

BUBBLECARS

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BOOK

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The Book of the

BUBBLECARS

by Cyril Ayton

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THE BOOK

OF THE

Bubblecars

Cyril Ayton

This handbook by Cyril Ayton will be of real value to all Bubblecar owners and enthusiasts. Information is included for the owner who likes to carry out his own maintenance and repairing.

Models covered in this book are the ISETTA, the TROJAN (HEINKEL), and the MESSERSCHMITT, up to

July, 1963.

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The Book of the BUBBLECARS

A PRACTICAL HANDBOOK COVERING THE ISETTA, THE TROJAN (HEINKEL), AND THE MESSERSCHMITT UP TO JULY 1963

CYRIL AYTON



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PREFACE

DESPITE the introduction of low-priced motor-cars in the past few years, three-wheelers—especially those defined in this book as the bubblecars continue to be good sellers. This is undoubtedly due to their extreme compactness and manageability, which make them so suitable for the heavy traffic of big towns, and to their low annual road tax and running costs. In August 1963 the anomalies concerning the driving-licence groups entitled to drive three-wheelers were resolved. Now the holder of a full motor-cycle licence may drive any type of three-wheeler with or without a reverse gear.

I thank the various concessionaries and manufacturers for their help in preparing this book: Trojan Ltd., Trojan Works, Purley Way, Croydon, Surrey; Messerschmitt-Cabin Scooters (Assemblies) Ltd., 11 South Wharf Road, London, W.2; Isetta—B.M.W. Concessionaires (England) Ltd., Victoria Road, Portslade, Brighton, 1. It should be noted that, although the Isetta is now produced in Germany and imported, ample

spares are carried at the Brighton factory.

C. A.

For your BUBBLE CAR

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CHAPTER I

THE BACKGROUND

THREE-WHEELERS are not new. They have been on British roads since the start of motoring. And at one time, between the two world wars, at least one name, Morgan, achieved the distinction of being confused as a general title for the species . . . in the way that Hoover for many means vacuum cleaner.

The Morgan was fast, noisy, not very comfortable. The engine was 10 h.p. Driving it, you felt the Morgan was more akin to a motor-cycle than a car, which was the feeling the manufacturers wanted you to have. It was motor-cycling with a third wheel. Very sporting, but not to be considered seriously as utilitarian, everyday transport.

A cut-price road tax for three-wheelers weighing less than 8 cwt also helped to define the three-wheeler public: young, sporting—at least, those who bought Morgans—and not very well off.

There had been other three-wheelers before 1939, of course. One or two of them had been aimed at people quite different from the Morgan fanatics; but they had only limited success, because they were not very attractive and sold at little under the price of family motor-cars such as the Ford Popular and baby Austin.

The current idea of the three-wheeler came after the war. Money was short; but even for the affluent the manufacturers could offer only dreary waiting lists for unexceptional motor-cars. So there was scope for new manufacturers—especially for those who could offer really cheap motoring.

In Britain that need was first answered by a northern concern, Sharps Commercials of Preston, who introduced the Bond Minicar. On the Continent money was shorter than in England. Workpeople in factories once devoted to war production faced unemployment and poverty. In Italy Signor Piaggio created the new-style scooter, named it Vespa, and sold it in hundreds of thousands. And a few years later, in Germany, one-time aircraft manufacturers, or new firms operating under the old names, made three-wheelers: the bubblecars. These firms were Messerschmitt and Heinkel (later, the Trojan). The third bubblecar was made by B.M.W., famous in cars and motor-cycles for many years.

Usage and of course appearance, rather than any arbitrary definition, gave these three German machines the title "Bubblecar"—and withheld it from the British Bond (which is not to claim any particular merit in the title). These three have a reputation which is subtly different from the Bond's.

The Bond offers cheap motoring but few other qualities to make it especially desirable for its own sake. Essentially the selling argument seems to be: if you can't afford a motor-car there is much to commend a Bond. It is cheaper to run, is cramped but can accommodate a small family, and has performance to surprise the sceptical. What is more (though this is not said, perhaps, but is implicit in the Bond's appearance), it looks very like a conventional small car.

The German approach was different. Certainly the bubblecars sell primarily on their low price but there is no suggestion that they should double for a family saloon.

In Britain they are more sophisticated than the entirely British three-wheelers. They are bought because "they are so handy in traffic," because they are unusually designed, particular fun to drive, or smart . . . all these reasons over and above the practical one that they are considerably cheaper to buy and run than the smallest motor-car.

CHAPTER II

CONTROLS, LAYOUT, AND RUNNING-IN

Controls, Instruments. The Isetta has the steering wheel on the right side, so has the latest Trojan, and the Messerschmitt has no bias at all but places the driver fairly in the middle. While the Trojan and the Isetta, apart from their front-opening doors (Figs. 1 and 2), emulate small-car layout



FIG. 1. FRONT OPENING DOOR OF THE TROJAN

Often confused by the "lay" public with the Isetta bubblecar, the Trojan is identifiable by more generous window area and a slightly longer body.

the Messerschmitt—mainly because of its narrow body—shows a profound break from car standards (Fig. 3). Inside it is more like a tiny aeroplane, with a steering bar drooping at each end for the hands in place of

a steering wheel, and the driver's seat which is raised to receive him then slides forward and down for driving.

All three makes are akin in their sparse instrumentation (Figs. 4, 5, 6, and 7). In standard form each has a (legally necessary) speedometer

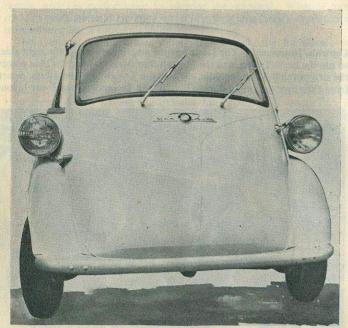


Fig. 2. ISETTA BUBBLECAR

This is the most elaborate of the Isetta range, the 300 Super Plus with right-hand drive, large headlamps and spare wheel. The engine is a 298 c.c. single-cylinder four-stroke with overhead valves.

incorporating a mileage recorder—and that is the only dial, though there is provision for fitting a matching clock in the Trojan and Messerschmitt. An ignition warning light is fitted in each car, and is important for two reasons. It glows when the ignition is turned on with the engine still, and warns against discharging the battery and overheating the ignition coil. It also glows when the engine is running but so slowly that the dynamo is not developing sufficient voltage to charge the battery. If the engine has to be speeded very fast before the ignition light cuts, attention to the charging system is indicated to avoid running the battery flat.

Messerschmitt Reversing Light. This is not a reversing light in the usual sense of a light fitted to the rear of the car, as an aid in backing: it is one of a pair, immediately below the ignition light on the right of the facia, and glows green when the "electrical reverse" system is engaged. This system is peculiar to the Messerschmitt among these three cars—where

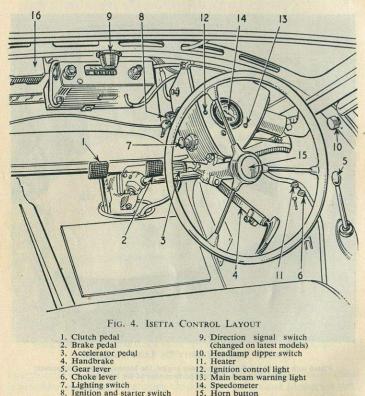


Fig. 3. Messerschmitt De Luxe Cabriolet

Fitted with the 191 c.c. Sachs two-stroke engine, the Messerschmitt cabin scooter has probably the highest performance of the bubblecars.

reverse is obtained by stopping the engine, then restarting it in the opposite direction. In practice it is simple, apparently foolproof, though irritating a little in the sequence of engine stopping and restarting which it demands. For the particularly skilful, or inordinately daring, it offers the interesting possibility of travelling just as fast "backwards" as the other way because, of course, top gear can be engaged with the engine spinning in either direction (Fig. 8).

Running-in. Though two of the cars have four-stroke engines, where the piston receives its thrust from the exploding petrol-air mixture only once in every four strokes of the piston in the bore of the cylinder, and one a two-stroke (with ignition, and thrust, occurring at the top of every second stroke), the same tactics are advisable for all. Acceleration should be



gentle, with no bursts of really high speed during the first 600 miles—and therafter only momentarily. But do not take caution to ridiculous extremes and "slog" the engine in too high a gear at crawling speeds. The idea is to be progressive in running-in, building up cruising speed gradually over the first 1,000 miles to around 40 m.p.h. For a hill that is climbable

16. Windscreen wiper motor

in top gear at lowish revs the best tactic is third gear and higher revs. Because the engine is new, working clearances (mainly, between piston

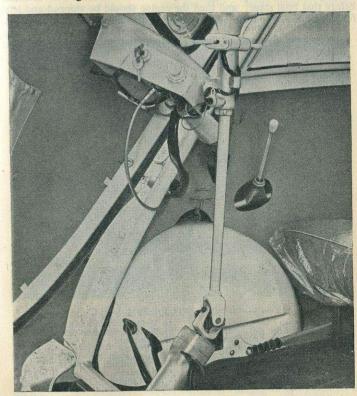


FIG. 5. ISETTA CONTROLS

Showing the action of the universal joint at the base of the steering column, as the door is opened; the gear lever on the right, and the car-type foot controls.

and cylinder wall) are dangerously small, and during running-in the mating surfaces should acquire polish through considerate driving.

However, running-in can be critical, even with the tenderest care, and incipient engine seizure may be experienced. But incipient seizure need not develop into the actual if the driver is alert. These are the signs: a fall-off in power, then perhaps a scraping from the engine—and then,

if you have not pushed the clutch pedal in, a scream as the piston locks in the cylinder! Usually, though, the driver can avert seizure a few seconds before that final stage: and then the engine should be stopped and left for a few minutes to cool. On restarting, speeds must be kept low and no

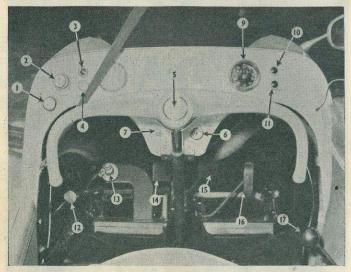


Fig. 6. Messerschmitt Control Layout

- 1. Choke
- Main and parking-light switch
- Main beam pilot light (blue) 4. Blinker pilot light (yellow)
- 5. Horn button
- 6. Ignition/starter
- 7. Blinker switch 9. Speedometer

- 10. Ignition warning light (red) 11. Reversing pilot light (green)
- 12. Handbrake 13. Dipswitch
- 14. Clutch pedal 15. Foot brake
- 16. Accelerator
- 17. Gear change

strain imposed until the engine is free again and ready for a reasonable cruising rate.

Taking the mean from the three cars' precise instructions on running-in (all very similar), these figures can be taken as a fair guide to running-in speeds: do not habitually exceed 10 m.p.h. in first gear, 20 in second, 30 in third, and 40 in top; at least during the first 600 miles.

Running-in Compounds. Many owners are puzzled over the virtues (if any) of running-in compounds, a confusion caused by the conflicting claims of advertising and personal opinion passed on to new drivers by

others as indubitable personal experience. The factories concerned differ, too: Isetta say "Don't bother. There's nothing to gain in using any special compound." Messerschmitt say that the 200 c.c. Sachs needs no special fuel mixture. At Trojans they are quite definite that the engine does benefit from a running-in compound and go so far as to specify the particular one to use-Addi-VJ, made by Senol Ltd., and available from Trojan.

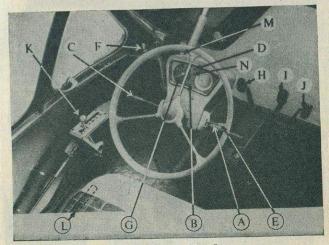


FIG. 7. TROJAN CONTROL LAYOUT

- A. Combined ignition and starter switch
- Ignition warning light Combined direction-indicator and
- horn switch D. Direction-indicator tell-tale light
- E. Lighting switch
- F. Parking light switch

- G. Speedometer
- H. Clutch
- I. Foot brake J. Accelerator
- K. Gear lever
- L. Hand brake (at side of seat). M. Panel light switch
- N. Main beam warning light

An independent judgement would be that a running-in compound is no substitute for the correct driving technique for running-in, which is all important: but there is certainly nothing to suggest that these special compounds have any adverse effects. The chances are that they are beneficial but in such slight degree as to make them hardly worthwhile.

Driving Technique. Though this book is too short for a lengthy homily on driving technique, one point is worth emphasizing and is particularly applicable to British drivers (for reasons which are obscure). These bubblecars, though of small engine capacity, thrive on hard work. They give best service with forceful rather than excessively gentle driving. The

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gears should be used generously, with the low gears held until the engine is spinning well, and a change down made directly there is a balk or a

THE BOOK OF THE BUBBLECARS

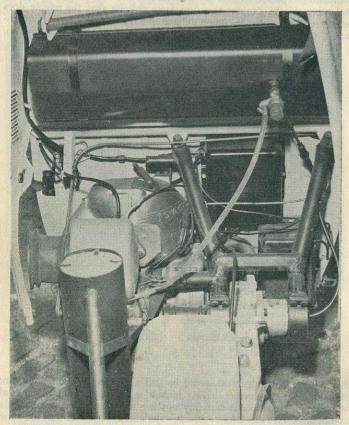


FIG. 8. MESSERSCHMITT ENGINE/TRANSMISSION The 191 c.c. Sachs two-stroke engine drives the rear wheel through chain and shaft.

hill imposes sluggish pulling in the high gears. The small engines, and the fact that they are all single cylinders, dictate this policy. There is no benefit to be obtained (other than extreme fuel economy) in treating a

bubblecar like a limousine and holding top gear when speed has dropped to walking pace.

Third gear is the one for speeds under 30 m.p.h. And this tactic pays dividends with the Sachs-engined Messerschmitt especially: here the engine is a two-stroke, and vigorous driving will inhibit carbon formation and so cut down the need for early decarbonizing.

Top speed of the Isetta and the Trojan is about 55 m.p.h., with acceleration to keep pace with average traffic. The Messerschmitt is probably a few miles an hour faster: a benefit from its more streamlined shape. Cruising speed of all three should be up to 50 m.p.h. without strain, and keeping to that speed where possible most drivers should have between 60 and 70 m.p.g. from the four-stroke machines and slightly less from the Messerschmitt.

Sideways roll on the springs through corners is slight on all the bubblecars and so is "pitching"—that undulating movement, front to back, of larger vehicles between ripples on the road. But bouncing can be induced very quickly. That is because the bubblecars are so small they tend to be lifted as one unit-rather than pitched. Their steering is very direct, very sensitive (so the need for correct tyre pressures is emphasized) and a light hand on the steering wheel is the way to drive them. A slight twitch of the wheel will be translated into a sharper twitch of the bubblecar, with none of that sluggish reaction found in bigger four-wheelers. The bubblecars' lightness and delicate steering make them sensitive to side winds, and the driver's full attention is needed to keep a true course in gusty conditions. And their lightness and smooth under-body can mean that deepish rain water on the road will have you "aquaplaning" if you press on at speed!

CHAPTER III

ROUTINE MAINTENANCE

A NOTABLE advantage of the bubblecar compared with conventional motor-cars is their small size and lightness, the fact that no one component -even the complete engine-gearbox unit—is too heavy to be manhandled by one person, or at most two. In this way the bubblecar encourages owner-maintenance more than the motor-car, which is too complex, too bulky and too heavy for the average driver to cope with.

For instance, there is no need to buy expensive ramps strong enough to support up to two tons; disused kitchen chairs, accurately placed, are quite strong enough for a bubblecar's 8 cwt.

LUBRICATION

The profound difference in lubrication between the Messerschmitt and the other bubblecars is in the use of petroil—oil mixed with petrol—in the two-stroke. This petroil mixture is inhaled from the carburettor, is compressed in the cylinder-head chamber by the rising piston, and ignited by a spark leaping the points of the plug; and so the piston is forced down in the cylinder bore on its power stroke. There is nothing out-of-the-way in that; essentially the same sequence occurs in the four-stroke engines. But whereas petrol, unadulterated, is used simply for power in the fourstroke, and engine lubrication is quite a separate business, in the two-stroke the petroil mixture is dissipated throughout the engine, the oil content lubricating bearings and piston to the standards achieved by separate oiling, from integral reservoirs in the crankcase, of the other machines. Petroil is simple, virtually foolproof, though perhaps a nuisance in its tendency to messiness through blow-back from the carburettor. It is also a slight burden in running expenses, calling for extra money for oil with every gallon of petrol bought. But the difference over a year, comparing petroil and separate oiling, is certainly one of the smaller factors in motoring costs—in a 10,000-mile year probably under £2.

All the bubblecars respond best to top-quality oils. It is not worth while using unbranded, cheaply priced, perhaps cheap-quality oils. The difference in cost for the oils over a year is negligible, and there is a possibility that the engine will suffer through use of the cheap oil. In "straight" (that is, non-detergent) oil the Messerschmitt should have SAE 40 oil mixed with petrol in the ratio of one part to 25 of petrol; a half-pint of oil to every 1½ gallons of petrol is a convenient way of ordering.

The Trojan and the Isetta take SAE 40 for summer and SAE 20 for

winter, or an SAE 20/40 multigrade oil. The Isetta concessionaires specifically recommend 20/40 as opposed to the (quite usual) 10/30 multigrade; it is thought that 10/30 is a trifle too thin for all-round use. Another tip in connexion with engines running on multigrade oil is to use a pint of fresh multigrade, rather than one of the special "flushing oils," as a cleaning agent for running through the engine during an oil change. After draining the used oil in the normal way (with the engine hot), the pint of fresh multigrade is poured in to fill the crankcase to the "minimum" level, the engine is run briefly, and then that pint is drained off also. After that the crankcase can be topped-up with fresh oil.

Daily Inspections. The only point to be watched is oil level in the engine reservoir—which does not apply to the Messerschmitt, of course, with its petroil lubrication. Owners of the other machines should always know whether the oil level is satisfactory: it is pedantic to suggest that the dip stick should be hoisted out every morning, though this is good practice, of course, if the car has covered several thousand miles and is beginning to "burn" oil. And as the oil volume in these small engines is necessarily low, greater care in maintaining the level is required.

Tyre pressures should be kept up to standard. The narrow track and light weight of the bubblecars make them sensitive to uneven tyre pressures, with consequent bad effects on steering and stability. The correct

pressures are given in the tables on page 80.

Every 1,000 Miles. Precise instructions as to those components and lubricants requiring attention are given in the individual instruction manuals; here it is intended to concentrate on essentials.

ENGINE OIL (ISETTA AND TROJAN). The engines should be drained and replenished with fresh oil (Fig. 11). With the engine well warmed up, stop the engine and unscrew the drain plug at the base of the crankcase. Drain the crankcase thoroughly. Give the engine a spin by the starter (with the ignition off) for complete draining. On both cars the gear transmission oil can be changed at the same time as the engine oil. The Isetta's transmission drain plug is on the left-hand side of the engine (looking from the back) and is at the base of the gearbox. The transmission is best drained while the whole unit is warm; then after it is drained, the transmission can be topped-up through the plug situated below the air filter just forward of the mudguard (Fig. 12). Capacity is just a pint. The sequence is similar for the Trojan.

DRIVE-SHAFT NUT (TROJAN). Remove the protecting cover on the lefthand side of the rear wheel and check the driveshaft nut for tightness. If there is any doubt remove the pin and tighten the castellated nut with

a suitable box spanner.

KING PINS (TROJAN). Pump medium grease into the nipples (one on

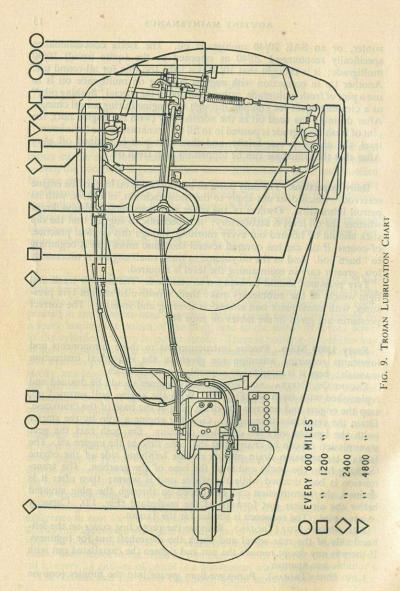
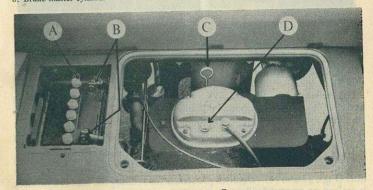


Fig. 10. Isetta Lubrication and Maintenance

- Pedals shaft
 Universal joint on steering
 Steering arm shaft
 Upper bearing, king pin
 Lower bearing, king pin
 Wheel bearings
 Oil reservoir, fulcrum bearings
 Brake master cylinder
- 9. Battery 10. Contact-breaker
- 11. Engine
 12. Rear leaf spring
 13. Rear drive
- 14. Air cleaner 15. Transmission
- Engine oil Transmission: SAE 40
- Lubricating grease
 Distilled water
 + Brake fluid: Girling
- Crimson
- × High-temperature (HMP) bearing grease



F.G. 11. TROJAN ENGINE COMPARTMENT

- A. Battery plugs
 B. Battery terminals
- C. Dip stick
 D. Oil filler hexagon

each king pin) with a pressure gun. (ISETTA) Two sets of nipples are provided on each Isetta king pin (Fig. 13). The upper nipples are for lubricating the top bearings, the lower nipples for the bottom bearings. Inject medium grease with a pressure gun. Also on the front suspension unit of the Isetta are two oil reservoirs, one at each wheel, to lubricate the fulcrum bearings

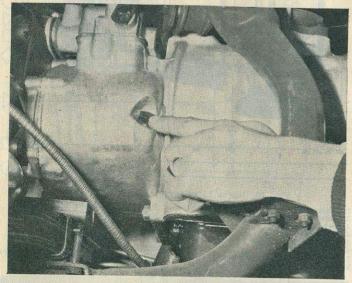


Fig. 12. Isetta Gearbox
Indicated is the filler for the Isetta gearbox; oil level should be checked every 2,000 miles.

of the swinging arm (Fig. 14). These should be topped-up to about the middle of the filler hole with SAE 40 oil.

STUB AXLES (MESSERSCHMITT). Both nipples should first be cleaned and then the grease gun applied until clean grease appears above and below the bolts on the stub axles. During prolonged use in rain or slush, the bolts should be greased more frequently and, of course, if the steering becomes stiff.

Brake Master Cylinder (Isetta and Trojan). The master cylinders should be checked to see that the fluid reaches the bottom thread of the filler (Figs. 15 and 16). Detailed procedure for refilling the master cylinders is set out on pages 62–67.

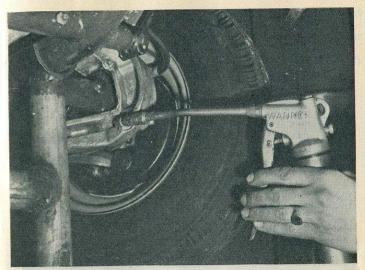


FIG. 13. GREASING ISETTA KING PINS
Two grease nipples are featured on each of the front suspension units.



Fig. 14. ISETTA STEERING LUBRICATION

The reservoir for the fulcrum bearings of the swing arm is shown.

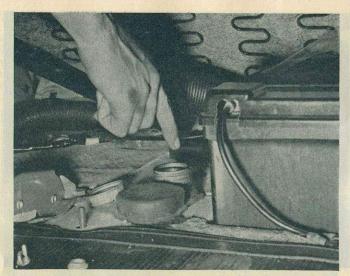


FIG. 15. ISETTA BRAKES: CHECKING MASTER CYLINDER Master cylinder for the hydraulic operation system of the Isetta's brakes is reached on raising the bench seat.

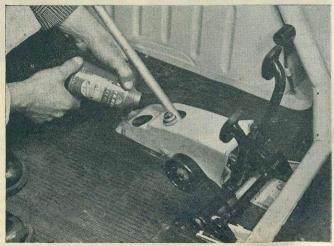


FIG. 16. TOPPING-UP TROJAN'S BRAKE MASTER CYLINDER

HANDBRAKE CABLE (ISETTA AND TROJAN). With a pressure grease gun

lubricate the handbrake cable through the appropriate nipples.

Control Pedals (Isetta). Inject grease by pressure gun (Fig. 17).

(Trojan). Use engine oil and lubricate through the holes provided.

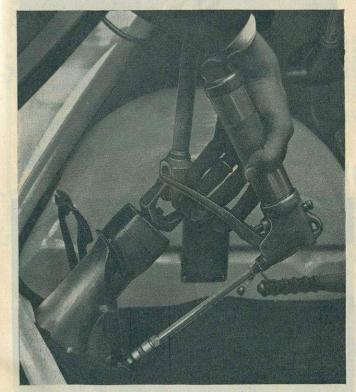


Fig. 17. Greasing Isetta Foot Controls

STEERING ARM SHAFT AND UNIVERSAL JOINT (ISETTA). Inject grease (Figs. 18A and 18B).

STEERING BOX (TROJAN). Inject grease.

CARBURETTOR AIR FILTER (MESSERSCHMITT). Clean the air filter and dip in engine oil thinned with petrol and replace.

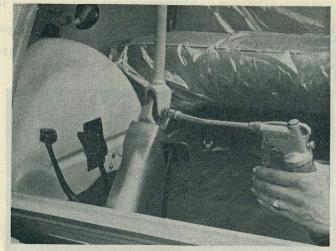
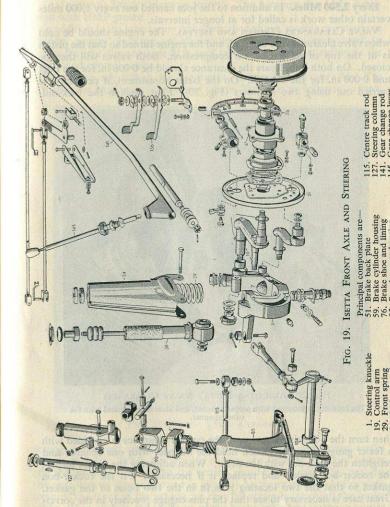


FIG. 18a. GREASING ISETTA STEERING





Every 2,500 Miles. In addition to the jobs carried out every 1,000 miles certain other work is called for at longer intervals.

VALVE CLEARANCES (TROJAN AND ISETTA). The engine should be cold when valve clearances are checked, and the engine turned so that the piston is at the top of its stroke, on compression. Both valves will then be closed. On both bubblecars the clearance should be 0.006 in. for the inlet and 0.008 in. for the exhaust. On the Isetta adjustment, if necessary, is carried out using two spanners (Fig. 20). First slacken the lock-nut,

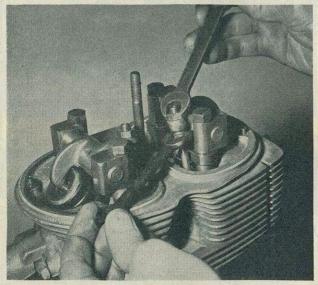


Fig. 20. Adjusting Isetta's Valve Clearances

The lock-nut is loosened with upper spanner, and clearance adjusted with the other spanner.

then turn the adjusting screw until the correct clearance is obtained with a feeler gauge (Fig. 21). Then hold the adjuster with one spanner and retighten the lock-nut with the other. When adjusting the valves inspect the rocker-box gasket and replace it if necessary. Fit the rocker-box gasket so that the two locating pins fit in the two holes of the gasket. Great care is necessary to see that the pins engage precisely in the corresponding holes in the rocker-box cover.

On the Trojan the adjustment is carried out by slackening the lock-nut on the rocker arm and turning the tappet screw as required (Fig. 22).

Transmission Shaft (Messerschmitt). The bearings should be lubricated with HMP grease.

In addition to the lubrication tasks described above, routine maintenance includes battery checking—which should be carried out every week to ensure that the electrolyte level is kept up—and periodic attention to the brakes and control cables.

Handbrake adjustment for the Isetta is described on page 66. The sequence for handbrake adjustment on the Trojan is as follows: correct



FIG. 21. ISETTA VALVE CLEARANCE

setting is achieved when the hand lever needs four to six notches to the full-on position. When the lever is nearing the limit of its travel before effective braking is obtained the setting should be restored by pushing the near-vertical lever (arrowed in Fig. 23) on the rear-wheel brake plate towards the front of the vehicle, so that the strain is taken off the brake cable. Then slacken the lock-nut on the brake cable and screw on two or three threads further along the cable. Check the lever. If it is satisfactory tighten the lock-nut; if not adjust the cable a little more.

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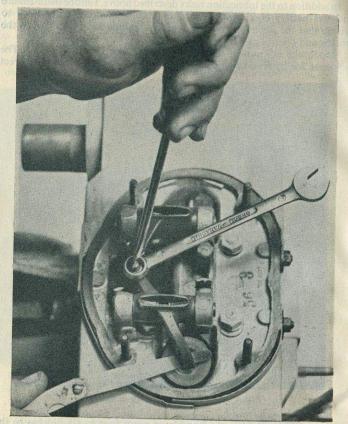


FIG. 22. ADJUSTING VALVE CLEARANCES (TROJAN)
Spanner retains lock-nut while adjuster screw is turned for correct clearance.

Greases. If the recommended grease is not available excellent lubrication will be obtained by using one of the special graphited greases which help to safeguard bearings by leaving a graphite surface even when the

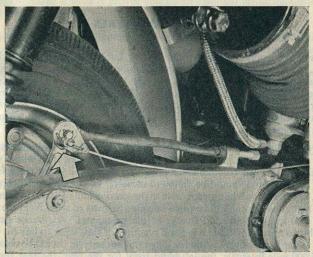


FIG. 23. TROJAN HANDBRAKE ADJUSTMENT Actuating arm for the rear brake is arrowed.

grease itself has been washed away or become useless through hardening. The normal small hand-applied gun forces grease through at high pressure. It is essential that the grease nipples be clean before the gun is used otherwise grit may be carried into the bearing with the clean grease. Pump in grease until it squeezes out from the bearing.

CHAPTER IV

WHEELS AND TYRES

Wheel. The only attention necessary for bubblecar wheels is to check that the wheel bearings are adequately lubricated. This is a job which crops up at, say, yearly intervals or every 10,000 miles. The wheel cover plates should be removed and fresh HMP bearing grease inserted in the bearings. Do not fill the dust caps to the brim with grease: the excess grease will almost certainly find its way into the brake linings when the unit becomes warm.

Tyres. Because of the three-wheeler's light weight, miniature track and wheelbase, tyre pressures are even more important than with a conventional car. The recommended pressures, as laid out in the table at the end of this book, should be followed closely: let the pressure drop too low, and the car will be unresponsive to the steering and will tend to wander; too high, and the car will be ultra-sensitive to gusts of wind from the side and will transmit all road shocks to the passengers. As garage gauges are by no means infallible it is good practice for the owner to buy his own and to use it exclusively. And for long tyre life the tyres should be changed at 5,000-mile intervals, the left-hand front for the rear, the rear for the spare, the spare for the right-hand front. Do not forget to examine the tyres for embedded nails and flints which can easily work into the casing and puncture the inner tube, and clean off oil and grease from the rubber with petrol before rotting can begin.

Tubeless Tyres. Some bubblecars are fitted as standard with tubeless tyres in which the inner tube is replaced by a special rubber lining forming part of the outer cover. In this type an effective air seal depends on close mating of the special tyre bead and the rim. Provided that this sealing is intact, air pressure is claimed to be maintained much longer than with the conventional tube and cover. A nail piercing the cover in a tubeless construction does not allow air to escape—provided the nail remains in the cover. The rubber inner lining grips the nail closely and so forms a seal. This is probably the chief advantage of tubeless tyres: the driver need have no fear of a blowout when motoring at speed.

Where a normal tube and cover is used the advantages of the tubeless variety can be obtained in some measure by using one of the proprietary sealants now on the market designed to be used either before or after the puncture, according to type. The cost of these sealants varies between 4s. and 25s.

The chief drawback of tubeless tyres—if the driver indulges in kerbclimbing tactics or in any way manages to disturb the once-perfect seal between cover and rim (and that occurs, of course, when a puncture is repaired)—is that it usually proves difficult to maintain an airtight set-up at the tyre-rim union.

Repairing Punctures. Repairing a puncture in the conventional tube means removing the tube, finding the puncture, cleaning the area round the puncture with petrol, roughing up the surface of the tube with the little file provided in the repair kit, applying rubber solution, and finally the patch. Nothing to it, really—but that sort of repair should only be used when it is not possible to have a patch vulcanized into place under heat. The technique for tubeless tyres requires a rubber plug to be inserted into the puncture with a special tool and then sealed in position.

Removing a Tyre. Trojan and Messerschmitt have "split-rim" wheels, composed of two plates with rims bolted together. The Isetta has an older-type wheel, a solid unit which bolts on to the brake drum. Wheel changing for both types is the same: merely jacking the car clear of the

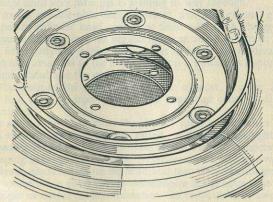


FIG. 24. REMOVING OUTER FLANGE, SPLIT-RIM WHEEL: TROJAN, MESSERSCHMITT

After flange-securing nuts have been removed, the flange is prized out of the tyre.

ground, undoing several nuts and pulling the wheel off. But the techniques for removing the tyre, for puncture repair probably, are quite different. The split-rim wheels on the Trojan and the Messerschmitt are simply "split," after the air in the tube has been released. Then with one side of the wheel off, following the removal of the outer ring of nuts (Fig. 24), the tube can be pulled out or the tyre removed. In refitting, the tube (slightly inflated to avoid "nipping" by the rim) is pushed into the tyre, then the outer plate is fitted and bolted up. Finally the tube is inflated fairly hard (say to 45 lb per sq in.), bounced, with the walls of the tyre smacking the ground, to ensure the tyre is mounted true on the rim, then let down to the correct pressure.

With the Isetta, the inner tube should be deflated and the edge of the cover opposite the valve pressed well down into the rim. Then the cover at the valve should come over the edge of the rim quite easily when a lever is inserted and leverage applied. Tuck another lever in a couple of inches away from the first and heave that segment of the tyre over the rim. Then withdraw the first lever and use it on the other side of the second lever, and so on. In refitting, inflate the tube slightly, brush the edge of the tyre with french chalk to help it slide over the rim, and finally inch the tyre into position with judicious use of levers or by "treading" the tyre with your heel.

CHAPTER V

DECARBONIZING

DECARBONIZING is the major job for the average owner who carries out his own maintenance. In fact this job seems to have extraordinary attraction; and often is indulged in more to prove the owner's (sometimes imagined) competence than because of the engine's crying need. With modern fuels and lubricants and sensible—reasonably vigorous—driving, the need for decarbonizing should occur only after many thousands of miles. Of course the two-stroke engine, because it inhales a relatively oily mixture, is more prone to carboning-up than is the four-stroke. And with the two-stroke the exhaust system is particularly sensitive to carbon formation. The residue of the petroil, burning in the exhaust outlet from the cylinder and the silencer, forms carbon which diminishes the passage until very little gas is pushing its way through.

This means considerable back pressure; and with exhaust gas unable to escape the cylinder head cannot be filled with fresh charge; and so performance drops. Extreme neglect here can result in almost no power at all. Eventually the engine may refuse to start. So in decarbonizing a two-stroke, attention to the exhaust system is at least as important as to the cylinder head and the piston crown.

In a four-stroke the valves—mainly the exhaust, because it runs in greater heat than the inlet—are a more important cause of diminishing performance.

After several thousand miles the contact faces of the valves and their seats in the cylinder head become pitted. A perfectly gas-tight chamber in the head is no longer achieved. This means a loss in compression, with gas escaping as the piston rises for the power stroke, and so power is lost. The only remedy is to remove the head, and then the valves for grinding-in; and of course it is a good idea to decarbonize at the same time.

The signs of undue carbon formation—in four-stroke or two-stroke—are "pinking" (a light-toned, metallic tinkling from the engine, more noticeable when under fair load as in hill climbing—and especially with too high a gear engaged), and "knocking" (deeper-toned than "pinking" but more obvious, again, when the engine is straining), generally rough running, and perhaps a tendency for the engine to keep running after the ignition has been switched off. In addition the two-stroke engine of the Messerschmitt may have a tendency to slip into four-stroking, although the carburettor setting is correct. This four-stroking shows as a slowing in the normal engine rhythm, the exhaust note separating into clear-cut

explosions compared with the smooth buzz of the two-stroke on form; and there is a great cut in power and reluctance in the engine to respond to the throttle.

Messerschmitt. Decarbonizing the Messerschmitt is absolutely straightforward. To remove the carbon from the combustion chamber in the cylinder head, the head must come off, and only four bolts secure the head. Take off the head and the seal between the head and the cylinder barrel—the gasket—and then scrape out the head with a bluntish screwdriver or special scraper. The idea in using something blunt is that the soft aluminium of the head should not be gouged, which would mean a tiny fragment of metal standing proud to be extra heated when the engine is running; that hot spot would contribute to running-on, with the ignition off.

The head should be cleaned to a bright, smooth finish. About the piston crown, the Sachs factory (where the engine is made) is emphatic that only the topmost burnt brown flakes should be removed, preferably with a fine wire brush. They believe that the solid black carbon crust on the crown should remain untouched as it protects the piston from excessive heat absorption, and so tends to cut down the chance of the piston seizing in the cylinder. This advice is not echoed by all engine specialists. For top performance it is probably a good idea to remove all the carbon from the piston crown—taking care, of course, not to damage its soft alloy (Figs. 25 and 26).

To clean the exhaust port in the cylinder take off the junction piece—the manifold—between the cylinder and the exhaust pipe and then turn the engine until the piston is in its lowest position; then scrape the port clean from the outside. Any carbon dropping on the piston should be cleaned off. Make sure that the exhaust system is free of carbon but do not interfere with the baffles in the silencer as undue exhaust roar will certainly result (which might be illegal)—and possibly a drop in performance.

Isetta. In decarbonizing, and any other relatively superficial attention to the engine, there is much to be said for removing the Isetta engine entirely from the chassis, when the unit can be worked on with greater ease. However, far less time is involved if the engine is merely lowered by approximately four inches in the chassis, which is enough for attention to the cylinder head.

To do this the two rear silencer straps must be released, the silencer flange and the exhaust flange and the exhaust flange nuts. Then the carburettor cable and all the electrical junctions should be disconnected. Finally unfasten the two top engine-mounting bearer bolts and the two lower bearer bolts. When the cylinder head is removed it will be necessary to take out the valves. A conventional valve lifter as sold by most motor-cycle agents will do the job. Mark the split collets holding the valve springs so that they can be replaced in their original order.

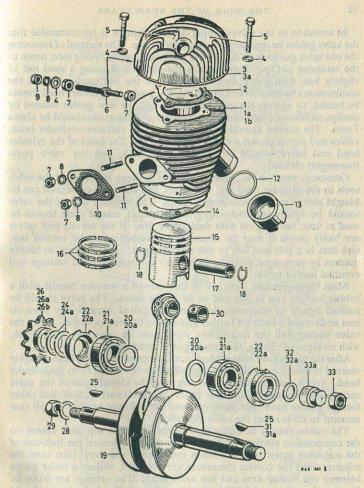


Fig. 25. Messerschmitt Engine Assembly

Main components are-

- 1. Cylinder barrel
- 3. Cylinder head
- 10. Gasket for carburettor flange
- 15. Piston with rings
- 17. Gudgeon pin
- 19. Crankshaft assembly (connecting rod, big-end, flywheels)
- 21. Main bearing

In attention to the valves during decarbonizing it is recommended that the valve guides be replaced as a matter of course. The method of removing the old valve guides is to cut or drill the guide, on the spring side, down to the retaining circlip. Then remove the circlip and using a steel rod of slightly less than guide diameter push out the old guides toward the combustion chamber. When fitting the new guides the cylinder head should be heated, to enlarge the guide channels, and the new guides secured by circlips. Clearance between the valve stem and the guide should be about 7 mm. The carbon should be scraped from all surfaces—cylinder head, valves and piston crown—with a blunt scraper. The faces of the cylinder head and barrel should be scraped clean also, and the valve ports thoroughly cleaned.

Grinding the Valves. The grinding is between the faces of the valve seats in the cylinder head and the valves, and the paste to be used can be bought at any motor-cycle or car dealer. The bevelled face of the valve should be lightly smeared with grinding paste; coarse paste should be used at first, finishing off with medium or fine. If the seating and valves are badly pitted it may be necessary for re-cutting to be carried out, and that is a job best left to the service agent. Any attempt to rectify matters by prolonged grinding in is likely to cause recessed seatings and eventual loss of power.

Most valve-grinding tools are in the form of a wooden handle with a rubber suction cup at one end to fit on the valve. The valve should be rotated lightly in alternate directions and raised occasionally from its seat and turned a little for further grinding in the new position. When the valve seating and the face of the valve have an even grey matt finish, with no signs of pitting, the grinding-in is completed.

After the valves have been ground-in, all components should be thoroughly cleaned in petrol, and all traces of grinding paste washed from the cylinder head. When reassembling make sure that the closed coils of the valve springs are towards the cylinder head. When all carbon, fluff, and other foreign matter have been removed, and the cylinder head is on, all that remains to do is re-set the valve clearances.

The valves should be adjusted with the piston at top dead centre on the compression stroke with both valves closed. Slacken the lock-nut of the adjusting screw with a 12-mm open-ended spanner; then turn the adjuster until the correct clearances are obtained, sliding a feeler gauge between the rocker arm and the valve stem. The settings are 0.006 in. for the inlet valve and 0.008 in. for the exhaust. The feeler gauge should slide easily but not sloppily.

After the lock-nut has been tightened check the clearance again to make certain it has not altered during tightening. Before replacing the rocker-box cover examine the gasket, and replace it if necessary.

ENGINE REMOVAL. If the owner should wish to remove his Isetta engine completely, this is the correct order of operation: turn off the petrol,

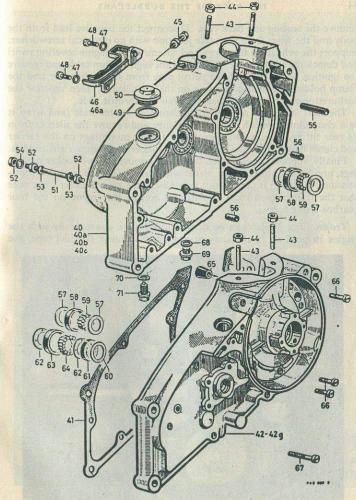


Fig. 26. Messerschmitt Crankcase

Principal components are—46. Oil sump

- 50. Breather plug
- 58. Roller bearing outer race
 64. Roller bearing inner race

remove the seating and back rest. Disconnect the negative lead from the body and the wires from the cable junction with an electrical screwdriver. Support the vehicle on the rear wheel. Remove the engine covering panel and detach the starter cable. Withdraw the high-tension cable and remove the ignition coil. Take off the petrol pipe from the carburettor and the clamp holding the hose connexion on the air silencer; then unscrew the carburettor cover assembly and withdraw the throttle slide.

The next step is to remove the carburettor starter slide (and wrap it in a clean cloth), detach the exhaust flange and remove the silencer from its rear fitting. Slacken the two upper rubber mountings on the carrier and clutch flange, and then the two lower rubber mountings, right and left.

Finally, support the engine on the knees, remove the two rubber mountings, and by light taps with a mallet withdraw the engine from the transmission. Refitting is carried out in precisely the reverse order—but note that the transmission must be lifted to engage the engine on the four gearbox fixing screws.

Trojan. The Trojan can be decarbonized quite conveniently with the engine in position in the chassis: merely disconnect the fuel pipe, the



FIG. 27. TROJAN: DECARBONIZING
Rocker arm shafts are being removed with a suitable-diameter drift.

carburettor and the exhaust. Unscrew the nuts retaining the rocker-box cover, then remove the cover together with the air vent hose. The nuts

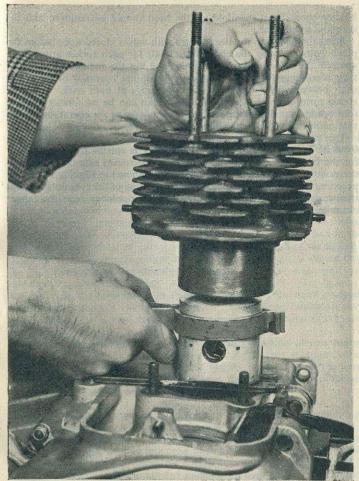


FIG. 28. FITTING BARREL: TROJAN

Using piston-ring compressor as barrel is lowered in position after thorough decarbonizing.

holding the exhaust manifold on the head should be removed and the manifold lifted clear.

Bring the piston to top dead centre with valves closed and slacken the pinch bolts retaining the ends of the shaft for each rocker arm. Then unscrew the valve adjustment a little, and tap the rocker shafts out of their mountings (Fig. 27). Spacing washers are normally fitted on the shaft between the rocker arm and mountings at both ends. With the rocker arms clear of the head the push rods can be withdrawn and the four cylinder-head nuts removed. The remainder of the operation follows that outlined for the Isetta (Fig. 28).

The valve settings are: a gap of 0.006 in. for the inlet valve, and 0.008 in. for the exhaust valve. The setting is carried out as described for the Isetta, except that the adjuster on the rocker arm takes a screw-driver instead of a spanner; the operation is shown in Fig. 22. It is good practice to warm up the engine following refitting of the cylinder head and then retighten the cylinder-head nuts and if necessary reset the tappet clearances.

CHAPTER VI

FUEL SYSTEM AND CARBURETTOR

Bubblecar engines, just like other engines, must be supplied with fuel and air to be compressed and then exploded as the source of power; and that is where the carburettor comes in. The carburettor brings the two components of that combustible mixture together, adding the petrol (or petroil, for the Messerschmitt) to the air in the ratio of about one part to fifteen by weight, then ushering the mixture into the engine. Though of differing makes, the carburettors on the bubblecars follow one principle: a float-chamber in which to store the petrol adjacent to the cylinder, a tube, its passage of tiny size—the jet—running between that float-chamber and a "mixing" chamber and permitting a dribble of petrol to be sucked along in response to suction created by the piston thrusting down in the cylinder. This dribble of petrol is caught up in the rush of air through the mixing chamber. The force and quantity of that air is determined by a shutter in the mixing chamber—the throttle, that is—and petrol and air together, enter the cylinder.

That puts the carburettor in simplest terms. But the most complex carburettors are only elaborate variations on the theme outlined above—and it may be a comfort to learn that bubblecar carburettors do not rank among the most complex!

None of the bubblecar makers is particularly keen on owners tuning the carburettor for more engine power. It is felt that so many other factors, such as the condition of engine gaskets, valve seats (in the four-stroke machines) and ignition timing, have to be taken into account in an attempt to increase performance.

Isetta. The carburettor used in the Isetta is a Bing fitted with an additional starting device which consists of a starter piston acting as a cut-off in a cylinder fitted to the side of the carburettor. In its top position the piston opens the air feed leading from the filter and the starting-mixture feed. During engine starting, when the mixture-slide valve is closed, fuel is drawn up, mixes with the air and so gives an over-rich mixture. Once the engine has started the piston is closed—in fact it is no longer operative—and the mixture-slide valve of the carburettor takes over. In all other respects the Bing carburettor is conventional.

After any attention to the engine involving removal of the carburettor great care must be taken during reassembly to make sure the carburettor is mounted with its float-chamber precisely vertical, and the carburettor

must fit without air leaks on the cylinder head. Where the carburettor fits over a tube or stub projecting from the engine there is considerable scope for setting the float-chamber off-beam. And take care that the slits in the carburettor body, designed to allow the body to be clamped securely over the inlet stub, are not inviting extra air into the cylinder. Where the carburettor bolts straight on to the engine, the thin gasket between carburettor and engine must be in good condition, and the retaining nuts drawn down evenly. Although the makers are reluctant to advise owners to alter main-jet sizes there is no valid objection against experiment.

SLOW-RUNNING ADJUSTMENT. Alterations in slow running should be carried out when the engine is warm. By means of the set screw the carburettor slide should be lowered so that the engine is ticking over slowly yet reliably. The volume-control screw should be adjusted so that the inner screw is turned out approximately one and a half turns from fully home. Beyond this simple procedure the carburettor does not need much adjustment.

Messerschmitt. A Bing carburettor (Figs. 29 and 30) is used on the Messerschmitt also, and attention to this particular instrument can be summarized as follows: periodic cleaning should be undertaken every two to three thousand miles, and to do this it is advisable to remove the carburettor complete. With the carburettor clear of the engine, the float-chamber cover can be detached on removing two screws and the float-chamber lifted out. Usually it will be found that dirt has formed a sludge in the bottom of the float-chamber and in the mixing-chamber plug underneath the carburettor.

At the same time the jets, main and idler, should be blown through with a low-pressure air line, or cleared with a fine brush. After perhaps seven thousand miles it is likely that the needle jet and needle will have worn slightly, and will therefore be passing more fuel than is desirable for correct mixture.

The only complete remedy is to replace jet and needle, although an interim measure would be to lower the needle by one groove. The slowrunning adjustment follows the same sequence as with the Isetta.

On the Messerschmitt the air filter fitted on the carburettor performs an additional role, in reducing intake roar. The filter body and element should be dismantled every 1,500 miles in order that the element can be soaked in petrol or paraffin and then blown through with an air line. Then the element should be left to soak in thin engine oil before hanging up to drain. This attention to the filter is necessary if the correct mixture strength for the carburettor and optimum fuel consumption are to be maintained. If the machine is habitually driven over unmade roads, or in a dusty atmosphere, the intervals between attention should be, of course, shorter than 1,500 miles.

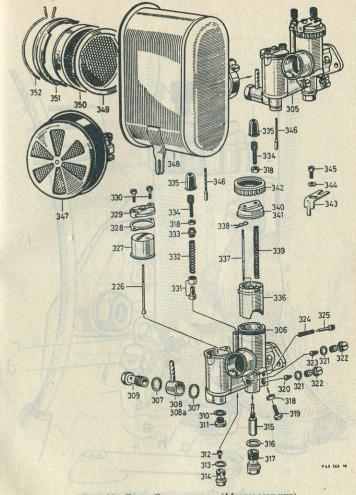


FIG. 29. BING CARBURETTOR (MESSERSCHMITT)

Principal	components	are
226 Flo	at needle	

- 306. Carbufettor body
- 311. Plug
- 312. Starting jet 314. Starting jet block
- 315. Needle jet
- 319. Throttle slide stop screw
- 320. Main jet
- 323. Idler jet
- 327. Float 331. Starting plunger
- 334. Adjuster screw 336. Throttle slide
- 337. Jet needle
- 339. Spring for throttle slide 348. Intake silencer
- 322. Block for main jet and idler jet 350. Filter cartridge

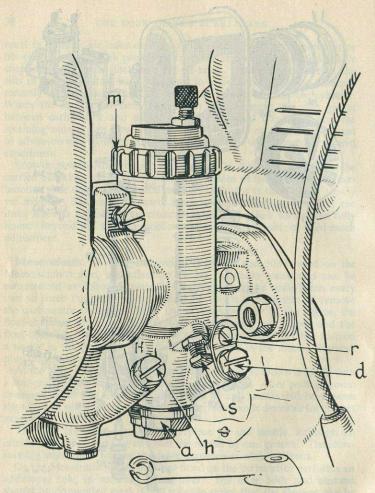


FIG. 30. BING CARBURETTOR: MESSERSCHMITT

- a. Plugd. Idler jeth. Main jet

- m. Mixing-chamber cover
 r. Air-regulating screw
 s. Throttle slide stop screw

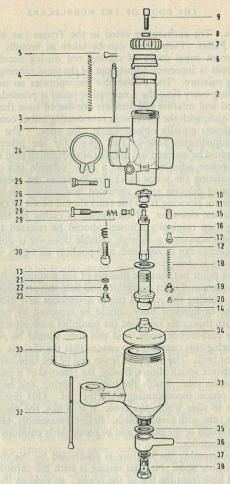


Fig. 31. Bing Carburettor: Trojan

Principal components are—

- 1. Carburettor housing
 2. Slide
 3. Jet needle
 4. Slide spring
 5. Needle holder

- 9. Adjusting screw 11. Gasket
- 18. Spring 20. Main jet

- 22. Idling screw
 27. Idling air jet
 28. Adjusting screw
 31. Float-chamber housing
 32. Float needle
 33. Float
 36. Banjo connexion
 38. Banjo bolt

The Trojan. The carburettor fitted to the Trojan can be either Bing (Fig. 31) or Pallas. These notes can be taken as broadly applicable to both. The most usual cause of cutting out during acceleration from tick-over speeds is incorrect adjustment of the slow-running stop and/or slow-running mixture. The carburettor incorporates an automatic fuel pump operating every time the acceleration pedal is pressed. If the slowrunning speed and mixture adjustments are out of tune the mixture will become over-rich, with the increase in revs causing either complete cutting out, or an almost equally objectionable "flat spot." The procedure to rectify the adjustments follows that given for the other bubblecars: the engine should be warmed up, and the slow-running stop at the bottom of the carburettor adjusted so that a slow, reliable tick-over speed is obtained. Rotating the screw clockwise increases the speed. After this the slow-running mixture screw mounted horizontally on the right side of the carburettor (looking from the rear) should be set so that the engine reaches its fastest tick-over. If the engine is racing on this setting the slow-running stop originally adjusted should be referred to again, and turned anticlockwise until a slowish, reliable tick-over is obtained. Then the whole sequence can be repeated, and possibly yet again, until the "flat spot" or cut-out is overcome.

The makers point out that the plunger of the automatic fuel pump can sometimes become stiff in its operation, and then this attention is required: the jet cover holding the jet and pump assemblies and mounted on the bottom of the carburettor body should be removed by unscrewing the hexagon. With this cover removed the pump/jet tube protrudes from the centre of the carburettor body, and this tube should be removed also. Take care during this operation to ensure that the throttle needle within the tube is not bent. The jet at the lower end of the tube can be removed with a screwdriver which allows, finally, the removal of a plug at the bottom of the choke tube. Inside the tube is a spring, and beyond this the brass pump piston incorporating a further jet. This piston should be perfectly free to slide within the tube. If it is not, the piston should be lapped in the tube with metal polish. Before reassembly, take great care to remove all traces of the polish and be particularly cautious in tightening the various assemblies.

For normal running the mixture is controlled by the throttle needle within the throttle slide. Normal setting is with the throttle needle clip in the second hole from the top of the needle; to weaken the mixture the clip should be removed, and the needle lowered so that the top groove is secured by the clip. Reversing the sequence richens the mixture.

CHAPTER VII

THE IGNITION SYSTEM

The ignition system which incorporates battery, ignition coils and contact-breaker is responsible for sparking at the plug: and thus for the running of the engine. Of all aspects of the modern internal combustion engine, the electrical is most suspect—and avoided—by owners. Ignition carries with it the aura of specialist knowledge, and is apt to frighten the owner into neglect which he would consider appalling if extended to any other part of the machine.

Messerschmitt. The 200 c.c. Sachs engine of the Messerschmitt is fitted with a Bosch ignition system (code number AZLR 12/90-12ZZ LR) which incorporates the generator for ignition and headlamp current (Figs. 32 and 33). The starter motor and the contact-breakers have forward and reverse drive. The voltage regulator with return current switch and built-in ignition switch, the coil and the magneto throw-over switch are in a closed case in the vehicle. Operating as the generator, the Bosch system supplies 12-volt electric current for, among other things, the ignition. When starting the engine, the system operates as an electrical starter motor.

Located around the crankshaft on the right of the engine are the twelve magneto poles which carry, alternately, windings for current for lighting and for the starter. The commutator is on the inner end of the armature and the contact-breakers are on the opposite (clutch) side. The contact-breaker for reverse drive, marked R, has a red cable, and the contact-breaker for forward drive, marked V, has a black cable.

CONTACT-BREAKER AND IGNITION TIMING. Check the contact-breaker gap after the engine has been run in, and then at 3,000 mile intervals. This is done by removing the cover over the contact-breaker and then rotating the engine until the fibre arm of the moving contact is at the highest point of the cam. Then check the gap by sliding the feeler gauge between the points. The gap should be 0.016 to 0.020 in. (Fig. 34).

The correct position of the piston at this gap should be: for forward drive, 4.5 to 5.5 mm (0.177 to 0.216 in.) before top dead centre and for reverse drive, 3 to 4 mm (0.118 to 0.157 in.) before top dead centre. If the points have less than the correct gap the ignition is retarded, if they have more the ignition is advanced; so it can be seen that precise ignition timing is influenced by the contact-breaker setting. To adjust the points the locking screw holding the fixed contact bracket should be slackened

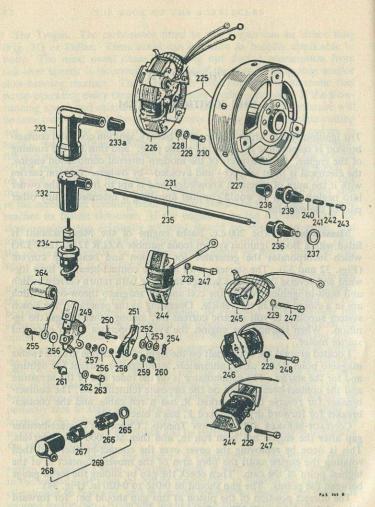
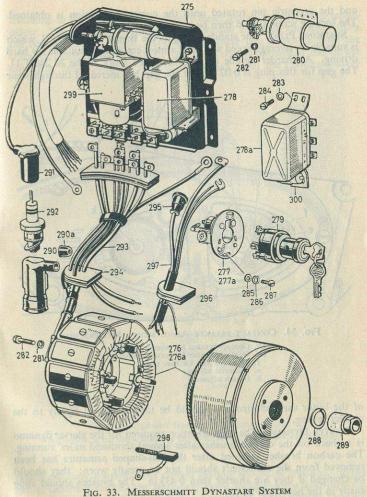


Fig. 32. Messerschmitt Ignition System

Principal components are—
226. Armature base plate
227. Magneto flywheel unit
231. High tension cable
234. Sparking plug

244. Lighting coil 246. Charging coil 249. Contact-breaker assembly 264. Condenser



Principal components are— 275. Control box 276. Magneto and armature 277. Contact-breaker plate 278. Voltage regulator

279. Dynastart switch 280. Ignition coll 298. Carbon brush 300. Condenser

THE BOOK OF THE BUBBLECARS and the eccentric pin rotated until the correct separation is obtained.

The locking screw should then be securely tightened.

Sparking Plug. The standard plug is the Bosch M 225 P 11 S, which is suitable for average-speed work but almost certainly unsuitable for hard driving. A "harder" grade of plug for speed work is the M 240 T 11. The gap for this plug is 0.027 in. If the gap has increased through wear

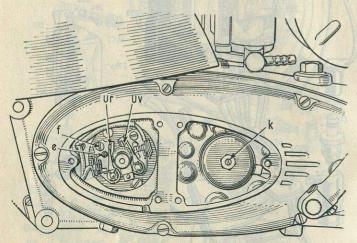


Fig. 34. Contact-breaker Adjustment: Messerschmitt

- Ur. Contact-breaker for reverse running Uv. Contact-breaker for forward running
- f. Security screw for base plate
- e. Eccentric adjuster k. Clutch adjuster

of the outer earth electrode it should be tapped inward lightly to the correct setting.

STARTER DYNAMO. The only attention required for the starter dynamo is a check on the carbon brushes after several thousand miles' running. The carbon brushes revealed after the bell-shaped armature has been removed from the crankshaft should not be greatly worn: they should be changed if they are shorter than 0.433 in. The brushes should slide easily in the holders (Fig. 35).

Isetta

CONTACT-BREAKER AND IGNITION TIMING. To check the contact breaker and ignition timing on the Isetta it is advisable to have a 12-volt test lamp in addition to the customary feeler gauge, spanners and screwdriver. The sparking plug should be removed and then the cover from the blower on the engine. Rotate the blower fan clockwise until the coloured blade on the fan aligns with the S on the housing of the blower unit (Fig. 36). Continue turning the blower until the contact-breaker

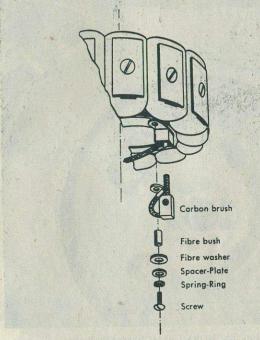


Fig. 35. Carbon Brushes: Messerschmitt

When removing the screw retaining the carbon-brush connectors watch out for insulating washers and rings.

points are fully opened. The correct reading should be 0.016 in. If the gap is incorrect slacken the stationary point locking screw and turn the eccentric screw until the correct gap is achieved. Then tighten the lock screw. Continuing with the procedure to check the ignition timing, slacken the two contact-breaker plate securing screws and turn the blower until the coloured blade again lines up with the S on the housing. Disconnect the black lead to the contact-breaker from the terminal CB of the ignition coil and connect the 12-volt test lamp with one pole to terminal 1 of the ignition coil and the other to the connector end of the black lead. Then turn on the ignition and move the contact-breaker plate upward until the lamp lights; after which move the contact-breaker plate gently

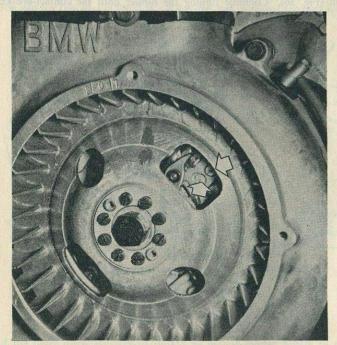


FIG. 36. ISETTA CONTACT-BREAKER POINTS

Release the locking screw (upper arrow), then turn eccentric adjusting screw (lower arrow).

back (downwards) until the lamp just goes out. Tighten the plate in this position, and refit.

SPARKING PLUG. The correct gap is 0.024 in., and the recommended plug is the Lodge HH 14, or the HH 13 for town work.

Trojan

CONTACT-BREAKER AND IGNITION TIMING. The contact-breaker set on the Trojan is reached from the right-hand of the engine casing: the

circular plate in the centre of the case, retained by three screws, must be removed. The contact-breaker gap is 0.014 to 0.018 in. and the adjustment is made in the normal way by slackening the lock-nuts and adjusting the stationary point. Ignition settings are: contact-breaker points just

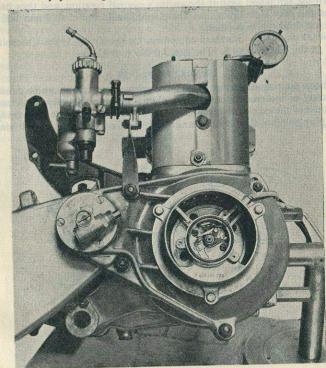


FIG. 37. ADJUSTING IGNITION TIMING: TROJAN Shown is the special gauge used to obtain extremely accurate timing

parting with the piston 6.5 to 7 mm before top dead centre on the compression stroke (both valves closed). For establishing reasonably accurate, though not precise, ignition timing three lines are marked on the fan wheel and an integrally cast arrow is provided on the fan housing. The extreme left-hand line represents top dead centre for the piston, that on the extreme right the piston 6.5 to 7 mm before top dead centre. When this latter line is aligned with the arrow, the contact points should be just breaking.

For precise timing this is the procedure (Fig. 37): set the contact-breaker gap to 0.016 in., with the contact-breaker cam in its topmost position. Find the piston's top dead centre position then switch on the ignition and connect the pilot light to terminal one of the ignition coil and to earth. Turn the fan wheel against the engine's normal rotation, and then back until the pilot light lights up. The piston should be 6.5 to 7 mm before the top dead centre position.

SPARKING PLUG. Standard equipment for the Trojan is the Champion L 7 or the Lodge H 14 S. The gap is 0.020 to 0.024 in.

SPARKING PLUGS

Difficult starting or misfiring once the engine has started can be caused by dirty or incorrectly set sparking plugs; and (though very rarely now because of the excellence of modern oils) a "whisker" of metal may bridge the plug points in the Messerschmitt's engine after prolonged hard driving.

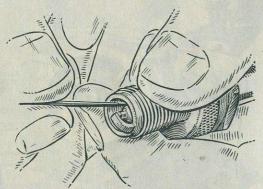


FIG. 38. ADJUSTING SPARKING PLUG Scrape electrodes clean, then reset by bending outer, earth, electrode.

So it is important that the plugs receive adequate attention. The insulator projecting above the main body of the plug should be kept clean by wiping with a dry rag. Dampness on the insulator can cause jumping of the high-tension current from the plug terminal to the plug body.

Dismantling of the plug and careful cleaning of the electrodes with a fine wire brush and possibly overnight soaking in carbon tetrachloride will remove most of the carbon deposits and oil. The setting of the plug should be done with a screwdriver or special gap-setting tool, and only the outer electrode should be bent (Fig. 38). Where the plug is of non-detachable type, cleaning in a sandblasting machine is the only method

which results in thorough cleansing of the plug. But inevitable scouring of the metal occurs, too, with probable reduction in plug life.

The threaded portion of the plugs should be cleaned with a stiff wire brush, and graphited or molybdenum disulphide grease smeared on the threads to ensure that the plugs do not jam tight in the cylinder head after prolonged usage. Be careful, when fitting the plugs, not to use too much force. Where no insert is used in a light-alloy cylinder head the

threads can be easily stripped.

Owners may be interested in an outline of electrode conditions as a guide to carburation and ignition settings. Before checking, the bubblecar should be motored at fairly high r.p.m. and the engine suddenly cut on the ignition switch. A light brown colour for the points indicates that carburation is about right; whiteness indicates definite overheating—probably too weak a carburettor mixture; a black, sooty colour shows too rich a mixture. Insulators which are dirty at the tips but cleaner towards the shoulders indicate over-oiling.

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CHAPTER VIII

THE ELECTRICAL SYSTEM

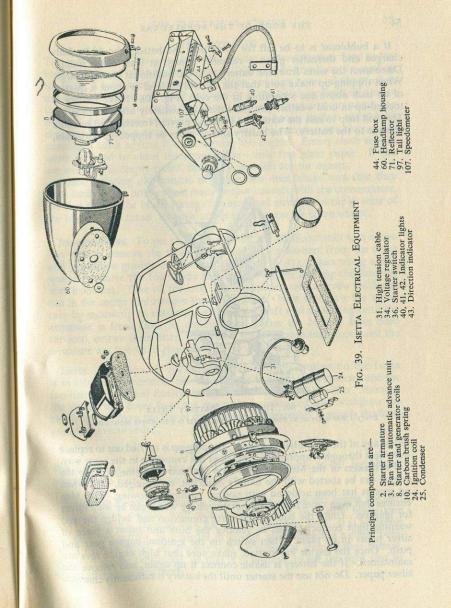
ALL the bubblecars are alike in having a 12-volt generator and voltage regulator, and circuits for the ignition system, lights, horn and indicators (Fig. 39).

BATTERY

The high-class batteries provided in the bubblecars (normally Bosch in the Messerschmitt, Exide in the Trojan, and Lucas in the Isetta) will give up to four years' use with considerate treatment. The rules for battery care are extremely elementary, yet often ignored. Basically, only three points need to be remembered: (1) the battery should be kept well charged or the plates may sulphate; (2) the electrolyte level should be maintained regularly by adding distilled water when necessary, and (3) the connexions and terminals should be kept clean and in good condition. The terminals should be kept clear of all corrosion and, when cleaned, smeared with petroleum jelly.

Topping-up. Obvious pointers to the state of battery charge are whether the lights and the horn work. If the lights go dim only a minute or so after switching on, then the state of charge is low or the battery faulty. However, a much more positive check can be made with a hydrometer, which is a glass device with a bulb at one end and a float inside. Readings with the hydrometer should not be taken immediately after topping-up; better to leave the battery for a while for thorough mixing of the water and acid. A similar reading should be obtained from each cell, and the electrolyte should be free of particles in suspension. Readings obtained should be very close to those given in the tables following—

Cell Condition	Temp. Climate (below 90°F)	Tropical Climate (above 90°F)
Fully Charged	1.270-1.290	1.200-1.220
Half discharged	1.190-1.210	1.120-1.140
Completely discharged .	1.110-1.130	1.040-1.060



If a bubblecar is to be left for some time the battery should be fully charged and thereafter given a refresher charge at least every month. Disconnect the wires from the battery to avoid additional loss of charge. When topping-up make sure that the electrolyte level is about a quarter of an inch above the separators in the cells (Fig. 40). If the battery is topped-up in cold weather run the engine immediately after topping-up. This will help to mix the water and acid and prevent freezing and possible damage to the battery. The battery should never be topped-up with acid,



FIG. 40. TOPPING-UP BATTERY CELLS
Every 1,000 miles or so check to ensure electrolyte is ½ in. above separators.

unless any of the electrolyte is spilled. Topping-up is carried out to replace water lost through evaporation. Acid does not evaporate in the same way.

The makers of the Messerschmitt have outlined a scheme whereby the engine can be started with the battery quite flat, or damaged, even when no success has been achieved with normal pushing or towing. This idea ensures that even quite low revs generate voltage which can be used direct for ignition. Undo the battery and earth connexion and bridge the red warning light contacts: that is, remove the bulb and insert a piece of silver paper in its place. Then switch on the ignition, engage gear and push. Once the engine has started, make sure that high engine revs are maintained. If the battery is usable connect it up again, and remove the silver paper. Do not use the starter until the battery is sufficiently charged.

THE DYNAMO

The only attention likely to be needed for the starter dynamos fitted to the bubblecars is an occasional (say every 7,000 miles) check on the carbon brushes. A low charging rate will be given—or even none—if the brushes are worn or sticking in their holders, or if the lightly splined section at the end of the centre armature (known as the commutator) on which the brushes gently press is pitted or dirty. The brush holders should be cleaned out with a petrol-soaked rag, and the commutator cleaned by pressing a cloth against it while turning the engine. Emery cloth should never be used to clean the commutator—only fine glass paper. If the commutator is deeply pitted, the job is best left for the agents.

When replacing old brushes or fitting new ones, make sure that they slide easily in the holders and make proper contact with the commutator. Do not stretch the brush springs for increased strength as rapid wear of the brushes will result through undue pressure on the commutator.

Messerschmitt. To get at the brushes on the Messerschmitt it is necessary first to remove the three screws and spring washers from the cover and protective grating on the fan housing (Fig. 41). Then using a box spanner remove the four bolts and spring washers holding the fan ring with its blades. Take off the ring. With a locking tool unscrew the flange nut in the centre and remove the lock washer. Now withdraw the armature by mounting an extractor on the crankshaft and tightening until the armature is freed from its seating cone. After the brushes have been serviced, or new ones fitted, make sure that the crankshaft taper and the armature are free from grease before reassembling.

Isetta. The sequence for getting at the carbon brushes on the Isetta is as follows: remove the fan housing, the dynamo front-end cap and the fan-fixing screw, and finally the fan itself by means of a puller. Remove the sheet-metal cover from the generator housing and then withdraw the brush springs from the top of the brushes. Reassembly is simply the foregoing in reverse order.

THE AUXILIARIES

The following remarks may be taken as applicable to all bubblecars except where particular notes are given.

Headlamp Focus. Headlamps should be set so that the beams are sent straight ahead, parallel with each other and with the road. Make sure that the setting is checked with the normal passenger load. It is advisable to check the setting, as a matter of course, after replacing a main bulb. Align the headlamps on a white wall or screen at least 25 feet distant. The wall should be shaded, so that it is possible to see the light cast by the headlamps quite clearly.

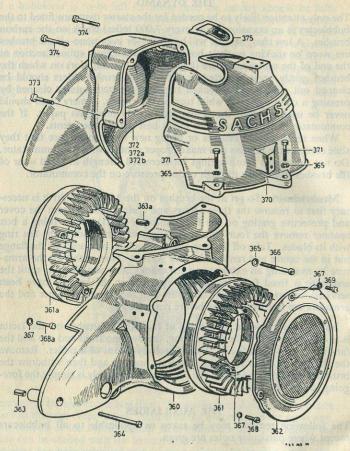


Fig. 41. Messerschmitt Fan Cowling

Principal components are—360. Fan cowling complete 361. Dynastart fan

362. Cover with screen 372. Air deflector hood

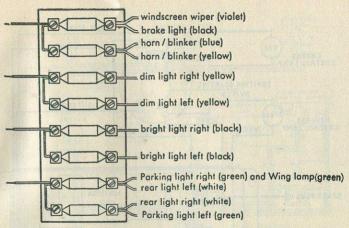


Fig. 42. Fuses: Messerschmitt

Bulbs on the 12-volt system vary from two watts, for the headlight warning light, to 35 watts for the headlight itself.

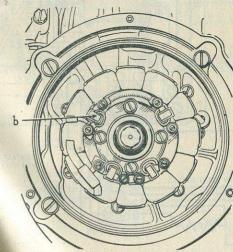


Fig. 43. Messerschmitt Armature
b. Carbon brush

3-(G.4147)

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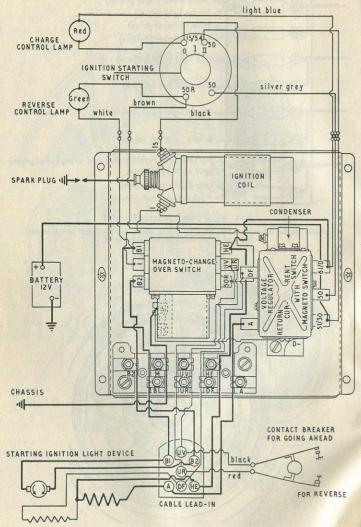


FIG. 44. MESSERSCHMITT: DYNASTART WIRING DIAGRAM

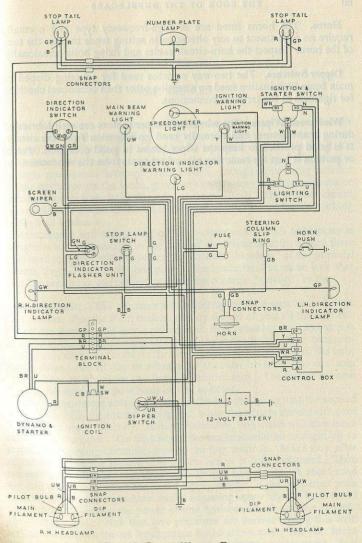


FIG. 45. ISETTA WIRING DIAGRAM

Horns. The horns fitted are of high-frequency type and normally require no adjustment as any alteration in setting tends to alter the tone of the horn. Inspect the horn-circuit cables and fixing bolts occasionally.

Dipper Switches. The two-way switches used for selecting dipped or main beam illumination need no attention other than occasional checking for tightness at the terminal connexions.

Windscreen Wipers. The windscreen-wiper motors are well lubricated during manufacture, and normally need no attention from the owner. It is good practice to keep the wiper blades in good condition. Petrol or paraffin is best for removing oil and tar spots from the windscreen.

CHAPTER IX

THE BRAKES

THE braking system on the Isetta utilizes hydraulic operation for all wheels with the handbrake operating through mechanical leverage on the rear wheel(s) only. The Trojan has hydraulic operation for the front wheels via the foot pedal, and the rear brake is operated solely by the handbrake through mechanical leverage. This system, though apparantly inferior to that employed on the Isetta, gives very satisfactory results as the major braking effort is invariably through the front wheels. The Messerschmitt has mechanical operation for all three wheels with the handbrake working through all brakes.

Maintenance and adjustment of the systems used on all bubblecars is straightforward, especially in the case of the Messerschmitt where there is no need to bother with the sometimes delicate "bleeding" of an hydraulic system, that is, the careful pumping of the brake fluid to make sure that no air is present in the system to make the controls "spongy" in use.

Messerschmitt. The sequence for adjusting the Messerschmitt brakes is as follows. For the front brakes, jack up the car so that all three wheels are off the ground and then remove both front wheels; the next step is to screw home both adjusting screws on the brake pedal. Two hexagonheaded nuts are to be found on the brake lever to left and right of the hub; loosen these. Adjust the handbrake so that the brake drums can spin freely. Then retighten the two hexagon-headed nuts. The brakes are now roughly adjusted and the wheels can be re-fitted.

Precise adjustment entails pulling on the handbrake so that the second or third tooth in the ratchet is engaged, when the wheels should still turn though with some difficulty. Almost invariably, one wheel will turn more easily than the other. On that wheel the brake should be brought up to scratch by adjusting the cable screw on the foot controls. Make sure, after adjustment, that the locking nut for the screw is fully tightened. Then release the handbrake, and the wheels should turn easily. A short road test will establish whether the brakes apply evenly; if the bubblecar pulls to the left then the right-hand brake-adjusting screw should be screwed out slightly to increase the power of that brake to match that for the left-hand wheel. Make sure that tyre pressures are correct during this road test, or you may be misled by apparent brake unevenness. The rear brake can be adjusted only if the front brakes have been set accurately. It is essential that the front brakes come on fractionally before the rear brake.

To adjust the rear brake the Messerschmitt must be jacked up again so that all three wheels are clear of the ground, and the handbrake applied so that the front wheels can be turned with a little effort. Then the locking nut on the rear brake adjusting screw should be slackened, and the screw set so that the rear wheel turns more easily than the front wheels. On releasing the handbrake the rear wheel should turn quite freely. When this stage has been reached the lock-nut should be tightened, and all three brakes should be in correct adjustment.

Trojan. The hydraulic brake system employed on the Trojan needs very little routine maintenance other than checking the oil in the master



Fig. 46. Adjusting the Trojan's Brakes Adjuster cap is arrowed.

cylinder every 1,200 miles. The filler plug situated just behind the steering column should be removed and a note made of the level of the fluid, which should reach the bottom thread of the filler-plug orifice.

After several thousand miles, brake-lining wear will result in excessive

pedal travel, a sign that the brakes should be adjusted to maintain the linings in closer proximity to the drum. Adjustment is carried out after jacking the Trojan up by, first, removing the two nylon plugs on the brake anchor plate. In each opening thus revealed is a serrated adjuster cap, top and bottom of the wheel brake cylinder (Fig. 46). The adjuster cap revealed in the upper hole should be turned, by using a screwdriver, towards the wheel's centre until the upper, leading, brake shoe is binding

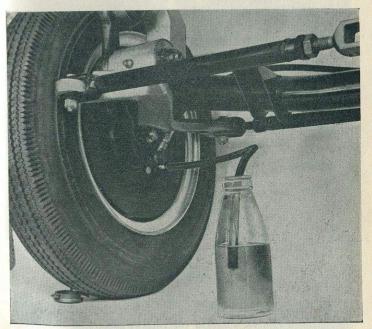


FIG. 47. BLEEDING THE TROJAN'S BRAKES

on the drum. Then back off the cap until the brake drum is just free. The same sequence carried out through the lower hole will adjust the lower brake shoe. Here closer adjustment is obtained by turning the serrated adjuster cap *away* from the wheel centre. This procedure should be followed with both front brakes.

If the brake pedal travels too freely probably air has entered the hydraulic system, and it will be necessary to bleed the fluid line. This job is usually left to a service station, but can be carried out by the owner. On the Trojan,

attention to the hydraulic system should follow these lines: remove the hexagon-headed plug on the main brake cylinder immediately behind the foot controls. If the level is too low, top up with Ate Blue Original Brake Fluid to the first turn of thread in the orifice. To bleed the system the dust protector cap should be taken from the air bleed valve (right-hand side); then fit a rubber hose of suitable diameter over the valve and drop the end of the hose into a container (a milk bottle will do) (Figs. 47 and 48)

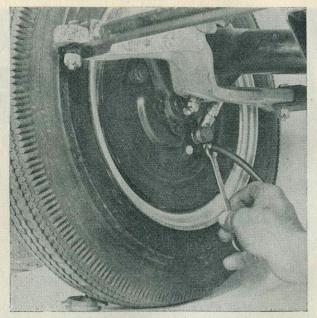


FIG. 48. BLEEDING THE TROJAN'S BRAKES

half filled with brake fluid. Make sure that the hose goes deep into the liquid. Then open the air bleed valve with a spanner and depress the brake pedal sharply, releasing it slowly. Repeat this process several times until the brake fluid in the system leaves the hose without showing any bubbles. Close the air bleed valve, take off the pipe and refit the dust cap. This sequence should be carried out on the other wheel. Then check the level in the brake cylinder and top-up if necessary as previously described.

in the brake cylinder and top-up if necessary as previously described.

Pay particular attention to ensuring that the air bleed valve is closed only when the brake pedal is fully depressed. If you have to use the old

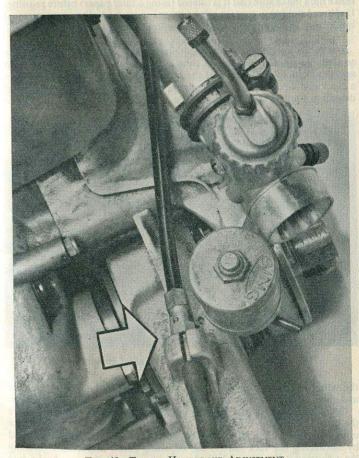


FIG. 49. TROJAN HANDBRAKE ADJUSTMENT

If sufficient adjustment cannot be obtained at lever end, the second stage is to make use of the cable adjuster near the engine.

brake fluid make sure that it is filtered (using a filter paper) before re-using. Unfiltered fluid may contain grit or other foreign bodies to cause eventual breakdown in the braking system (Handbrake adjustment, Fig. 49).

Isetta. Adjusting the brakes on the Isetta starts with jacking up the car so that the wheel concerned is clear of the ground. Then release both adjuster bolts on the outside of the brake back plate. Adjust one bolt in a clockwise direction, at the same time rotating the wheel in the driving direction, until light drag occurs (Fig. 50). Then back off the bolt until

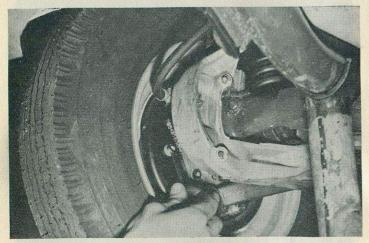


FIG. 50. ADJUSTING ISETTA FRONT BRAKES

the wheel just turns freely. Repeat the process for the second adjuster and shoe. The procedure for the other front wheel is precisely the same.

Only one adjuster is provided for both shoes in the rear brake, and here the method is to turn the adjuster on the outside of the brake back plate until resistance is felt, then slacken two clicks. The handbrake is tested by slackening the lock-nut on the adjusting screw and then tightening the adjusting screw (in a clockwise direction) until the rear brake just begins to rub. Then back off the adjusting screw until the wheel runs freely. The method to be followed in bleeding the Isetta braking system follows that outlined for the Trojan, except that the fluid used is Girling Crimson Brake Fluid.

The brake master cylinder with the fluid reservoir is underneath the bench seat of the Isetta, and the level can be checked by unscrewing the filler plug. Take great care to avoid getting dirt into the brake fluid. The order in which the wheels should be bled is: rear wheel, front right, front left. If it is necessary to adjust the master cylinder on the Isetta, first remove the cotter pin from the brake rod securing bolt at the end of the pedal, then the brake rod bolt, and slacken the lock-nut on the adjuster. Push in the brake rod until the bolt can be slid through the clevis and brake pedal. Locate the adjusting nut in the middle position between the brake rod halves and secure it with two lock-nuts.

Note. Cars with a chassis later than 404 360 feature a right- and left-handed thread on the adjusting nut that obviates any need to detach the brake rod when adjusting the brakes.

CHAPTER X

GEARBOX AND TRANSMISSION

Adjusting the Isetta's Chain. Only the Isetta offers ready adjustment of the final drive. The first indication that chain tension has slackened will usually be when the chain strikes against its case. Slackness can be established by placing the gear lever in the neutral position, grasping the rubber coupling with the hand and turning it back and forth. If chain slackness is being increased the chain will slap against the case. Adjustment is carried out by means of the perforated plate on the case, which is accessible from the side opposite the engine (Fig. 51). Remove the plate-locating

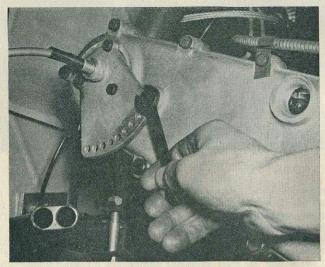


Fig. 51. Adjusting Rear Chain on Isetta Refit the security bolt with spanner as shown

bolt with a 10-mm spanner, then raise it with a screwdriver until resistance is met. Resistance means that correct tensioning of the chain is achieved. Then the bolt must be screwed home in one or the other of the two threaded

Replacing the Chain on the Messerschmitt. Jack up the Messerschmitt and engage neutral. Then place a receptacle below the case to catch oil.

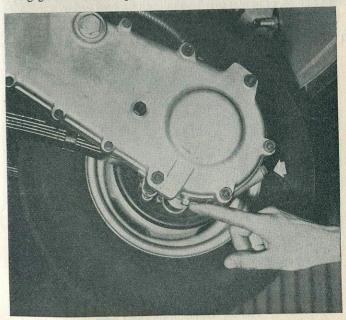


FIG. 52. ISETTA TRANSMISSION

Indicated is the drain plug for the chain case. Arrowed is the filler plug.

With a box spanner remove the six springs together with spring washers from the swinging-arm cover, and remove the cover and rubber seal. Allow the oil to drain. If the old chain is being replaced with a new one remove the spring link from the old chain, and with the connecting link join the new chain to the upper end of the old chain. Then pull the lower end of the old chain to guide the new one into position. If the chain is broken remove the two screws together with the spring washers from the

swinging-arm front cover near the shock absorber safety plate. Remove the cover and rubber seal. A length of wire should be manoeuvred from the swinging arm main cover to the front of the case above the small sprocket, where the new chain should be attached to the wire; pull the wire and fit the chain on both sprockets before pulling the wire to the front beneath the pinion. Disconnect the wire and attach it to the other end of the chain and pull to the rear. Place the chain on the rear sprocket and insert the connecting link. Replace the covers and put in just one pint of SAE 90 oil, or until it overflows through the level orifice.

Trojan. No adjustment is provided for the rear-chain drive of the Trojan. It has been found that chain life, provided the case is kept topped-up to

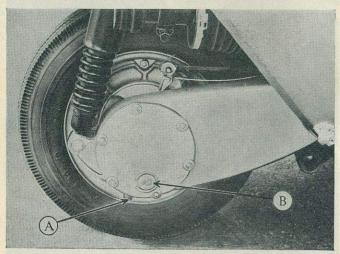


Fig. 53. Trojan Rear-chain Case

A. Drain plug

B. Oil level plug

the correct level with oil (Fig. 53), covers many thousands of miles. When wear is apparent, or slackness, the chain should be replaced.

GEAR CONTROL ADJUSTMENT

Isetta. Put the gear lever into neutral, then adjust the two transverse gear rods by slackening the lock-nuts and rotating the toggle unit until the desired position is obtained.

Trojan. Set the gear lever to neutral, then lift and secure the tail cowl covering the engine. Remove the safety bracket on the ball socket on the gearbox and depress the gear-selector arrangement on the gear lever. Turn the rear wheel, depressing the gear lever, and bring it again to the neutral position. In this position the ball socket should come up without

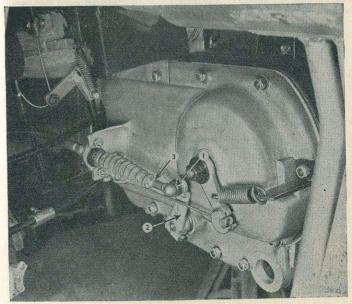


Fig. 54. Gear Adjustment on the Trojan

- Ball socket
 Gear lever
- 3. Ball socket lock-nut

the gear lever shifting. If necessary, undo the lock-nut and adjust the ball socket accordingly. Check the gear setting and then replace the safety clip (Figs. 54 and 55).

Messerschmitt. The rear wheel should be turned by hand and at the same time the gear-change lever on the gearbox pulled slowly to the rear. If the clearance between the lower part of the gear-change lever and the end stop at the moment of engaging first gear is approximately 5 mm, then the second gear should be engaged. When adjusting the gear lever to fine limits the clearance between the lower part of the lever and the end stops

must be approximately the same when engaging first or second gear. If, after moving the gear lever to the first-gear position the gear is not properly engaged, and the lower part of the lever is resting on the end stop, the two screws on the gear-cable clamp behind the partition should be loosened, and the cable moved upwards until, when the first gear is engaged, the



Fig. 55. Trojan Gear Control

Fine adjustment of the gear control is possible on releasing the lock-nut (arrowed) and turning the knurled nut one way or the other.

necessary distance of 5 mm between the lower part of the gear lever and the end stop is obtained.

The Messerschmitt has a separate neutral selector attached to the gear in the cockpit. To check that this device is working properly, the Messerschmitt should be jacked up so that the rear wheel is free. Then engage third gear and try to turn the wheel. At the same time pull the neutral lever gently. The engaged gear should jump out with a slight but audible click, and the wheel should then rotate freely.

CLUTCH ADJUSTMENT

The clutch, working satisfactorily, must transmit full engine power yet be able to disconnect the engine from the gearbox absolutely cleanly.

It will always perform its job provided it is properly adjusted so that the slight amount of normal wear and tear is promptly taken up.

Isetta. The free movement of the clutch pedal should be approximately half an inch. Adjustment takes place on the clutch lever on the transmission case from the side opposite the engine. Turning the adjuster screw on the cable clockwise increases clutch-pedal clearance. If sufficient

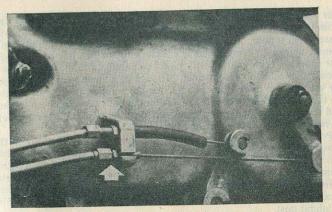


Fig. 56. Trojan Clutch Adjustment The cable adjuster is arrowed.

adjustment is not provided here, alter the shims behind the adjusting screw at the clutch thrust point until a satisfactory adjustment is achieved.

Messerschmitt. Detach the control cable from the gear lever on the engine and check whether the end of the lever can be moved at least half an inch. As the plates wear the free travel at the clutch lever decreases. The necessary amount of free travel can usually be restored by screwing in the cable adjuster. If it is no longer possible to obtain the adjustment on the cable, the right-hand section of the cover on the housing should be opened. After slackening the lock-nut it will be possible to turn the adjuster screw on the outer plate until free travel has been restored.

Trojan. Clutch adjustment is carried out on the clutch cable just forward of the operating lever mounted on the nearside of the transmission case. Slacken the lock-nut, and then turn the adjuster anticlockwise to take up excess play in the cable (Fig. 56).

CHAPTER XI

THE BODYWORK

THE interior of the car should be cleaned first so that all grit and dust from this source is removed. Then wash the chassis and the body with water from a hose. Use plenty of water to loosen the mud, and then a sponge or brush. Never wash a vehicle with the sun hot on the body. Tar spots are best removed with petrol or paraffin and the affected parts should be washed in soapy water. Though mild detergents may be used for washing the body it is essential that the solution is weak or varnish on the bodywork may be affected. After the bodywork has been washed and sponged, rub dry with a clean, soft leather. Rubber edging should be rubbed with a little glycerine to prevent it becoming brittle.

Polish with a good-quality wax polish applied with a soft cloth on the completely dry finish. Light metal parts should be treated with polish and then rubbed with a cloth; or they can be lightly smeared with petroleum jelly. Where Perspex or other synthetic glass is used, abrasive metal polish must be avoided and all dust and dirt removed with plenty of water. Plexipol polish can be used and should be left on the windows in a fine film to inhibit dust.

The fabric roof should be handled carefully. When wet, it should be allowed to dry opened out, and should never be folded wet. The hood should be beaten and well brushed with a soft brush as dust particles damage the hood and can cause fraying. Petrol benzine, stain remover or any other solvent should never be used as they soak into the rubber employed in the material and cause leaks. To wash the hood use a mild mixture of non-detergent soap flakes and water and wash and rinse alternately until the hood is quite clean.

Where the car is to be left out during winter months it is sensible to clean and then coat chromium-plated parts with clear varnish which, when dry, will be almost invisible yet will render the plate almost impervious to rust

CHAPTER XII

TRACING TROUBLES

If you have little experience there is much comfort in these facts: the engine *must* (well, should!) go if (1) fuel is reaching the cylinder, (2) there is a spark at the plug, (3) the spark is occurring at the right time.

It is rare for an engine to cut out absolutely without warning, and to keep dead; usually there is an irritating period of failing power, spluttering from the carburettor, misfiring. Check one thing at a time—and do not even look at the engine until you are certain there is fuel in the tank and the battery has a charge in it. If the ignition warning light comes on while the engine is running you know that the dynamo has packed up; and so you will need a fair charge in the battery to keep you going to a service station.

If you use the self-starter (assuming there has been no trouble with the dynamo, as mentioned) and petrol oozes round the carburettor, it is certain that nothing is wrong with the pipe line. So use the starter a little more, and then take the sparking plug out: it should be wet from the unburnt fuel sucked in. If it is not, then perhaps the carburettor jet is blocked: clean it out.

If the plug is wet you can forget about fuel troubles. Dry the plug (by blowing on it), then balance it—without touching it—on the cylinder. Now you must ask an obliging passer-by (if you are not on the remoter roads of Dartmoor or Glen Coe) to press the starter. If there is no spark, it is ignition trouble.

Check the contact-breaker points; see whether they are opening and closing. If they are, it's time to ring for that patrolman!

FAULT-FINDING GUIDE

Engine Will Not Start

1. When Fuel is not Getting to the Carburettor Check: Empty tank (not so rare!)
Air vent in filler cap blocked
Air bubbles in fuel pipe
Fuel tap filter or other filters choked
Carburettor float needle stuck
Passage from float-chamber blocked

TRACING TROUBLES

2. WHEN FUEL DRIPS FROM THE CARBURETTOR

Check: Carburettor main or pilot jet blocked

Tickler has been used too much

Float is not punctured; and its needle is seating correctly Stuck throttle

3. WHEN NO SPARK AT PLUG

Check: Maladjusted plug

Oiled-up plug

Damp insulation on plug

Battery discharged Faulty ignition switch or leads

Contact-breaker points sticking, or not opening properly

Wrong gap at contact-breaker points
High tension pick-up cracked

Carbon brush broken

4. When Plug Sparks on Inspection

May fail to spark under load

Try new plug

5. WITH ALL ABOVE CHECKED, BREAKDOWN MAY BE DUE TO

Stuck valve (Isetta, Trojan)

Stuck valve (Isetta, Trojan)
Air leak (Messerschmitt)
Broken valve springs (Isetta, Trojan)

Engine Starts, but—

Misfires

Misfires
Suspect: Dirty (or loose) plug
Wrong type plug

Wrong type plug

Wrong type plug
Faulty high tension lead to plug
Cracked high tension pick-up

Dirty contact-breaker points

Points not opening and shutting properly; i.e. hardly any gap Air intake through "blown" cylinder head gasket (Messerschmitt) Exhaust pipe partially blocked with carbon: this shows as reluctance to respond to throttle (Messerschmitt)

Shows Lack of Power

Suspect: Choked silencer (Messerschmitt)

Cylinder head loose (Messerschmitt)

Too weak carburettor mixture

Incorrect ignition timing or valve timing (unlikely)
Burnt exhaust valve (Isetta, Trojan)
Sticking valve (Isetta, Trojan)
Chains too tight
Brakes binding

Knocks (i.e. metallic, light-toned knocking from engine under load)

Suspect: Low-grade fuel (especially Isetta, Trojan)

Too much carbon in cylinder head—calling for decarbonizing

Wrong type plug

Ignition timing over-advanced

Burnt exhaust valve or seat (Isetta, Trojan)

Carburettor jet dirty, obstructing fuel, leading to overheating

FACTS AND FIGURES

Engine

Single-cylinder four-stroke O.H.V.	Single-cylinder four-stroke O.H.V.
64 mm	
	72 mm
61·5 mm	73 mm
	295 c.c.
	6·8 to 1
00.001	0.9 10 1
10 at	13 at
	NAME OF TAXABLE PARTY OF TAXABLE PARTY.
detachable	5,200 r.p.m.
	T-1
	cold)
	198 c.c. 6·8 to 1 10 at 5,500 r.p.m. , detachable Inlet, 0·006 in.

Oil and Fuel Capacities

Strong Lych of Pa	Messerschmitt	Trojan	Isetta
Sump Capacity . Gearbox Transmission Fuel Tank	1 pt 1 pt 2 gal of which approx. ½ gal reserve	2½ pt With engine ⅓ pt 3½ gal; ½ gal reserve	3 pt 1 pt ½ pt 2 ³ / ₄ gal; ½ gal reserve

Carburettor

	Messerschmitt Bing with starter device	Trojan Bing Pallas 1/22/116 22/17/P	Isetta Bing 1/22/98
Bore Main Jet . Needle Jet .	. 24 mm . 120 . 1608 3	22 mm 85 85	22 mm 130 1308 1
Needle Position Idler Jet Starter Jet	35 90	35 25	35 55

Ignition System

	Messerschmitt Bosch combined generator and starter unit	Trojan Bosch combined generator and starter unit	Isetta Noris combined generator and starter unit
Advanced Timing .	4·5–5·5 mm before T.D.C. 3–4 mm before T.D.C.	6·5–7 mm before T.D.C. (or 33–35° before)	42° before T.D.C.
Sparking Plugs .	(reverse gear) Bosch M 225 P 11 S/M 240 T 11 Gap, 0.028 in.	Champion L7 or Lodge H 14 S Gap, 0.020– 0.024 in.	Lodge HH14 or HH 13 Gap, 0.024 in.
Contact-breaker Points (in.)	0.016-0.020	0.014-0.018	0.016

Gearbox

Attack		Messerschmitt Four-speed and electrically en- gaged reverse gears	Trojan Four-speed with reverse	Isetta Four-speed with reverse	
First gear Second gear Third gear Top gear Reverse			3.62 1.85 1.24 0.86 internal ratios	23·14 to 1 12·07 8·08 5·83 20·37	23·21 to 1 12·15 8·17 6·2 30

Transmission

Messerschmitt	Trojan	Isetta
ByCardanshaft to rubber- mounted swinging arm; chain final drive in oil- bath case	Primary and final drives by separate chains in oil-bath cases	Primary drive by shaft; final drive by fully adjustable chain in oil-bath case

Wheels and Tyres

Model	Size	Pressure		
Messerschmitt .	4·00 × 8 in.	Front: 15 lb/in. ²		
Trojan . *.	4·40 × 10 in.	Rear: 25-30 lb/in. ² Front: 20 lb/in. ²		
Isetta	4·80 × 10 in.	Rear: 22–24 lb/in. ² Front: 16 lb/in. ² Rear: 28 lb/in. ²		

Battery

Messerschmitt: Lead-acid 12-volt, 18 ampere-hour capacity Trojan: Lead-acid 12-volt, 18 ampere-hour capacity Isetta: Lead-acid 12-volt, 32 ampere-hour capacity

AND A SHEET AND ADDRESS OF THE PARTY OF THE

Suspension

Messerschmitt: Independent on all wheels through rubber-in-torsion; hydraulic shock absorbers.

Trojan: Front: independent trailing arm with coil springs and hydraulic damping. Rear: swinging arm with coil spring and hydraulic damping.

Isetta: Front: independent by swinging arm with coil springs and hydraulic damping. Rear: swinging arm, quarter-elliptic leaf springs and telescopic shock absorbers.

		Messerschmitt	Trojan	Isetta
Castor	100 P	Chi. Stor Story A.	42 mm	12°
Camber			2°	1½°
Toe in			3–5 mm	2 mm
King-pin inclination			8°	5°

Weights and Dimensions

		Messerschmitt	Trojan	Isetta
Wheelbase . Track Overall Length Overall Height Weight Ground Clearance	Roma Ho House III	6 ft 10 in. 3 ft 7 in. 9 ft 2 in. 4 ft 1 in. 510 lb 6 in.	5 ft 9½ in. 4 ft 0¼ in. 8 ft 10 in. 4 ft 4 in. 602 lb 5 in.	4 ft 10 in. 3 ft 11¼ in. 7 ft 6 in. 4 ft 4½ in. 770 lb 6 in.

Recommended Lubricants

MESSERSCHMITT

and the same of	Regent	Castrol	Mobil	Esso	BP	Shell
Engine .	Motor Oil 2T	Two-Stroke Oil (16/1) or XXL	Mobilmix TT (16/1) or Mobiloil BB	Two-Stroke 2T (20/1) or Essolube 40	BP Zoom or Energol Two-Stroke Oil	2T Mixture or Two-Stroke
Gearbox and Rear Chain	Thuban 90	Castrol ST	Mobilube C 90	Esso Gear Oil ST 90	Energol SAE 90	Dentax 90

ACTS AN	D FI	GUR	ES
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Recommended Lubricants

	1	R	0	J	A
101	ii		H	100	7

magnitud be	Castrol	Mobil	Esso	BP	Shell
Engine/Gear Unit (Winter)	XL	Mobiloil Special	Essolube 30	Energol SAE 30	X100-30
Engine/Gear Unit (Summer)	XXL	Mobiloil Special	Essolube 40	Energol SAE 40	X100-40
Swing Arm .	XL	Mobiloil Special	Essolube 30	Energol SAE 30	X100-30
Cables, front wheel bearings, axle crank bearings, king pins, steering gear	Castrolgrease LM	Mobilgrease MP	Multipurpose Grease H	Energrease L2	Retinax A
Brake Fluid .	Castrol (Girling Brake I	luid Crimson; Hydraulic Fluid	Lockheed Clea	r; Mobil

Recommended Lubricants

ISETTA

TO THE RESERVE OF THE STREET	Shell	BP	
Engine.			
UK, Summer	X100 Multigrade 20W/40 or X100 40	Energol Visco-Static or Energol SAE 40	
UK, Winter	X100 Multigrade 20W/40 or X100 20/20W	Energol Visco-Static or Energol SAE 20W	
Overseas, above 32°F .	X100 Multigrade 20W/40 or X100 40	Energol Visco-Static or Energol SAE 40	
Overseas, 10°-32°F	X100 Multigrade 20W/40 or X100 20/20W	Energol Visco-Static or Energol SAE 20W	
Overseas, below 10°F .	X100 Multigrade 10W/30	Energol Visco-Static	
Transmission, Final Drive, Front Suspension	X100 Multigrade 20W/40 or X100 40	Energol Visco-Static or Energol SAE 40	
Grease-lubricated parts .	Retinax A	Energrease L2	
Rear Spring	Donax P	Energol Penetrating Oil	
Brake Fluid	Wakefield/Girling Brake Fluid Crimson		

Lubrication and Maintenance Summary

Daily Check engine oil

Weekly Check tyre pressures Check battery level

1.000 Miles Change engine oil (T, I) Grease king pins (I, T, M) Check drive shaft nut (T) Grease handbrake cable (T, I) Grease steering arm

shaft (I) Grease steering universal (1) Grease steering box (T)

Clean air filter (M)

2,500 Miles Check brake master cylinder (T, I) Check transmission oil level (T, I) Grease Cardan shaft (M) Oil lower steering bearing (M) Check oil level in fulcrum bearing reservoirs (1) Check valve clearances (T, I)

Oil all hinges, joints, control cables

Clean sparking plugs

Check battery electro-

Check contact-breaker

lyte

points

5,000 Miles Clean (or renew) air filter (T, I) Change transmission oil (T, I) Change gear oil (M) Change chain-case oil (M)

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