 3, 4, 2.

Several interesting points are to be noted in connection with the cooling system. Amongst them is the fact that the inlet pipe by which cool water is circulated from the base of the radiator is not taken to the cylinder block, but to the back end of the cylinder head, whence the water passes forward under the influence of the impeller and so via the outlet pipe at the front end to the radiator header tank; in other words, there is no direct forced circulation through the block, the flow in which is induced purely by the ordinary thermo-siphon action.

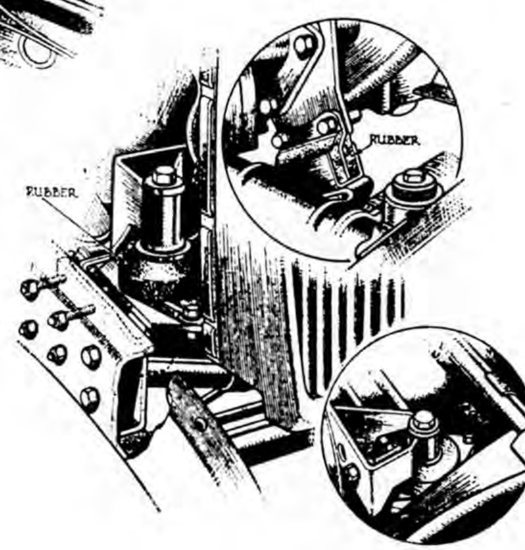
*(Right)* ***Two S.U. semi-downdraught carburetters are fitted. The air supply is taken through an A.C. combined silencer and cleaner.***






*(Left)* ***A broken-open view of the water pump and fan assembly, showing the oil and water seals.***

*(Below)* ***Details of the engine mounting. The main sketch shows the front bearers and rubber buffers; top inset sketch illustrates one of the moulded rubber mountings at the back of the gearbox; and the lower inset shows one of the front alignment tie strips.***




Special care has been taken to ensure that the water in the block and head shall rapidly rise to a proper working temperature, and shall be maintained in that state thereafter. To this end a thermostat is incorporated in the outlet pipe from the front of the head and the valve remains closed until the necessary temperature is attained.

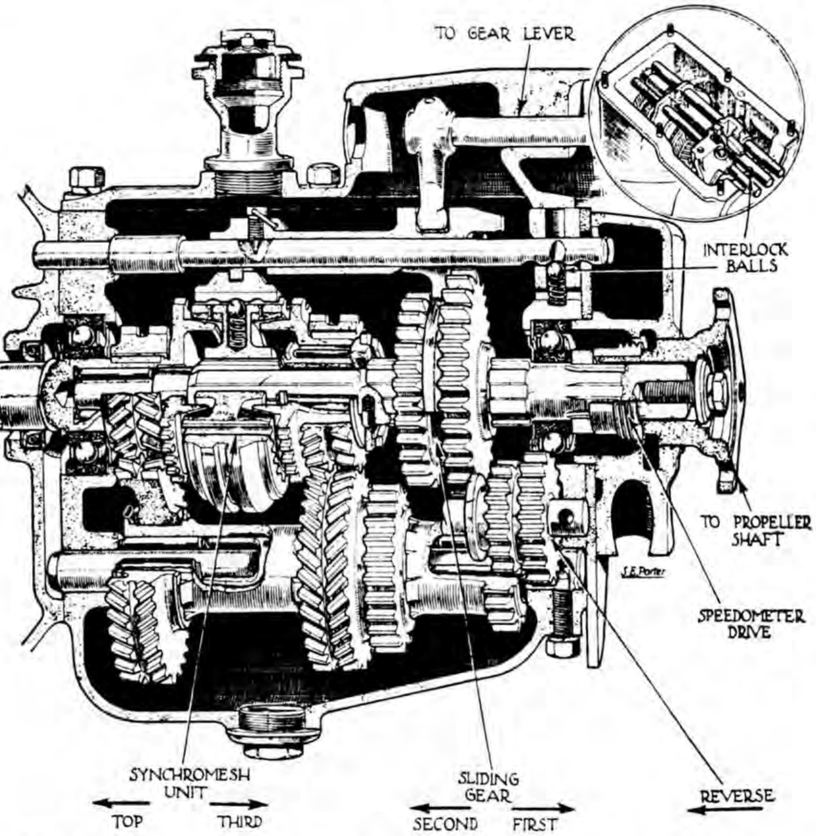
Owing to the presence of an impeller, however, it is obviously necessary to relieve the pressure that would otherwise be built up when the valve is closed. Accordingly, the thermostat valve is so arranged that, when closed, it uncovers a passage communicating with a by-pass pipe which enables the water to flow from the head back to the inlet pipe. In other words, whilst the thermostat is closed, the water simply circulates through the engine but does not pass on to the radiator. Overheating is avoided by the use of a large-capacity radiator and a four-bladed fan.

### The Water Pump.

The actual construction of the impeller is clearly shown in one of the illustrations on these pages. As will be seen, it is built in one unit with the fan, a single spindle serving to carry the impeller blades, the driving pulley and the fan itself. This runs in a plain bearing at the rear and a ball bearing at the front. Leakage of water is prevented by the combination of a carbon block and a rubber washer pressed into contact with it by a helical backing spring. Oil leakage from the front bearing is prevented by felt retainers.

The whole engine-gearbox unit is flexibly mounted at three points. At the front a plate sandwiched between the timing case and the front end of the crankcase is extended to form engine bearers, the bosses of which rest on rubber buffers on brackets on the chassis side members. At the back a plate is bolted on to the rear of the gearbox, its ends being embedded in moulded-rubber buffers attached to brackets on one of the tubular cross members. In order that correct alignment shall be maintained, canvas straps fitted with threaded end pieces are provided between the front bearer plate and the tubular cross member under the radiator. These serve to take any thrust imposed by clutch operation or in any other manner.

*(To be concluded.)*




# The T-TYPE M.G. MIDGET

## (PART IV)

## Concluding Instalment —the Transmission System Described in Detail

*This fine cut-away sketch of the gearbox gives an excellent idea of the layout and the manner in which the various gears are engaged. Inset are details of the selectors and their locking mechanism. The whole unit is described in the text.*

IN previous instalments of this series, the general design of the chassis and engine of the T-type Midget have been dealt with in detail. Attention can now be turned to the transmission. In the main, the design follows conventional well-tried lines, but one feature that is rather uncommon these days is the clutch, which is of the cork-insert type running in oil. This arrangement is well known for its sweet action, but additional smoothness and flexibility are given in this case by a Borg and Beck sprung centre. The result is a clutch which gives an exceptionally smooth take up.

On the other hand, the whole design has been produced with a view to withstanding the hard use that M.G.s are apt to receive in competition work and, as owners can vouch, once the pedal is right back, the clutch immediately goes fully home—and stays there without a trace of slip.

An accompanying illustration shows the various components. The flywheel, of course, is bolted on to the rear end of the crankshaft and, spigoted into its centre, is the first-motion shaft of the gearbox. This shaft carries the driven plate, which, together with the pressure plate, fits within the recess formed by the flywheel rim. Bolted to the latter is the cover plate which encloses the main assembly and carries the 12 helical springs.

The driven plate is splined to the gearbox first-motion shaft, but the hub of the pressure plate, on the other hand, is carried in a bearing in the centre of the cover plate and is clear of the shaft. Slots cut on its periphery engage with pegs or keys on the inside of the rim of the flywheel, so that the plate rotates with the latter. It will now be obvious that the pressure of the springs forces the pressure plate against the driven plate and, in fact, sandwiches the latter between the pressure plate and the flywheel face, thus conveying the drive from the flywheel to the first-motion shaft.

It remains only to indicate the manner in which withdrawal is effected. To this end, the centre of the pressure plate is extended through the centre of the cover plate and carries a ball thrust race, held in position by a locking ring. In contact with this race is the withdrawal fork coupled to the clutch pedal. When the latter is depressed, a force is exerted on the thrust race which draws the whole pressure-plate assembly backwards, so relieving the pressure on the driven plate and disconnecting the drive.

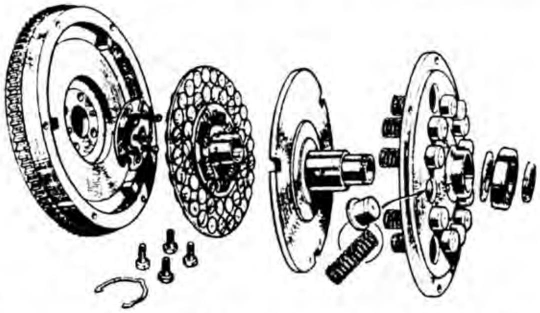
### Clutch Runs in Oil.

The whole mechanism runs in oil, and the manner in which it receives its supply from the engine was fully explained in the section dealing with the engine lubrication system.

The gearbox provides four forward speeds, and synchromesh is applied to the changes to top and third. The general layout is shown in one of the accompanying illustrations, and it will be seen that double helical pinions are used both for the constant-mesh drive to the layshaft and for the third-speed cluster. A pair of straight-cut sliding pinions are used for engagement of second and first gears, and reverse is engaged by means of a pair of idler pinions formed in one and sliding on a separate shaft. The smaller of these pinions engages with the first gear pinion on the tailshaft, and the larger reverse idler with the first-gear pinion on the layshaft, the extra stage in the drive, of course, providing the necessary change of direction.

A feature of the design is the manner in which every effort has been made both to reduce friction and ensure accurate running by the generous use of ball and needle-roller bearings. Both the first motion shaft and the tailshaft run in ball bearings of generous size, located in the ends of the gearbox casing, and a Hyatt race of the needle-roller type is used for the spigot bearing by which the forward end of the tailshaft is supported in the end of the first motion shaft.

The layshaft itself is stationary, and the constant-mesh and third and second gear cluster are mounted on a splined sleeve which is carried on this fixed shaft by further Hyatt roller races. The first-gear layshaft pinion is formed in one with the sleeve. A further needle-roller bearing is used for the third-speed constant-



***Components of the single-plate cork-insert clutch which runs in oil. The main parts, from left to right, are the flywheel, the driven plate with corks and sprung centre, the pressure plate and the cover plate complete with springs. The retaining plate for the spigot bearing and the thrust bearing and lock-nut are also shown.***

mesh pinion and dog assembly, which run freely on a sleeve on the tailshaft and are located endwise by a locking ring and spring plunger.

Formed in one with the first-motion shaft are the dogs for top-gear engagement, whilst the constant-mesh pinion which drives the layshaft is keyed to this shaft. Both the top and third-gear dogs are made in one with synchronizing cones, which engage with corresponding cones in the synchromesh unit.

Reference to the accompanying illustration will show that this synchromesh unit consists of two main portions; the inner part is splined to the tailshaft and carries the outer synchromesh cones, whilst, surrounding it, is an internal toothed ring which must turn with it by reason of the teeth, but which can slide endwise. It is normally prevented from doing so by a series of spring-backed balls, which are arranged in the inner portion of the unit and engage with recesses in the outer portion.

For top gear, the outer portion of the synchromesh unit is moved forwards by its selector fork, and the first thing that happens is that the cone on its inner portion comes into contact with the cone on the first motion shaft. The obvious result is to synchronize the speeds of the first motion shaft and the synchromesh assembly.

When this point is reached, the inner portion obviously cannot move any farther, but further pressure on the gear lever results in the balls being depressed when the outer portion slides farther forward, so that its internal teeth engage with the dogs on the first motion shaft. Obviously, they do so silently, as the speeds of the two sets of teeth have been synchronized, and the effect is to lock the tailshaft to the first motion shaft, thus giving a direct drive straight through the gearbox.

Exactly the same action takes place when the synchromesh unit is moved backwards, except that in this case it engages with the third-speed dogs, so locking the third-speed pinion to the tailshaft. When this happens the drive passes through the forward pair of constant-mesh gears to the layshaft sleeve, which, in turn, transmits the drive to the third gear constant-mesh pinions, so driving the tailshaft.

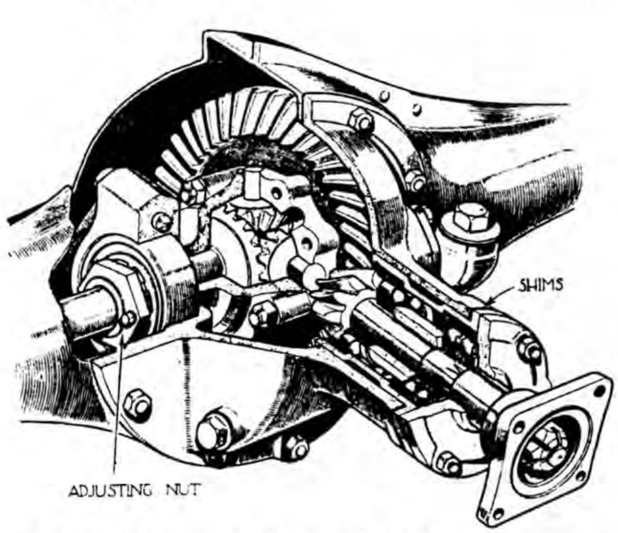
It should be mentioned, incidentally, that additional recesses are provided in the outer portion of the synchromesh unit, so that the spring-loaded balls fit into them when engagement of the gears is complete and the load on the cones is relieved.

Second and first gears are engaged by a slideably mounted pair of pinions on the tailshaft—forward to engage the second gear pair and backwards to engage bottom gear.

**The Selector Mechanism.**

Details of the selector mechanism are clearly shown in one of the illustrations, and it will be seen that the selector shafts are locked in position by spring-backed balls, which fit into recesses. In addition, inter-locking balls are provided between the three selector shafts, these balls being of slightly larger diameter than the distance between the shafts. The latter, however, are grooved, but the effect of moving one shaft is to force the ball into the groove in the other, thus effectively locking them and preventing two gears from being engaged at once.

From the back of the gearbox a Hardy-Spicer propeller shaft with needle roller universals takes the drive to the spiral-bevel rear axle. This is of conventional type, incorporating a bevel-type differential with four pinions. The usual adjustments are provided for the mesh of the crown wheel and pinion, and, as the design is very clearly shown in one of the cut-away drawings on this page, there is no need to describe it in detail.




***The final drive unit showing the differential and the arrangement of the various bearings. The two adjustments for mesh are also identified—the shims by which the pinion is adjusted in a fore-and-aft direction and one of the nuts by which the crown wheel assembly is adjusted transversely; these adjustments should be attempted only by competent mechanics.***

# The "TF" MIDGET FRONT SUSPENSION

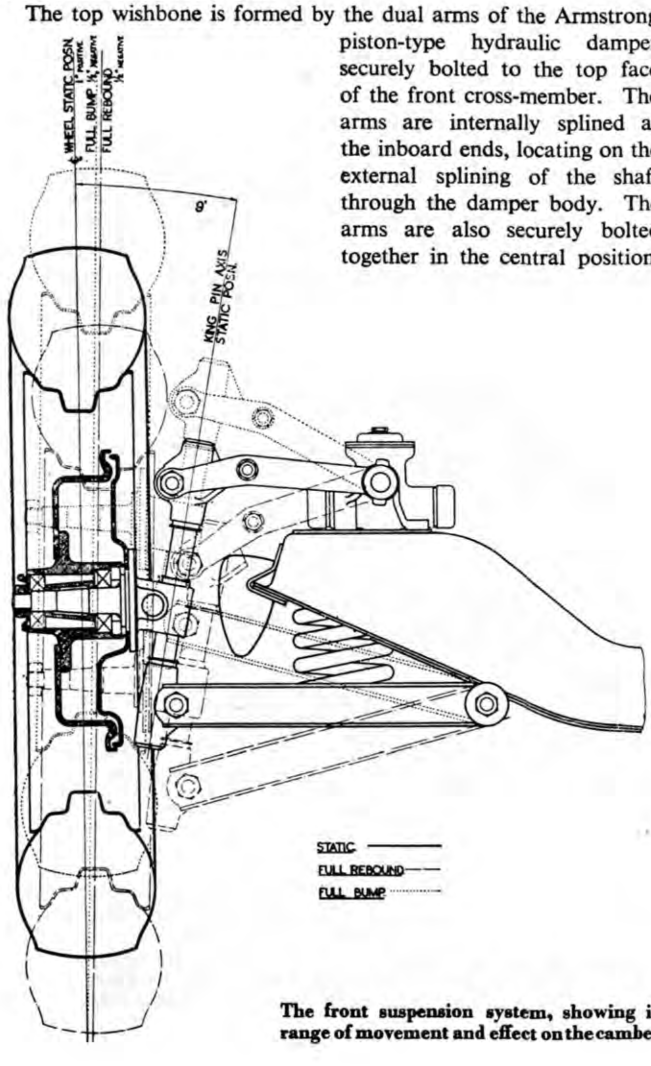
***The care and maintenance of this most important feature is fully described by***

***W. E. BLOWER***

THE independent front suspension layout, formed by top and bottom wishbones and incorporating coil springing, is now an accepted feature on the Midget models and is, without a doubt, a tremendous improvement on the pre-war and early post-war semi-elliptic springing.

Independent road test has proved the suspension to give perfect stability with riding comfort, and by the combination of the direct-acting rack and pinion steering gear, provides light and accurate control under all conditions.

The top wishbone is formed by the dual arms of the Armstrong piston-type hydraulic damper securely bolted to the top face of the front cross-member. The arms are internally splined at the inboard ends, locating on the external splining of the shaft through the damper body. The arms are also securely bolted together in the central position.




**The front suspension system, showing its range of movement and effect on the camber.**

Maintenance is confined to periodical replenishment of the damper fluid and examination of the anchorage to the chassis, the securing bolts being tightened as required.

The dampers are correctly set before leaving the Works to suit the requirements of the car, and no further adjustment is therefore required or provided. Initial damper setting is :—

*Rebound stroke setting*

1,000±100 lb./in. torque at 180°/sec.

*Mean lever arm speed*

20°/sec. at 250±50 lb./in. torque at a temperature of 18° C. (65° F.).

Weight applied at end of 8-in. arm = 31·25 lb.

*Compression stroke setting*

500±50 lb./in. torque at 180°/sec.

*Mean lever speed*

20°/sec. at 250±50 lb./in. torque at a temperature of 18° C. (65° F.).

Weight applied at end of 8-in. arm = 31·25 lb.

The bottom wishbone is formed by two " U " channels and bolted to the bottom spring pan, the assembly being mounted on the lower suspension pin, securely bolted to the robust box section chassis frame cross-member. The inner mountings of the lower wishbones are fitted with flexing rubber bearings, forming a silent and resilient connection to the chassis cross-member. The bushes do not rotate, the angular movement being taken up by the rubber flexing.

The king-pins are of a special design, the threaded top and bottom bearings providing large bearing areas and absorbing thrust and journal loads. The king-pin threads are right-hand threads for the right-hand side of the car and left-hand threads for the left-hand side.

### *Examination of Bush*

The swivel link, screwed to the top and bottom of the king-pin, is a special casting, fitted with a renewable bronze bush. The dimension across the thrust faces is 2·327 in.±·0015 in. When the swivel links show appreciable signs of wear the assembly of link and bush should be renewed. If, however, examination shows the bush only to be worn, a new bush can be pressed in, with the hole in the bush facing the threaded bore, and then reamed and burnished to ·750 in.±·0015 in.

The threaded bore of the link is a free turning fit on the king-pin, without any slack. An appreciable amount of slack is permissible in these threaded bearings and they do not require renewal unless excessive slack is apparent.

Running inside the swivel link is the fulcrum bolt distance tube, a steel tube ·7485 in./·7480 in. in diameter and 2·337 in.±·0015 in. in length.

Interposed between the swivel link and the suspension arms are

*(continued overleaf)*

two, one each side, case-hardened thrust washers, with an overall diameter of 1·25 in., bored in the centre ·510 in./·505 in. The thickness is ·068 in./·066 in. and the faces are flat and parallel to within ·0005 in.

Ingress of water or dirt to the king-pin bearings is prevented by the fitting of rubber cups or seals and retainer plates, the whole assembly being held in place in the wishbone arms by a fulcrum bolt, nut and spring washer.

On assembly, a total end clearance of ·008 in. to ·013 in. is allowed between the link and thrust washers.

The shouldered rubber bushes used in the inboard ends of the lower wishbone arms have an overall diameter of 1·242 in. at the outer face and 1·161 in. ±·002 in. at the inner face. The bore diameter is ·625 in. with an overall length of ·942 in. ±·005 in., the shoulder depth being ·293 in. radiused ·0625 in.

The bushes are quite a loose fit in the lower wishbone arms, but when clamped up with the securing nuts they expand into their housings. They do not rotate on their surfaces, the torsional deflection of the bush taking up the angular movement. Special care is taken when assembling to maintain a central location, so that the expansion of each half of the bush is equal.

To achieve this, each bush is inserted so that it protrudes equally each side of the housing, and then clamped up with the washer and nut. When central, the outer flanges of the bushes are of equal proportions.

To ensure even stresses on the bushes they are clamped up with the suspension levers set parallel with the ground.

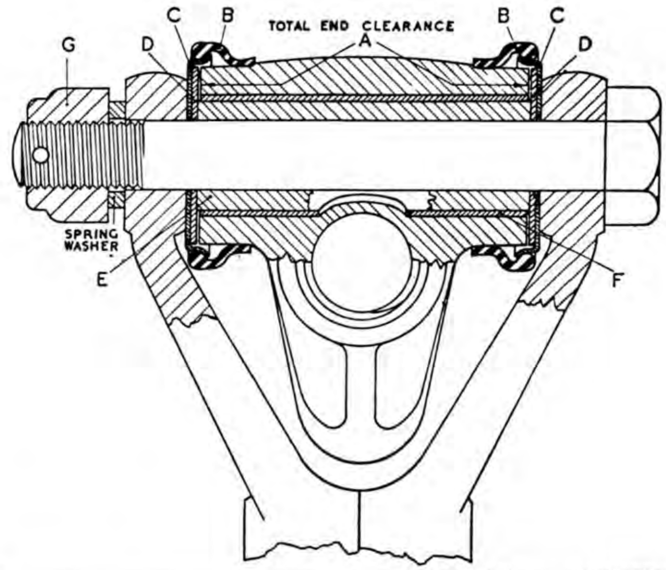
Lubrication for the king-pin and bearing is by means of two grease nipples, one at the base and the other at the top of the king-pin.

The stub axle to which is attached the brake back-plate and hub and drum assembly is located on the king-pin by means of a collar.

## *Heaviest Anticipated Load*

Upward movement of the lower wishbone assembly is controlled by the check rubber secured by two bolts to the cross-member, whilst the downwards movement or rebound is controlled by the extent of the damper travel, which is under normal circumstances capable of withstanding the heaviest anticipated load. In exceptional circumstances, however, where the road wheel leaves the ground the rubber mountings obviously relieve the initial shock.

The top of the coil spring is positioned in the top housing of the front cross-member by means of the spring spigot, whilst the bottom of the spring is located in the bottom wishbone pan, the top face of




**The assembly of the king pin swivel link.**

**A.** **Total end clearance.** **B.** **Seal—link.** **C.** **Support—link seal.** **D.** **Thrust washer—link.** **E.** **Distance tube—link.** **F.** **Bush—link.** **G.** **Nut—fulcrum bolt.**

the pan being relieved to take the bottom coil, with a raised spigot in the centre.

The spring has a ground wire diameter of ·498 in. with a mean coil diameter of 3·238 in. There are $7\frac{1}{2}$ effective coils, the free length of the spring being 9·59 in. $\pm\frac{1}{16}$ in. with a length of 6·44 in. $\pm\frac{1}{32}$ in. when loaded to 1,095 lb. Maximum deflection 4·24 in.

Steering geometry details :—

Camber angle (static position) : nil (tolerance $\pm 1°$).

Castor angle : $2° \pm \frac{1}{2}°$ with side-members parallel to the road.

Toe-in : nil.

King-pin inclination : 9° to $10\frac{1}{2}°$ on full bump.

The steering connection from wheel to wheel is provided by the steering gearbox rack bar and two short track-rods, with ball joints at each end. The outer ball joints are fitted with grease gun nipples, the inner ball sockets being automatically lubricated from the steering gearbox.

# The COOLING SYSTEM of the M.G. MIDGET (Series "TF")

***Having dealt in detail with a number of pre-war models, ERIC BLOWER now turns his attention back to the latest product of the M.G. factory at Abingdon***

THE pressurised cooling system of the M.G. Midget (Series "TF") is of the thermo-syphon impeller-assisted type with a thermostatic control. The water circulates from the base of the radiator by the pump, and after passing round the cylinders and cylinder head it reaches the header tank via the thermostat, top water connecting pipe and water hose. It then passes from the header tank downwards through the cooling ducts back to the radiator base tank.

Air is drawn through the radiator by a fan mounted on the water pump spindle, being driven by a belt from the crankshaft, which also drives the dynamo.

The system can be drained by opening the drain tap on the right-hand side of the engine at the front of the crankcase and the tap on the left-hand side of the radiator bottom tank. The location of the water impeller in the cooling system prevents the system from being fully drained from the radiator tap alone.

If an anti-freeze mixture is used, drain the water into a suitable clean container and retain for future use. To fill the system close both taps and fill through the filler in the radiator header tank, using rain-water for preference, until the water is approximately ½ in. below the bottom of the filler neck. It should be noted that the radiator cap cannot be removed.

When the engine is hot the filler cap should be unscrewed slowly. It is retained by a bayonet catch with a graduated cam which permits the release of internal pressure prior to the cap's removal. A lobe on the end of the cam guards against accidental release of the cap before the internal pressure is relieved. It is most important that your hand is protected against escaping steam whenever the pressure cap is unscrewed.

If the car is not kept in a heated garage, steps should be taken to prevent the cooling water from freezing during frosty weather. As a precautionary measure the water can be drawn from the radiator and engine or an anti-freezing solution may be used.

The M.G. Car Co. Ltd. recommends the use of Smiths "Bluecol", Filtrate "Neva-freze" or Shell "Snowflake" anti-freeze in order to protect the system and reduce corrosion to a minimum.

Before introducing the anti-freeze mixtures, clean out the cooling system passages with a hose inserted in the filler cap aperture, with both drain taps open. To avoid loss of anti-freeze due to expansion, top up when the cooling system is at normal running temperature.

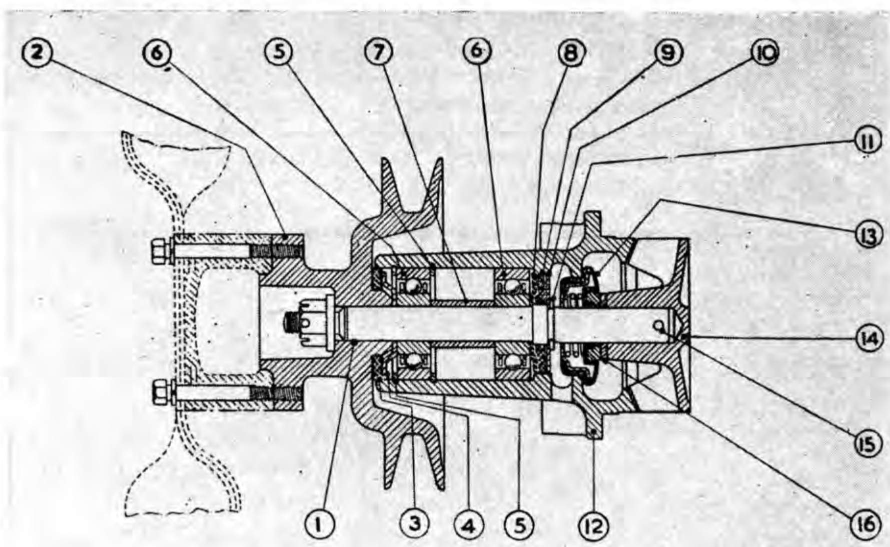
Make sure, too, that the system is watertight, and examine all joints and renew any hoses if necessary.

To remove the radiator, first open the drain tap and, while the system is draining, remove the two screws securing the rear bonnet hinge bracket and withdraw the bonnet top rearwards from the front hinge and lift the bonnet clear of the car.

Detach the forward end of the radiator stays.

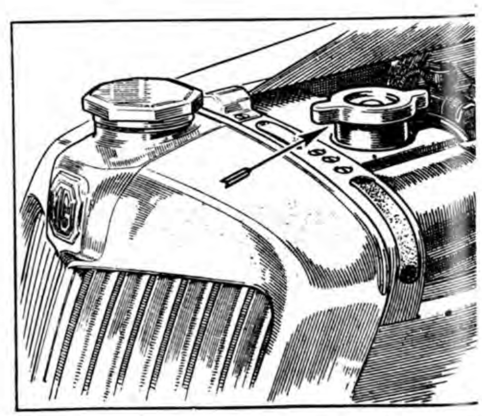
Remove the two set bolts securing the front bumper, withdrawing bumper complete with number-plate and distance-pieces.

Remove the two bolts, nuts and washers,




**The assembly of the water pump.**

1. **Spindle.**
2. **Fan pulley.**
3. **Felt washer (front).**
4. **Retaining cover (front).**
5. **Bearing circlip.**
6. **Bearings.**
7. **Distance tube.**
8. **Retaining cover.**
9. **Felt washer (rear).**
10. **Retaining washer (rear).**
11. **Pump spindle circlip.**
12. **Pump body.**
13. **Seal.**
14. **Impeller vane.**
15. **Taper pin.**
16. **Gland seating washer.**



**Showing position of cooling system filler cap.**

one in each corner, securing the front valance to the lower corners of the front wings.

Remove the bolts, nuts and washers securing the front valance to the radiator and withdraw the valance.

Remove two self-tapping screws, one in each bottom corner of the bonnet sides, securing the sides to the radiator casing.

Remove, one each side, the bolts, nuts and washers securing the bonnet sides and wings to the radiator casing.

Remove, one each side, the bolt locking nuts and flat washers securing the top front corners of the bonnet sides to the brackets on the radiator casing.

Disconnect the by-pass hose at the thermostat housing.

Disconnect the hose on the water pump elbow, and the hose at the water connecting pipe bolted to the thermostat housing.

Remove the securing nuts and locknuts from the mounting brackets, noting the position of the rubber buffers, retaining rings and washers, and lift radiator complete from chassis.

Replacement is carried out in the reverse manner to that detailed for removal, always remembering, of course, to close the drain tap prior to filling with soft water.

### *Removal of Water Pump*

To remove or replace the water pump it is first necessary to remove the radiator. Then release dynamo bolts and set screw, push dynamo towards engine and slip off drive belt.

Remove bolts and washers securing pump to crankcase, and remove nuts from water pump studs. Note that bolts are of different lengths.

Withdraw water pump assembly from crankcase.

Replacement is carried out in the reverse manner to that detailed for removal, but ensure that the flange washer is in good order and that the pump bolts are replaced in their correct position.

The pump is fitted with a special integral seal which provides an efficient water seal and requires no lubrication or adjustment.

Remove the radiator and water pump and withdraw the bolts securing the fan blades to the fan centre and remove blades.

Tap out the taper pin attaching the impeller vane to the pump spindle, taking care to see that it is tapped out in the right direction. Withdraw the impeller vane, which will give access to the gland seating washer and integral seal.

Remove the gland seating washer and seal, taking care not to damage the seal during removal.

Remove the attachment nut and flat washer securing the fan pulley to the pump spindle, and withdraw pulley and pulley key. Remove the felt sealing ring and felt retaining cover. Remove the outer bearing circlip by engaging the lugs with a pair of long-nosed pliers.

Pour a little paraffin into the impeller body around the outer bearing and tap the inner end of the spindle on a piece of wood until the outer bearing can be withdrawn, and remove distance-piece between the bearings.

Remove the inner circlip by contracting the ring and inserting a screwdriver behind it to ease it out of its groove.

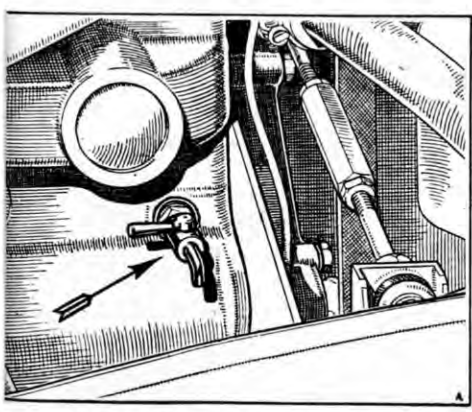
After removal of the circlip the retaining bearing and impeller spindle can be withdrawn. Renew the front and rear felt oil sealing rings if badly worn and the bearings if unduly slack.

Carefully examine the seal for wear or damage and renew if necessary. The face of the gland sealing washer should be checked for flatness and all edges freed from burrs.

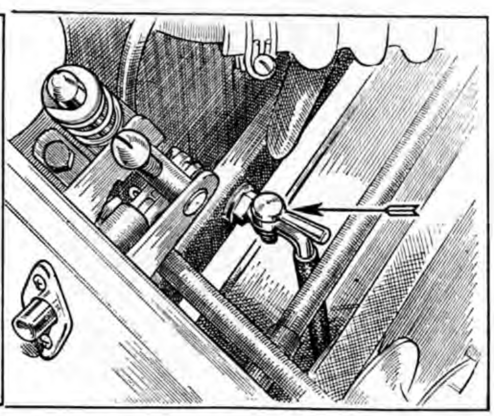
Reassembly is carried out in the reverse manner to that detailed for dismantling, noting that the sealing for the integral seal is against the boss of the impeller vane.

Partially fill the space between the races with grease and liberally soak the felt washers in engine oil or grease before replacement.

Do not overtighten the slotted nut retaining the pulley.



**The water drain tap on the cylinder block.**



**Showing position of radiator drain tap.**

# MGTD WOOD REPLACEMENT

***by Gil Dupre***

I bought my TD three or four years ago and as I was in the middle of restoring a 1962 MGA MKII that I spent almost ten years to finish, I tucked it away in the back of the garage and only cleaned it up for driving around the block occasionally. I know ten years sounds like a long time to restore one car, but it really wasn't too bad consider ing that I also restored a VW GHIA, three MGB's, helped several friends with their restorations as well built up about twenty engines to support my hobby.

First, I'd like to tell you how I happened to acquire this TD. About six years ago I was visiting the local MG dealer here in Chattanooga and was talking with the service manager. He started telling me about this 1951 TD he had been restoring in his garage for some person involved in a divorce. Evidently the guy didn't want his ex-wife to get the car so he hid it. She got it anyway but had never come to pick it up and pay the storage charge of three dollars a day. He continued to describe the car and after he got through he said that if the woman didn't come for it soon, he was going to start legal action to take possession of it for storage charges. I matter of factly said that if he did get the car and wanted to sell it, that I would give him $3,000 for it. Since I had known him for several years and he had never mentioned this car before, I wasn't sure if he was pulling my leg about the whole thing. I left and forgot about our conversation and, even though I spoke to him many times after that over a period of two years, it was never mentioned again. I didn't even know where he lived.

One evening I got a call from him and he told me that he had taken possession of the car and wanted to know if I still wanted it. Of course I said yes. The next morning I went to the bank and hocked every MG I had and got the money. I went over to his home, aired up the tires hooked up a towbar and towed it home. I decided that I had made a very good deal. Other than a siezed engine and rotten wood it was in what I would call excellent restorable condition. It still had the tool kit, jack, grease gun and crank.

Well to get on with the tub restoration.

This past summer 1984, I decided to start on the restoration of this car so I got out the original workshop manual someone had given me titled "MG MIDGET-SERIES TD" published by Scientific Magazines; Rockdale NSW, Australia copyright 1952, and proceded to remove the body per its instructions. That was easy I said to myself, now what do I do? I knew the lower wood was rotted so I started trying to remove it but found out very quickly that it was not all that easy. I made a few calls to NEMGT members and it seems nobody has ever written anything on this tedious procedure. I dug through about four years of TSO's and anything else I could find until I finally found a photograph of a TD on the assembly line with no clothes on. From that I devised a plan of action. The following is a step by step description of what I did:

1. Remove all eleven bolts from cowl that holds it to the firewall (see Photo A) and lift the firewall off.
2. Remove the wood screws that secure the outer skuttle (cowl) wood to the inner wood.

*Photo A*

3. Remove the small nails that secure the cowl and front side quarter and rocker panels, all the way around, to the wood.
4. Carefully pry the edges of these metal pieces away from the wood and remove from the wood without bending the edges. These edges will be important to properly re-install the new wood.
5. Remove the bolts and nuts securing the rear inner fender wells to the body frame rails. There are about 6 or 8 flat head bolts on each side.
6. Remove the small nails securing the rear metal skin to the coachwork wood all the way around the top, down the doorpost and the bottom as well as the rear behind where the gas tank was mounted.

*Photo B*

7. Remove the four rivets on each side that secure the inner rear fender wells to the rear cross brace. Drill or grind these rivets.
8. Now you can pry the metal skin away from the rear wood carefully as you did the front skin.
9. Now remove the rear deck flooring by removing the flat head bolts around the edge of the wood that secure it to the body frame.
10. Remove the sidecurtain stowage compartment by removing the wood screws attaching it to the rear wood cross piece.
11. Remove the gas tank mounting wood by removing the flathead bolts that secure it to the body frame. Before completely removing this piece of wood measure the distance between the body frame rails and record this for future use if you have to replace this wood.

Now you have all of what is left of the wood coachwork exposed. Look at it very carefully and even take photographs of it for future reference. Decide which pieces that you need to replace and make any measurements that you need to make sure the new pieces will be positioned the same when you install them and before you drill holes for their securing screws. Patience is a virtue unless you have a jig to put it back together. Before removing any of the wood order the pieces that you are planning to replace and wait until you get them so you can compare them and trim them to be as close to the original as possible. You can be working on rust removal and refinishing the metal skin while you wait. I sandblasted the inside of these and put two coats of De-Rusto ready mixed epoxy on them as I do all of the black frame and body parts that don't show.

Now for replacing the wood.

1. Compare the new wood with the original using calipers, etc. The new wood will be slightly oversized so that you will have to fit and trim to fit. If not I would resolve any problems with your supplier before continuing.
2. Now that you feel comfortable that the new wood can be installed very closely to the original, you can remove the old wood from the body frame rails to which it is mounted and sandblast or wirebrush and refinish with black paint. As before DeRusto epoxy if you so desire.
3. Reassemble the cross brace to the frame rails in the reverse.
4. Using the measurement between the frame rails at the rearmost points position and clamp the lower rear wood crossbrace and drill holes to attach to frame. Install new bolts temporarily until you get ready to install the gas tank support.
5. Install the top rear rail wood using the same precautions to make sure you have the proper distance between the frame at the top.
6. Fit and clamp the main bottom wood rails to the frame rails so as the rear door post or hinge pillar will fit against the crossbrace and align with the slots in the bottom main rail. This is a troublesome fitting spot and the slots in the main rail wood may have to be trimmed etc. as well as the door post. The same is true of the front door post or latch pillar. (Photo C).
7. After you think all is in place and clamped or secured with screws you should install the rear inner fender and quarter panels to check for proper fit. If not remove and sand and trim a little at a time until they do fit both in height and depth and length. This can be tedious but patience pays off.
8. Now position and clamp in place the front door post in the same manner. You will also have to use your door on each side and position it in place with the hinges in their slots in order to make sure there is proper door clearances on the front. (Photo D).
9. Once you have the front to rear door opening properly set with clamp the front new cowl wood pieces to the corresponding old pieces and drill the holes for the bolts to match. Now install these pieces and bolt to the front angle support on the frame then install and fit all of the cowl wood pieces and attach to the front door post. Also install the inner facia panel.
10. Install and fit the rocker rails below the door making sure the proper door clearances are maintained all around. (Photo E).
11. With all of these cowl pieces and door post in place now fit the front cowl and side rocker sheet metal parts over the wood checking the fit and noting places to be trimmed and adjusted for easy installation as near to the original fit using the original lips on the edges of the metal as a guide.
12. Now that all sheet metal is fitted remove it and using the holes in the frame and door post crossmember drill holes in the new pieces of wood and install screws and bolts to attach as original.
13. I removed all of the wood at this point and sealed it with epoxy then re installed it.

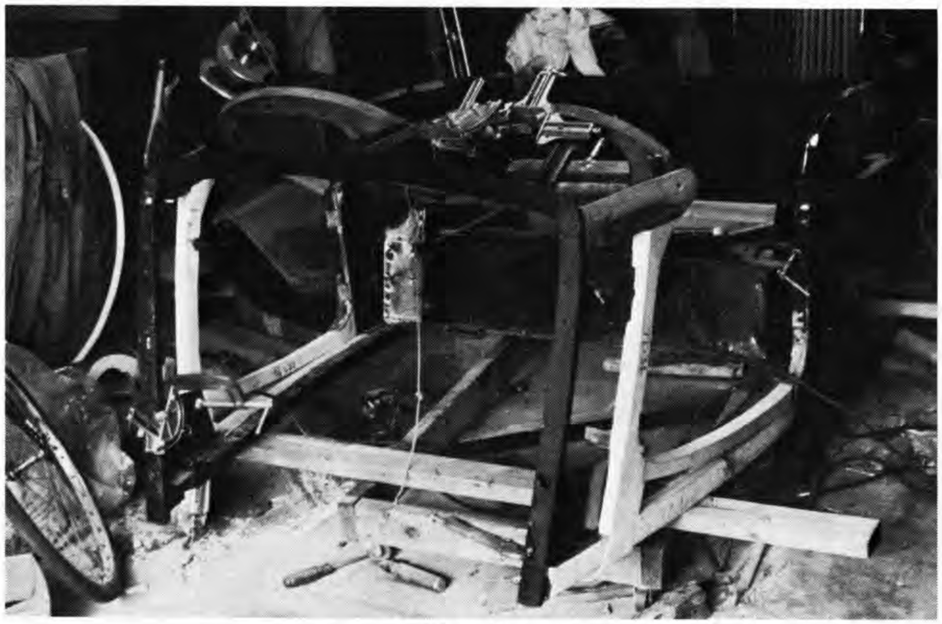


*Photo D*

*Photo C*

Photo E

14. Re-install all sheet metal and nail down the edges as original using clamps and mallet to get proper fit.
15. Now install the outer firewall cowl wood pieces and screw them to the inner cowl wood.
16. Install and bolt the firewall to the cowl. I used a silicone sealer between the firewall and wood.

## MGTD DOOR WOOD REPLACEMENT

Now that you have successfully replaced the rotten wood in the tub of your TD you can tackle the replacement of the wood in the doors.

1. Remove the uphostery panels.
2. Remove the hinges and mark them for the side and upper or lower. Remove the door check and mark lh or rh store in safe place with the hinges (Photo M).

Photo M

Photo N

3. Remove the diagonal cross brace and mark, refinish, and store.
4. Remove the door pillar brace mark, refinish, and store.
5. Remove the nails that secure the door skin frame to the wood.
6. Bend the door skin up from the bottom door frame by starting on one end and driving a screw driver under the lip and prying up until you can grab the lip with a pair of channel locks or a big pair of pliers. Bend this lip up the full width of the bottom until the bottom frame piece can be removed (See Photo N).
7. Remove all screws from the corners securing the wood together.
8. Now pry out the bottom wood then the front and rear pieces then the top piece.
9. Re finish the good pieces and fit the new pieces by installing them and trimming and sanding then seal all wood with epoxy.
10. Sand blast or wirebrush the inside door metal and refinish with epoxy (See Photo O).
11. Re install the wood and install the bottom door frame and recrimp the door skin by putting on a flat surface and tapping with a body hammer until secure as before.
12. With all wood joints properly joined with new screws, re-nail the door frame to the new wood (See Photo P).
13. Re install the pillar brace and diagonal brace.
14. Drill holes in the rear pillar for the hinge bolts and door check. Also drill hole for door handle in the front pillar.

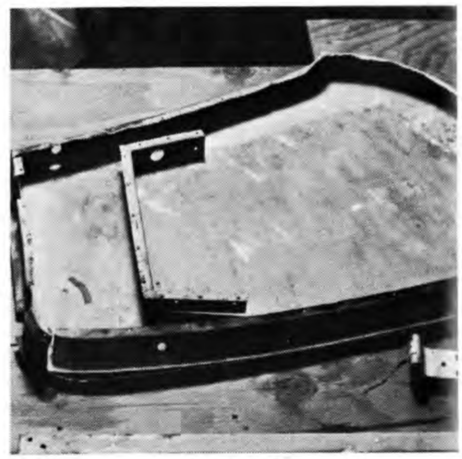


Photo O

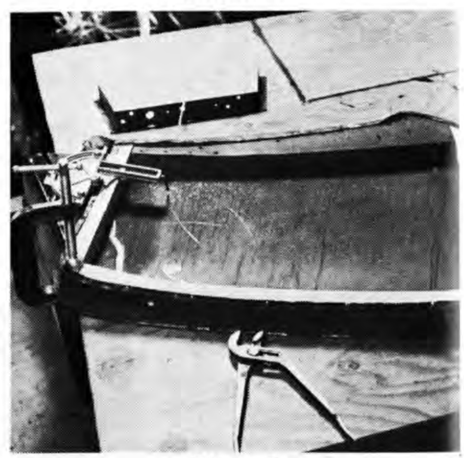


Photo P

Note - My TD was in very good condition and only the bottom wood was rotted so these were the only pieces that had to be replaced with new pieces. Of course the vertical pieces were replaced because they were bad at the bottom. I got all of my wood from Abingdon Spares and was well pleased with it.

*The M.G. Midget "TC" Series cars are equipped with Hydraulic Dampers incorporating the "Pressure Recuperation" feature. This reprint from* ***The Light Car*** *explains, in non-technical language, how they operate.*

## THE LUVAX-GIRLING DAMPER

*A New Device and How It Works*

You've read as good deal already about the Luvax piston-type, pressure recuperating shock-absorber in the descriptions of new cars that have appeared in "The Light Car." What is it? What does the term means? How does it work?

Well, first of all, you must forget the word "shock-absorber;" it is considered to be a misnomer: the road springs are the shock-absorbers: *damper* is a better term. Next, an amplification of the name: the result is the Luvax-Girling Damper and that is the name by which this particular commodity will be known in future. We must stress the fact that it is an entirely new and improved version of our old friend the Luvax shock-absorber.

The secret of the Damper is wrapped up in the term "pressure recuperating." In essentially non-technical language this means that when the piston returns to its "neutral" position after its initial damping movement, the cavity thus formed in the end of the cylinder is filled with oil — *completely filled* —for the simple reason that the oil has nowhere else to go. This is important. The piston must be "fully armed" for the next damping stroke, and it can't be unless the cavity or chamber is fully replenished.

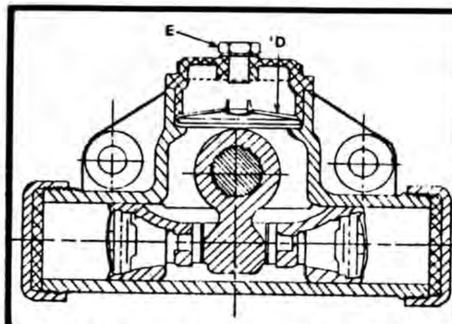
Now let us see how it works, assuming, for the sake of simplicty, that there is only one piston (the double-acting type is shown in the sketch has two opposed pistons).

Deflection of the chassis frame partially rotates an arm, one end of which actuates a cam. In turn, that cam forces a piston outwards in a cylinder. The speed with which the piston can move outwards, however, is governed by the speed with which oil can be transferred from one side of the piston to the other. This is controlled by (A) a relief valve and (B) a "bleed," the area of which is fixed by a restrictor pin. Both valve and "bleed" are part of the piston. The "bleed" is formed by a small flat on the top of the piston and a hole through which the restrictor passes.

On the return or inward stroke of the piston (as the chassis frame rises again) a disc-type recuperator valve permits the oil to be quickly transferred back again to the other side of the piston.

The transference is complete, because the body of the Damper, which is, of course, filled with oil, is sealed by a lid, or (to give it its technical term) a baffle.

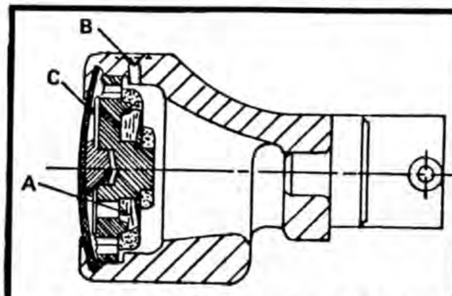
The baffle has one important peculiarity in the shape of a "predetermined annular leak," which does, in fact, permit oil to pass to the recuperation chamber above it. The leak permits a slow flow, but is too small to accommodate a rapid flow such as that which movement of the piston tends to generate. Its object is to take care of volumetric increases due to expansion by temperature and to permit the oil to




**Section of a complete double-acting unit, showing the camoperated pistons, and the baffle (D) which seals off the recuperating chamber above it, except for a "predetermined leak" past the extension of the filler cap (E).**

pass back again to the main oil chamber when the temperature falls.

To sum up, then, the piston moves backwards and forwards, the displaced oil on one side being squeezed via by appropriate ports and valve into the space on the other side. The manner of its regulation governs the ease, and



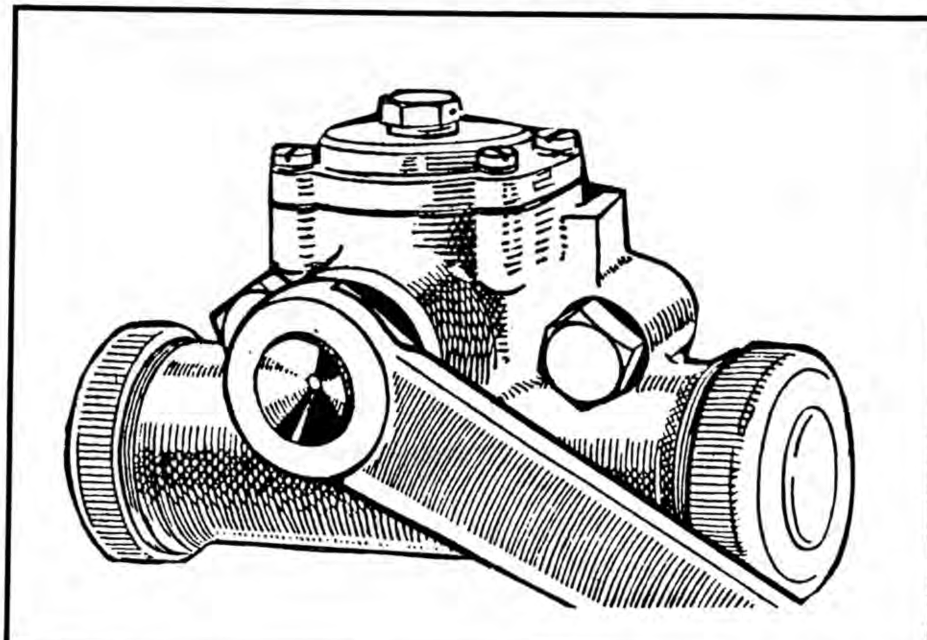

**A section of one of the pistons. (A) is the relief valve, (B) the "bleed" and (C) the disc-type recuperator valve. The curved member on the extreme left is a steel spring which keeps the valve assembly in place.**

therefore the speed, with which the piston can move, and the operating arm of the Damper can oscillate. That regulation of movement provides the damping action which enables you to drive over bumps and potholes as though they weren't there.

These Dampers are not adjustable. The best setting is obtained during actual road tests of each make (and model) of car and this setting is adopted on the standard production model.

The new Luvax-Girling Damper is good for 25,000 miles without attention. It is not an afterthought, so to speak, but an integral part of the springing assembly: a scientific device which is the outcome of much thought, knowledge and experiment: and it has a stern task, for pressures up to 1,000 lb. per sq. in. may be generated.

It's nice to think that you haven't got to worry about it, but it's worth knowing how it works.



# The NEW ENGLAND MG 'T' REGISTER, LTD.

**OFFICIAL USE ONLY**

Number ______

Date Recd. ______

Amt. Recd. ______

Date Plaque, card mailed ______

## MEMBERSHIP APPLICATION FORM

(One car only per form)

DATE ______

NAME ______
PLEASE PRINT LEGIBLY

ADDRESS ______

CITY ______ STATE ______ ZIP ______

OCCUPATION ______

SERIES MG ______ YEAR ______ COLOR ______ LEFT HAND DRIVE ______ RIGHT HAND DRIVE ______

TD s ONLY
CAR NUMBER include letters found here, if any [ TD/ ] [ ]

ENGINE NUMBER [ ]

TA, TB, TC, TF and Vintage MG s
CAR NUMBER [ ]

ENGINE NUMBER [ ]

The car and engine number data must be complete with letters as well as numbers. The required data is to be found on the 3" x 4" MAKER'S PLATE fixed to the battery box, tool box or firewall. Above is shown a facsimilie of that portion of the plate containing the data to be recorded. TD owners are cautioned to include the letters in the lower half of the CAR NO. rectangle: i.e. EXL, EXLU, EXL/NA, EXR, EXRU, etc. All registrants must include all letters and digits in the ENGINE NO. This data is important no matter which T-Series or Vintage MG is being registered. In the event the MAKER'S PLATE is missing, you may locate the Chassis Number on the left front frame rail and the Engine Number may be found stamped on a round or octagonal brass plate riveted to the block. If you are developing the required data in this manner, please take particular caution to record TYPE of Engine as well as the Number. If the Engine in your car is a replacement, i.e. if the ENGINE NO. stamped in the round or octagonal brass plate does not agree with the Number stamped on the MAKER'S PLATE, please write the data for the replacement engine here:

DETACH BEFORE MAILING

Replacement Engine Number ______

Please do not fail to give the original ENGINE NUMBER above if known.

Please use additional sheets if you would care to describe any **Modifications** made to your car. We are particularly interested in its **History**, such as ownership, competition record, date of manufacture, etc. or any pertinent data you would like to have made part of the record.

How (from whom) did you learn of the Register? ______

Are you already a Member of the Register? Yes ____ . No ____ . If Yes, please list your Membership Number(s) and car(s) so we may make proper notations. ______

Are you transferring from AM to Full or Vintage Membership? Yes ____ . No ____ . If Yes, what was your AM Number? ______ .

Are you reactivating a Membership that was interrupted? Yes ____ . No ____ . If Yes, what was your Membership Number? ______ .

If Yes, are you reactivating with the same car? Yes ____ . No ____ .

Has the Car shown on this form been registered previously by a former owner? Yes ____ . No ____ . If Yes, what was that owner's name and what Membership Number was assigned to him? ______ .

Do you have the previous owner's permission to retain this Membership Number? Yes ____ . No ____ .

I, ______ , hereby apply for Membership in The New England MG 'T' Register, Ltd. and enclose my fee in accordance with the schedule printed below. I understand I shall be billed for $25.00 Annual Dues as of 1 September each year and that these dues are payable promptly upon receipt of dues billing.

**Fee Schedule:**

| **If this application is mailed in:** | | | |
|---|---|---|---|
| | **Sep Oct Nov:** | **$35.00** | **(Includes $10.00 Initiation/Reinstatement Fee)** |
| | **Dec Jan Feb:** | **$33.00** | |
| | **Mar Apr May:** | **$31.00** | |
| | **Jun Jul Aug:** | **$35.00** | **(Paid For Next Full Year)** |

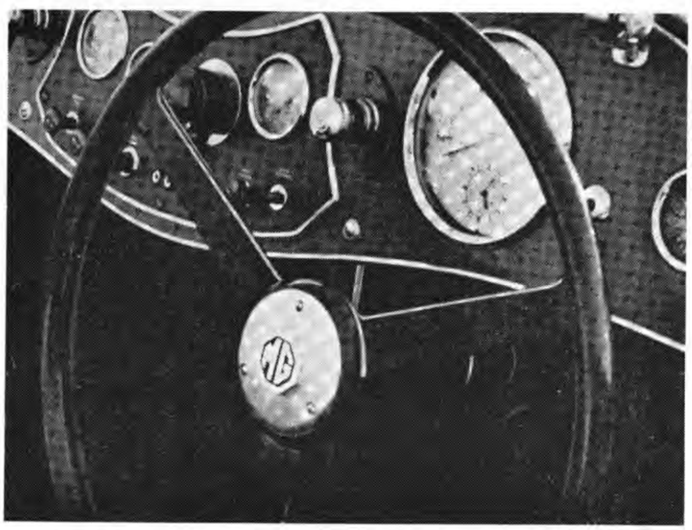
If you are already a Member in good standing and this application for Membership is intended to register an additional vehicle, the fee for each such additional vehicle is $5.00. $22.00 of your fee - if paid in Sep, Oct, Nov - is for a subscription to THE SACRED OCTAGON and is pro-rated for payment in other months.

To avoid errors, delays and confusion, please make certain you have provided all requested data in LEGIBLE FORM.

Please detach this sheet and mail with your check to: MG, Drawer 220, Oneonta, NY 13820

# The Way It Was . . . Accessories from the past

*Who said there wasn't anything to look for at flea markets?*



## STEERING WHEEL MEDALLIONS

A highly polished, cast aluminum steering wheel medallion, with the outstanding MG crest picked out in color that adds that certain touch of conservative adornment to your car.

. . . . . . $2.50

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## UNION JACK DECALS

A true, four color reproduction of the British flag for mounting on the side of the bonnet, or any flat surface. For use on all British cars, set of two.

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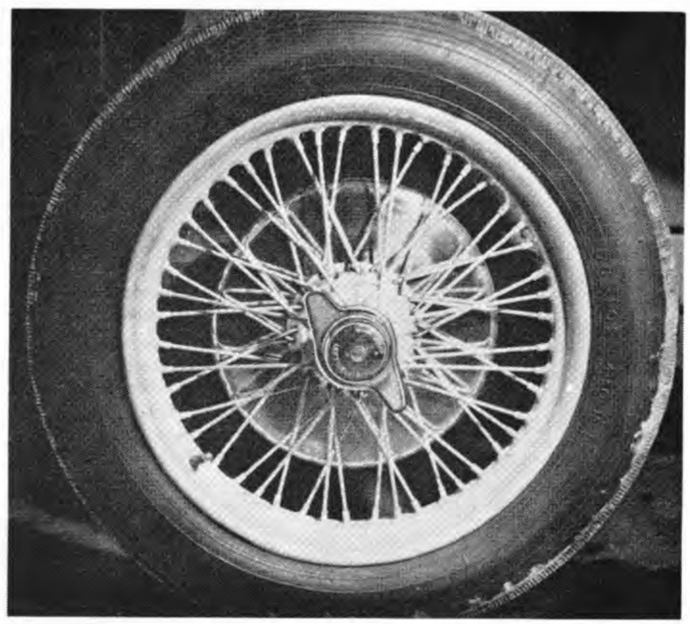
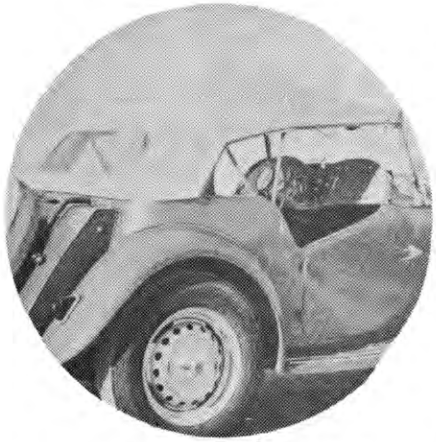


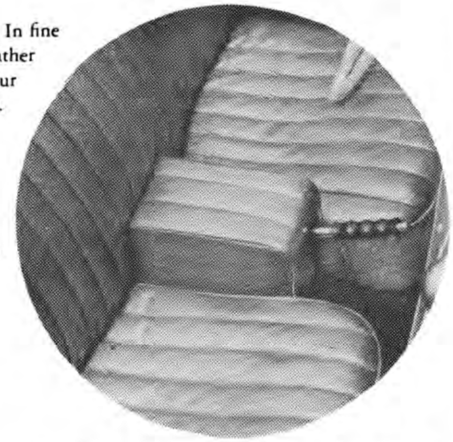
## POLISHED ALUMINUM WHEEL DISCS

A highly polished aluminum wheel disc for the MG TC Roadster that mounts securely between the wheel and brake drum, giving the appearance of a much larger drum. Effectively covers the gap between the rim and hub, to give the whole car a more solid look. Set of four ready to install on your MG.

. . . . . . $19.95



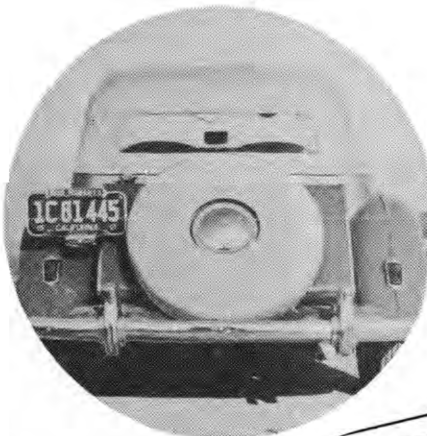
Center Armrest. In fine
genuine leather
to match your
upholstery.
Ash tray
optional.



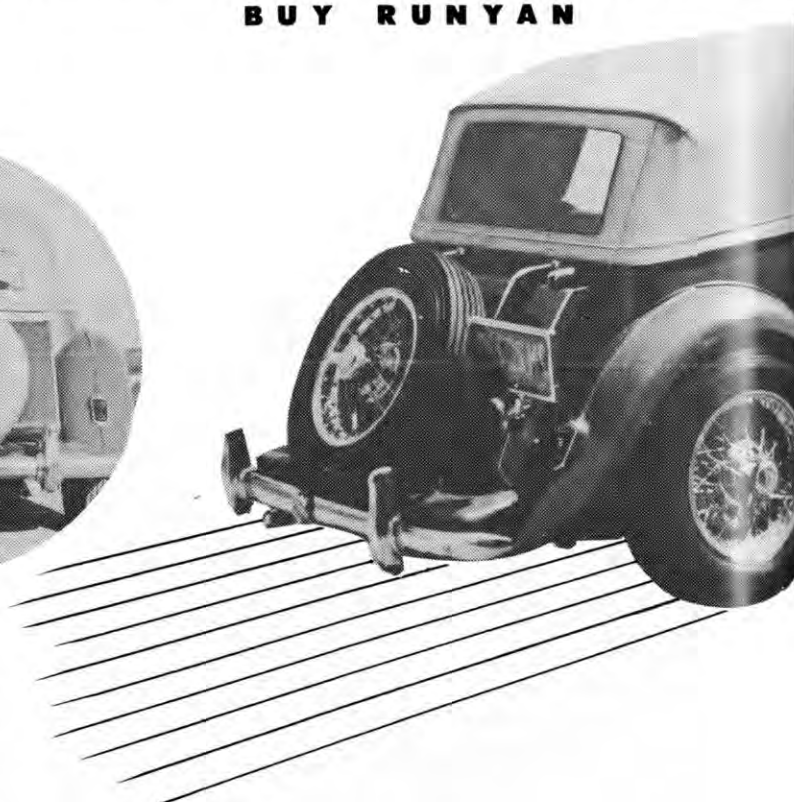
Our M.G. Tops are the
finest available.
Tailored to insure
a good fit
to side curtains.
Choice of colors.

**TO BE SURE YOU'RE SATISFIED...**

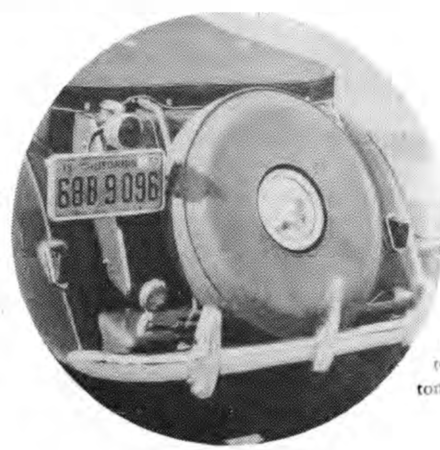
**BUY RUNYAN**




Note extra vision afforded
by larger rear window,
which is approximately
10x30 inches.



Tonneau Cover.
Gives overall
protection
and lasting
beauty to your car.
Over 2500 users now.

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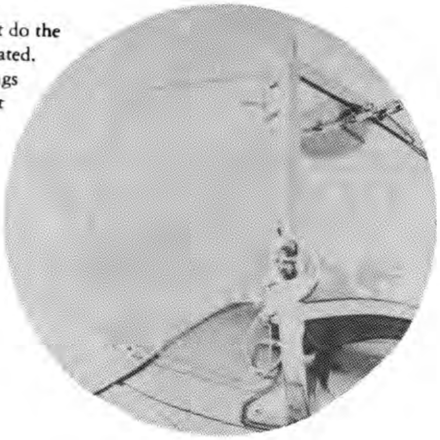
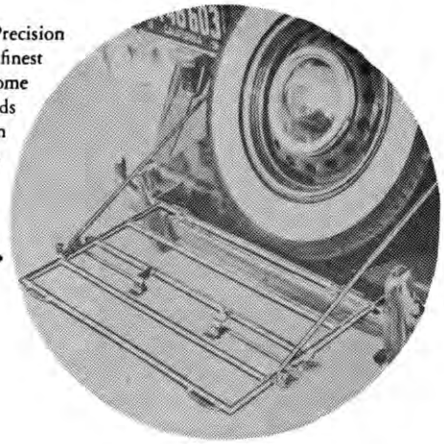
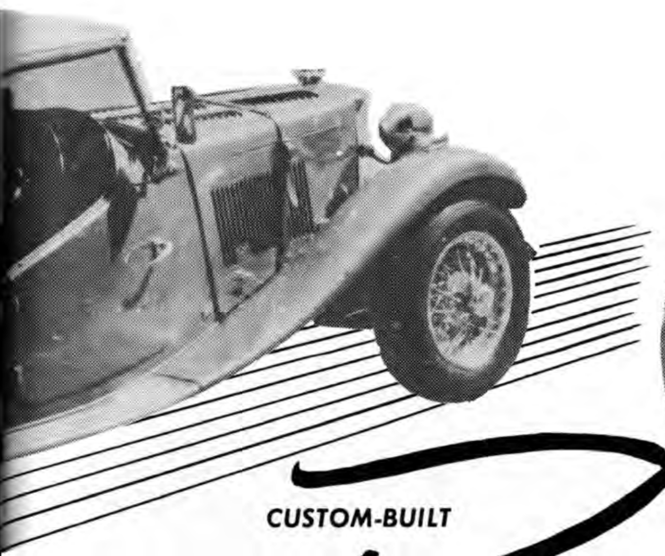
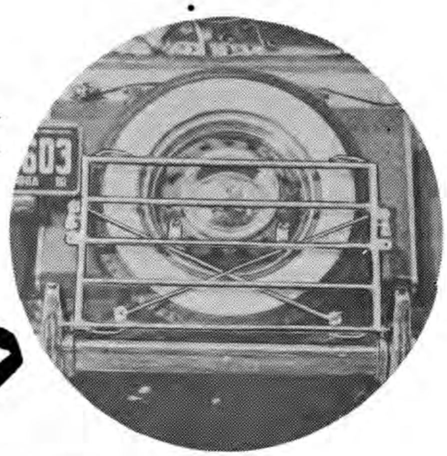


Trunk Rack. Precision crafted of the finest material. Chrome plated. Folds up as shown below.



Trunk Rack folds neatly when not in use. A must item that enhances the appearance of your M.G.



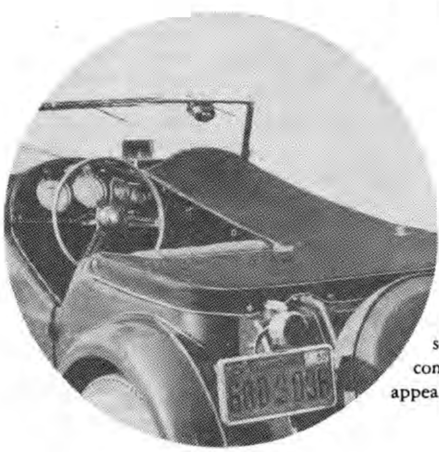


CUSTOM-BUILT

**Runyan**

**7966 SANTA MONICA BLVD.**
**HOLLYWOOD 46, CALIF. • PHONE GR. 5071**

Tonneau Locker. Steel framework, leather covered. The lid slides behind the seat when not in use, does not decrease space.



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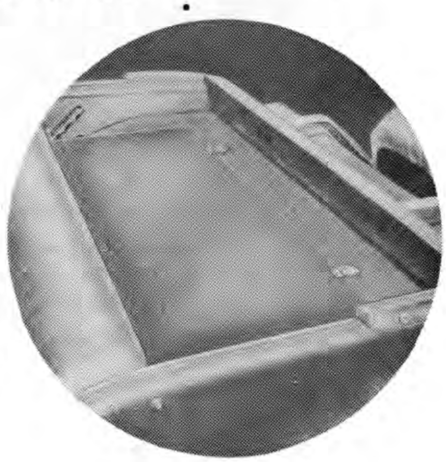
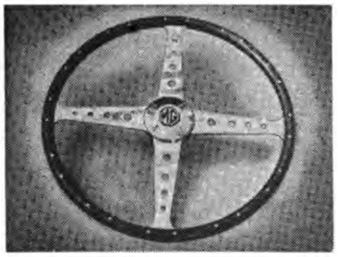
tops.

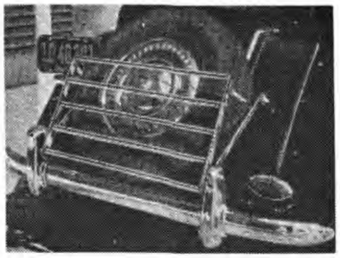
Tonneau Cover. Half folded back so that only driver seat is open. Adds comfort and smart appearance.



# MG CUSTOM ACCESSORIES by DORETTI

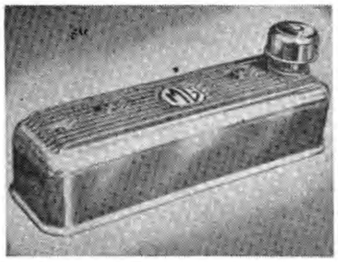


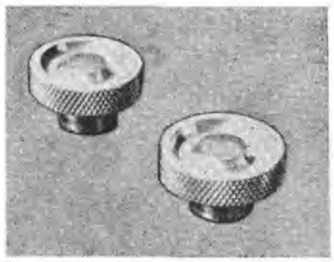
**STEERING WHEEL** . . . Patterned from a famous racing wheel. One-piece metal construction of Spring Aluminum. Rim covered with natural grain, English Walnut wood, highly polished and sturdily riveted in place.



**LUGGAGE RACK** . . . For you travelers . . . Carry all your luggage on this convenient rack. Folds easily and attractively out of the way when not in use. Beautifully chrome plated. Attaches quickly, simply by two special brackets.

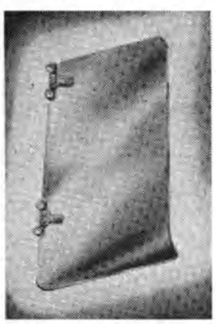
Styled to the exacting tastes of the discriminating Sports Car enthusiast . . . Designed to add that extra touch of Beauty . . . Manufactured to give the practical service that makes all Doretti Accessories so distinctively outstanding . . .





**VALVE COVER** . . . All Aluminum. Die cast for precision. Highly polished for appearance and machined to insure a perfect head seal. Specially designed breather cap prevents "blow-out" from oil filler hole. Has tapped (1/4" pipe) port for standard MG breather tube.

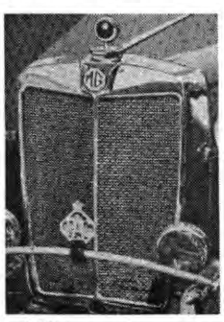
**VALVE COVER KNOBS** . . . Designed for easy removal of valve cover. No wrenches needed. Polished aluminum with knurled edge.



**WINDWINGS** . . . The ONLY Custom Designed Windwing on the market. The lower edge is flared for perfect wind deflection and just enough to make a snug fit over the door when side curtains are used. Made of sparkling, clear Lucite with snappy chrome fittings that attach securely to windshield frame without drilling holes.

**OTHER RUNYAN ACCESSORIES ARE:**

- Tartan Tonneau and Tire Cover
- Fiberglas Hard Top
- Sun Visor
- Center Arm Rest
- Assist Grips
- Direction Signals
- Wheel Discs
- Rear View Mirrors
- Radios
- and many more.

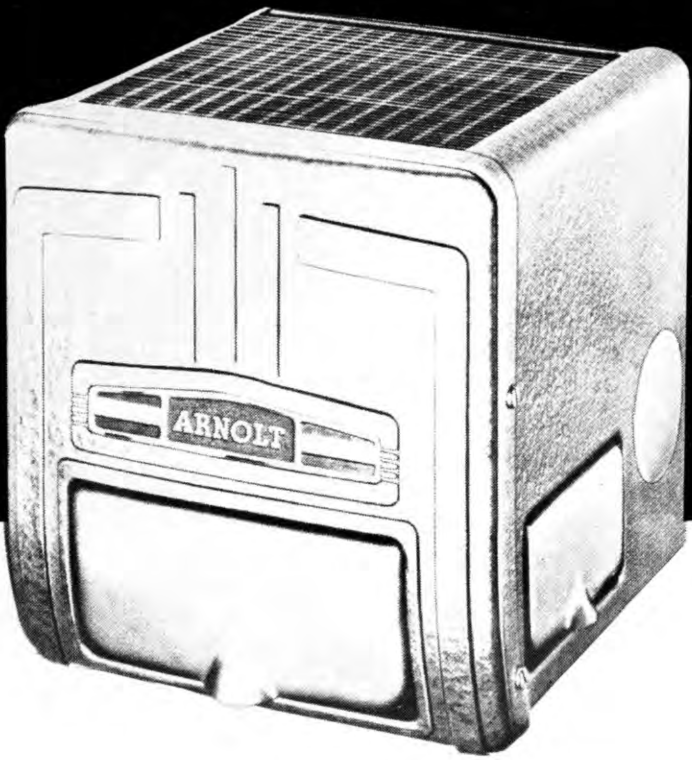


## TEMPERATURE GAUGE — GRILL — BADGE BAR

Here's "triple-threat" Beauty and Service for the front end. The **TEMPERATURE GAUGE** is easily visible as you drive . . . The woven steel **GRILL** is beautifully chrome plated and protects the radiator . . . and the **BADGE BAR** is a MUST for you club members.

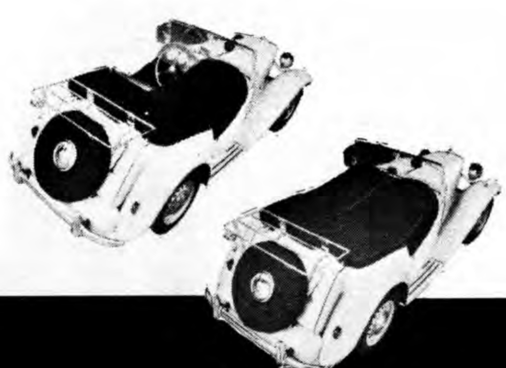
Runyan Inc.

819 NORTH LA BREA AVENUE
LOS ANGELES 38, CALIFORNIA




weather protection accessories

## ınd tonneau covers!



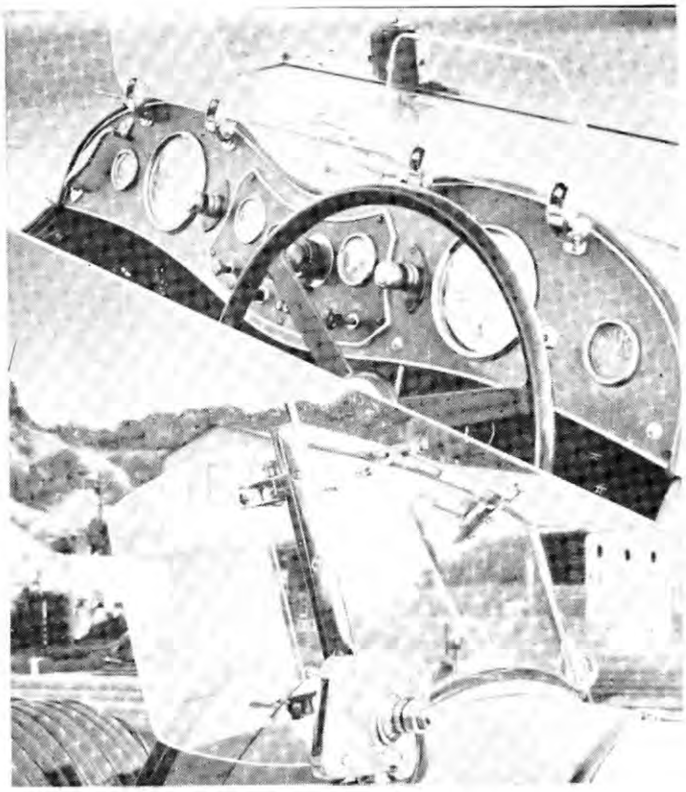
weather protection accessories

**Tire Covers**

Rugged three-ply Arnolt tire cover keeps tire new looking while adding a distinctive look to your MG. Custom-tailor styling makes sure of a snug fit. Seams double stitched for double protection. Available in ARNOCOLOR.

## Convertible Type Windwings
## Aero Windscreens

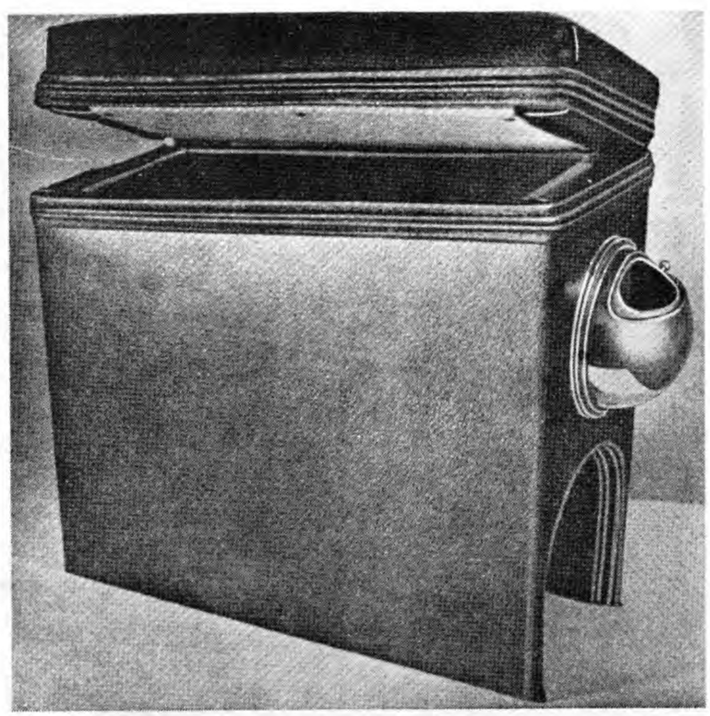
The famous accessory with a quality, factory installed appearance and a dual purpose. These are the only windwings on the market that can be instantly converted to a practical aero or racing style windscreen. As windwings they are ideal. . . . fully adjustable and non-rattling. They can be folded in flat against the windshield for use with the side curtains in position, or removed from the windshield and mounted on the facia as racing windshields. Chromium plated brass fittings, knurled adjusting screws, and a wrench, complete.



Above—As racing windshields.
Below—As windwings.

## Center Armrest - -
## Glove Compartment

This beautifully upholstered center armrest provides support for driver and passenger. Instantly mounted in place, or detached, it is finished in a dull black to harmonize with all interiors. The hinged top opens to reveal a spacious, fabric lined glove compartment. A chromium plated positive closing ash receiver is mounted within easy reach on the front of the unit. Made solely for use on the TC model MG.



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