Price 1/-

THE “Manxman” HANDBOOK

ON

“EXCELSIOR” “MANXMAN” MOTOR CYCLES

Models E.11, E.12, F.11, F.12 and F.14 with special section dealing with E.R.11, E.R.12, F.R.11 and F.R.12 Racing Models.

1935-36 Edition

The Excelsior Motor Co., Ltd.

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INTRODUCTION

This handbook is issued as a guide to EXCELSIOR "MANXMAN" riders in the proper care and maintenance of their machines, and we hope the information contained herein will be found interesting, useful and helpful.

In accordance with our policy, we are continually experimenting, with a view to "improving the breed;" consequently, modifications and improvements are, from time to time, being embodied in the design; therefore, if the description of component does not necessarily apply, please write to the Works for fuller details.

IMPORTANT NOTE.—Do not omit to quote both Frame and Engine numbers.

Remember! Our efficiently staffed Service Department has been created entirely for your convenience. It is always at your disposal for advice and service.

ERRATA

Page 25. Technical Data Table should read

Valve Clearance Engine Cold	
Inlet	Exhaust
.002	.008
.004	.008
.004	.008
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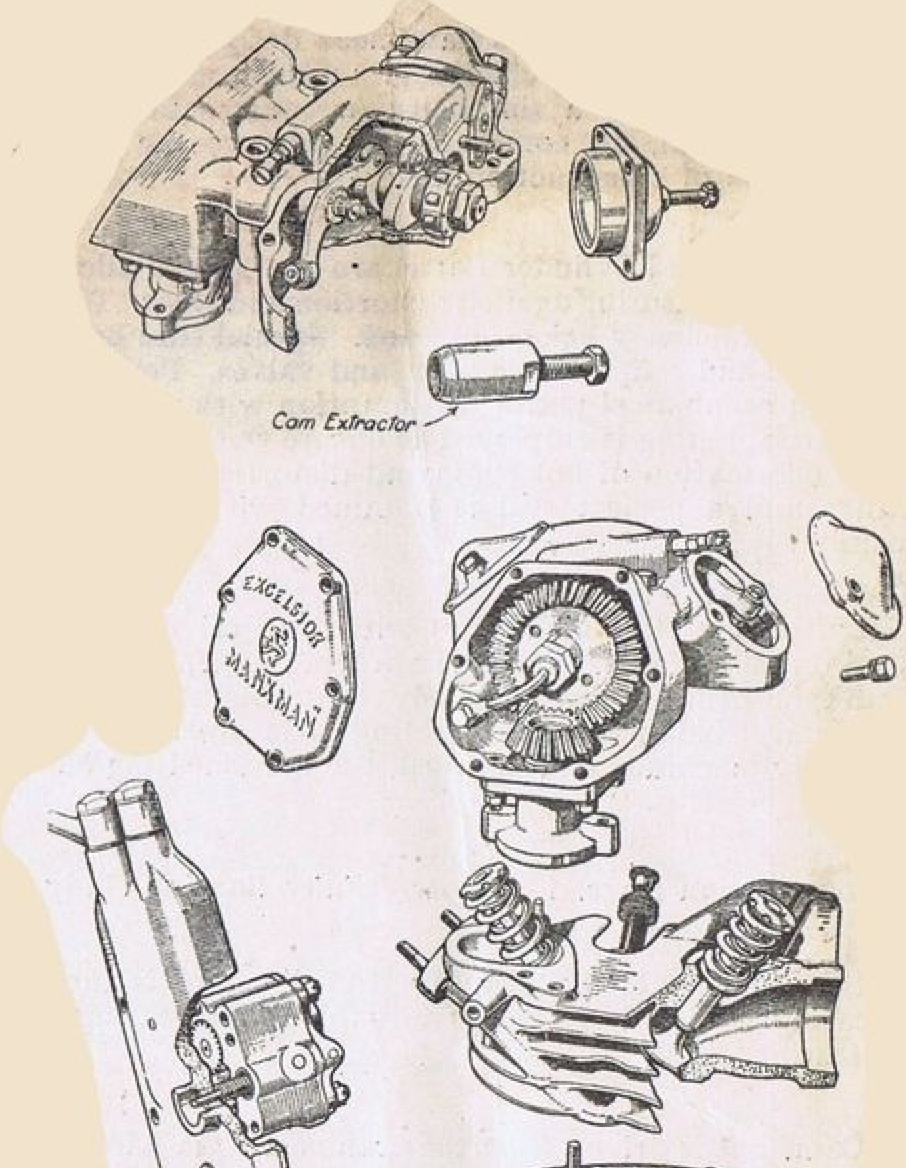
Page 23.

F. 14 Solo—First Gear, should read 12.17 in place of 17.17



" EXPLODED " VIEW OF " MANXMAN " ENGINE

(Reproduced by courtesy of " Motor Cycling.")

CONSTRUCTION.

The " MANXMAN " O.H.C. Engines have been designed and are constructed to obtain the highest possible degree of efficiency. Whilst being essentially modern, the " MANXMAN " engines have a simplicity of construction and accessibility with special features of design, all combining to produce the ideal motor cycle engine. Some brief details of construction are:

CYLINDER HEAD.

Both the Cylinder Head and Cylinder Barrel are of a special alloy cast iron with a high percentage of chrome, ensuring against distortion and wear. The hemispherical head results in very high efficiency being obtained. Special care has been bestowed upon the disposition, size and shape of the ports and valves. Perfect gas turbulence is obtained, resulting in economical petrol consumption with an extraordinary high power output. Very deep finning is employed to ensure the greatest possible cooling effect and the entire elimination of hot spots and distortion. The barrel and head are separate castings and a perfect seal is obtained with a wide copper gasket spigotted into position.

CRANKSHAFT ASSEMBLY.

Flywheels: High tensile steel stampings with integral mainshafts machined, ground and polished on all surfaces. The roller bearing big end is of the double row cage type, the crankpin being of exceptionally large diameter. Every flywheel assembly is individually balanced. Connecting rods are a special heat-treated alloy stamping, carefully machined and polished, the hardened big end sleeve being shrunk into position.

PISTON.

R/R Alloy, 2 compression rings, 1 Scraper. Fully floating Gudgeon pin.

BEARINGS.

Not a little of the efficiency of the " MANXMAN " engine is due to the size and type of the main bearings. The drive side is a double roller bearing and the timing side a double ball bearing.

VALVE GEAR.

The overhead Camshaft is driven from the crankshaft via hardened and ground bevel gears incorporating a hunting tooth to prevent wear and noise. The vertical shaft is mounted on substantial bearings, the thrust being taken on hardened and ground steel washers. The camshaft proper is mounted on two roller and one ball bearings.

DRY SUMP LUBRICATION.

Lubrication being of paramount importance, very careful attention has been given to the designing of the most efficient system for " MANXMAN " engines. The pump is a double-gear type and mounted in the timing chest in such a position as to ensure both pumps being continually primed. The amount of oil circulated throughout the working parts of the engine is regulated at the works and there are no adjustments to be carried out. The oil is drawn from the tank through a filter equivalent to 10 square inches of special mesh gauze, through a short ½" bore flexible pipe connected to the engine, guaranteeing a constant head of oil to the pump even in the coldest weather. On reaching the pump, the oil is forced from the gears to a spring-loaded piston plunger which controls ports leading direct to the big end, cam box and timing gears. Incorporated in the plunger is a tell-tale which is visible when oil is circulating. It is important that the tell-tale is visible all the time the engine is running. The oil delivered to the cam box passes directly through the hollowed camshaft and drillings to the top bevels, cam faces, bearings, valve springs and guides. Surplus oil drains through the valve walls and cam box via the vertical shaft and special passages to the timing chest and sump, where, together with oil from big end and piston, it is drawn through a second filter by the return pump and back to the tank. Flywheel oil drag is reduced to a minimum by the employment of carefully placed scrapers. The return oil pipe is visible if the tank filler cap is open. To provide for the displacement of air and oil, the tank should never be filled higher than to within 2" of the top.

It is most important that the oil tank and engine sump are drained every 1,000 miles, filters cleaned and tank replenished with fresh oil of the recommended grade. To drain tank remove feed pipe and filter, to drain engine remove filter on off rear side of sump. **Note.**—The tool kit provides a double ended ring spanner for oil banjos and tank filter. The 14 m/m plug spanner fits the engine filter.

We recommend the use of the following oils for all "MANXMAN" Standard engines. Mobiloil "D," Castrol "X.L." or Shell "Aero." It is not economical to use a cheap oil.

Remember the "MANXMAN" totally enclosed valve gear is oil cooled; keep tank and filters clean, and oil unions tight; use the recommended brand of oil and no lubrication troubles should occur.

TO REMOVE CYLINDER HEAD.

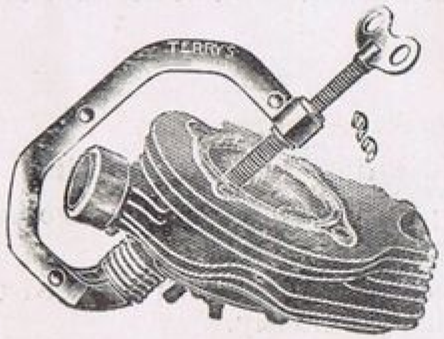
Remove Sparking Plug, turn engine until magneto points are just breaking, with lever set at full advance. Next remove cover from bevel case and mark the meshing of gears with indelible pencil (indelible pencil will not easily wash off with oil). Disconnect petrol lines, carburetter, exhaust lift Bowden cable, cylinder head stay bolt and exhaust pipe. Unscrew four holding down bolts and two vertical shaft gland bolts. The head can now be lifted off. As an additional precaution, the position of Oldham coupling stamped "D" may be marked in a similar manner to the gear wheels. Also mark the slot in bevel gear in relation to the casing.

If the crankshaft or camshaft is not rotated, the timing will be O.K. on replacement of head. If, however, it is desired to move the crankshaft, note direction and number of turns moved and return to original position. In the event of doubt, check position of contact breaker and markings on coupling "D." If camshaft is revolved, return to the markings.

To remove valves, place the head on a block of wood to obviate damage to the spigot face. Unscrew the four bolts securing the cam box, and if the cam box is tight, it may be eased up with a lever inserted between the box and top of cylinder head, taking care not to damage the faces.

Remove the hardened valve caps, marking them to avoid the possibility of mixing.

To remove the valves it is advisable to use a Terry Valve Removing Tool. Price 250 c.c. and 350 c.c., 7/6, and 500 c.c. 8/6, obtainable from us.



Examine valve faces and seats. If the exhaust valve has been in long service it is advisable to fit a new one. Clean out all carbon from the sphere and ports, grind valves in, using fine paste only. Carefully remove all traces of surplus paste with a petrol or benzole wash. Pull the valve guides through with a clean soft cloth. The chamferred ends of guides must not be damaged, otherwise excessive oil may reach the piston.

The valves should be checked for clearance in the guides, and if the movement or play is as much as 1/32" at the top of the stem, the guide should be replaced. If a suitable guide punch and re-seating tool is not available, it is strongly advised to let us or your Dealer handle the job.

Check the valve springs for length. They should measure not less than 2". If shorter than this, replace with genuine "Manxman" valve springs.

In replacing the valves, smear stems with oil.

To guard against oil leakage, we advise the use of new washers, **Part No. 5376.** under cam box, also the two oil seal washers on the feed and drain to and from cylinder head. We advise the use of Chemico Jointing Cement on the washers. This cement is obtainable in tubes from your Dealer, or from us, price **6d.**

Replace the valve caps on correct valves, and after the cam box has been refitted, check clearances between rocker shoe and valve (see table for correct clearances).

To remove the cylinder barrel and piston, tap barrel gently all round with palm of hand, slide it up and off piston, exercising care to remove and replace the flat breather valve on its seat. Wrap clean cloth around the alloy connecting rod below the piston, to keep out dirt and avoid possible damage to the rod.

To remove piston, ease out the circlip on the drive side with a sharp pointed spoke, and push out gudgeon pin from the timing side. Never replace the piston and/or the gudgeon the other way round. Do not remove piston rings unless necessary. The scraper ring should be step down. See tables for correct ring gaps and piston clearance. In reassembling, smear oil on both sides of the copper head washer. Do not use jointing cement.

The foregoing may appear complicated, but is in actual fact a simple procedure, and, if followed, the so-called complications of the camshaft will be conspicuous by their absence.

If it is wished to check timing accurately, we can supply a combined engine sprocket removal tool and timing disc holder, price **5/-.** Timing disc we will supply free of charge on receipt of **6d.** for postage and packing.

If it is desired to experiment with the valve timing, a **Special Cam Extracting Tool** will be necessary. This is available, **price 5/-.**

To remove cam, first undo the four nuts on bearings housing No. **5300,** remove the slotted centre screw and the housing may be extracted by the use of one of the studs from the rocker cover plate. This will expose the end of the camshaft. The lock washer must be prised away from the nut face and the nut removed, right hand thread. Next slip off the roller bearing. The cam extractor screws on cam, right hand thread, and the centre stud will extract same from taper. To re-time, set pointer under engine bolt and fix disc with zero at top dead centre on firing stroke. Turn engine forward to correct reading for exhaust opening, fit cam on shaft, turn it in a clockwise direction until clearance on exhaust valve is taken up. Tap cam on to taper and replace bearing and nut and new lock washer. Do not attempt to use lock washers a **second** time.

PISTON AND RINGS.

Care should be taken that the joints of the rings are not opposite.

If the compression is weak, and all other possible sources of leakage have been tested, it may be assumed that new piston rings are required.

If the piston is removed, care must be taken to see that it is replaced the same way round in the cylinder as it had been running previously.

It should be noted that the Gudgeon Pin will automatically be a tighter fit in the piston when the latter is cold than when hot; therefore, to facilitate the removal or replacement of the Gudgeon Pin in the piston, the piston may, if necessary, be warmed.

TO RE-SET VALVE CLEARANCE.

Remove rocker covers, turn engine to top dead centre on firing stroke, slide feeler gauge of correct thickness between the valve and shoe, slack off lock nut on top of rocker with hexagon end of special tool—this will permit the screwing of sleeve nut underneath rocker until feeler gauge becomes tight. Re-tighten lock nut and re-check the clearance, the feeler gauge should just slide easily. See tables for correct clearances. **Note.** Always carry out this operation on a cold engine.

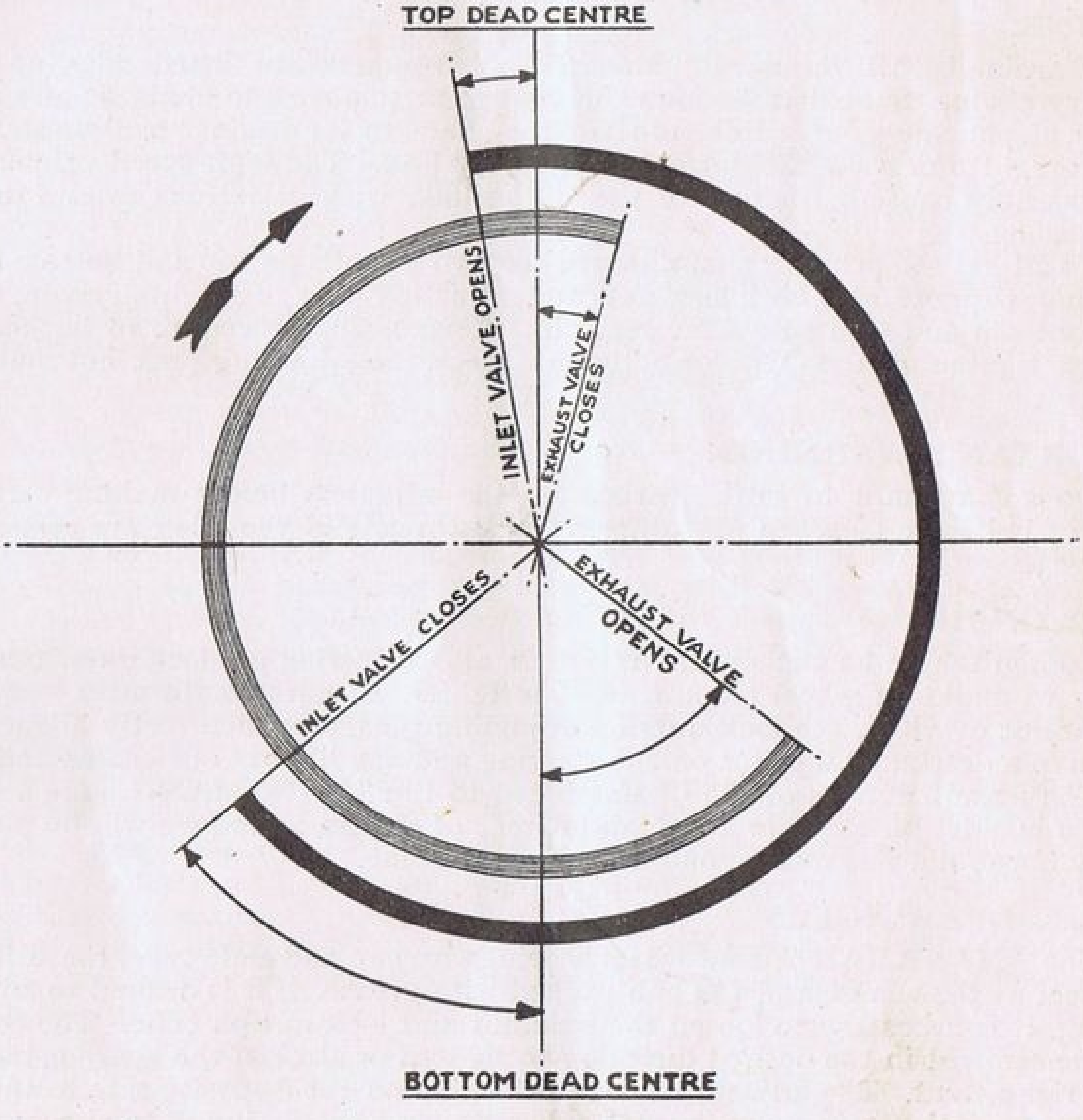
VALVE TIMING.

It is generally assumed that this is a particularly difficult operation. If the following instructions, however, are carefully followed out, the operation should present no difficulty to a person possessing a very limited knowledge of the principles of the internal combustion engine.

The two folowing points should be remembered :—

1. The Inlet Valve starts to open slightly before the commencement of the induction stroke.

2. The Exhaust Valve finally closes slightly after the commencement of the induction stroke, and it will thus be seen that both valves are open at the same time for a short period. This period is called the period of overlap.



TIMING DIAGRAM

MAGNETO TIMING.

Remove sparking plug, and rotate engine until piston is at top dead centre. both valves closed. Set ignition control to " fully advanced " position and rotate engine backwards until piston is correct distance before T.D.C. (see tables). Move contact breaker in direction of rotation until points are just separating and tighten up Gear Wheel, taking care that this operation does not alter setting.

TRANSMISSION.

The care of Chains.

Correct lubrication is the preventative of nearly all chain troubles. Unfortunately, a number of Motor Cyclists overlook this. Failure to clean and lubricate the chains periodically means loss of power and undue wear to both chains and chainwheels, leading to the expense of renewals sooner than would otherwise be necessary.

The " MANXMAN " front chain is totally enclosed in a cast aluminium oil bath, and providing the oil is kept at the correct level, the primary chain, which incidentally is endless, will last for many thousands of miles. The oil bath is provided with a level screw, which is located on the lower side of the clutch dome. There should always be sufficient oil in the bath to reach this level. The crankcase breather releases a small quantity of oil into the bath, usually sufficient to maintain level, but it is advisable to check the level every 1,500 to 2,000 miles. **Note.** Use the same grade oil as used in the engine.

CHAINS.

Warning ! All standard " MANXMAN " models are fitted with an endless primary chain. Should it be found necessary to remove the chain at any time by means of punching out a link, re-rivet the chain to its original endless state when replacing, Do not use the normal type spring link. The high speed primary chain may possibly cause a fracture of the spring link, with disastrous results to the oil bath casing.

To adjust the primary chain, loosen the two ½" bolts on top and bottom of Gearbox pivot support, also both lock nuts and adjusting pins. To tighten chain, unscrew the front pin and tighten up the rear pin. Reverse the procedure to slacken chain. Finally, tighten up the ½" pivot bolts and check the adjusting pins, not omitting to lock up the nuts.

IMPORTANT WARNING.

Do not attempt to shift Gearbox by the adjusters before making certain the ½" pivot bolts are loosened off, otherwise the threads in the alloy are certain to be damaged.

REAR CHAIN.

Loosen the brake anchor and axle nuts, also adjusting pin lock nuts. Screw pins evenly to maintain wheel alignment. Re-tighten all nuts—**axle nuts very tight,** and do not overlook the lock nuts on adjusting pins. An incorrectly aligned wheel will have a detrimental effect on the steering and the life of both chains and tyres.

The manufacturers of the Chains fitted to the "MANXMAN " issue a comprehensive booklet on the care and maintenance of chains, which we will be pleased to supply if you did not receive one with your machine.

WHEEL BEARINGS.

The " MANXMAN " front wheel bearings are cup and cone type, the adjustment being set at the works, and the hub packed with grease. If it is desired to adjust the bearing, it is necessary to loosen the axle nut and lock nut on cone. The cone may then be screwed in the desired direction to tighten or slacken the bearing, the thread being right hand. The adjustable cone is located on the opposite side to the brake.

Rear wheel bearings are journal ball type, and are designed to give extra long life. The only attention is periodical packing of grease. No adjustment is necessary.

BRAKES.

A considerable amount of power can be absorbed by binding brakes. At the same time, ineffective braking is often due to incorrectly adjusted brakes. To adjust brakes, put the machine on both stands and screw up adjustments until brake commences to bind, then screw adjustment back three full turns. Always remember to lock the front brake adjustment—the road shocks transmitted from the forks could easily shift the adjustment if it is not locked up. If the front brake operation becomes stiff, examine the pivot pin on lever and the freedom of Bowden wire inside its cable.

STEERING AND FRONT FORKS.

Slackness in the head bearings may be adjusted by removing pinch pin below handlebar fixing and screwing down large nut below steering damper knob. Do not omit to replace pinch pin and tighten same up. This operation is best carried out with blocks under the cradle of the frame, sufficiently high to have wheel clear of the ground. Turn wheel from one lock to other, testing for any tight spots. If the steering appears " lumpy," try the head bearings a little slacker. If this does not cure the trouble, it is possible the races or ball bearings need renewal. The bearings are packed with grease on assembly at the works, and in this direction require no attention for at least 5,000 miles providing the adjustment has been maintained correctly.

Side play on the fork links may be corrected by loosening off the nuts and screwing the squared end of the roller from left to right. Tighten up nuts and check adjustment by turning knurled washers. These should not be too tight to move.

Remember the Forks are out in all weathers. It is, therefore, advisable to go over all grease nipples regularly.

NOTE.—Do not make the mistake of spoiling good steering by running with the steering damper too tight, and do not put additional stresses on the links and roller assembly by having the fork dampers too tight. If the fork action appears rough and you are satisfied the links are moving freely, check your front tyre pressure; it may be too hard.

LIGHTING AND IGNITION.

The Miller Dynomag Lighting and Ignition system standard on " MANXMAN " machines is dealt with in a special booklet issued by the manufacturers, Messrs. H. Miller & Co. Ltd., Aston Brook Street, Birmingham, 6. This booklet contains a list of all Miller Service Depots throughout the world.

Warning Note.—Do not neglect the battery. Check the level in all three cells regularly, and if below top of plates refill to correct level with pure distilled water. During the winter, make a practice of charging battery when riding in daylight hours, to store up energy for probable parking at night.

IGNITION.

Though trouble is not often experienced with the magneto, it is advisable to have a copy of the maker's Instruction Booklet available. It is important that the ignition timing should be correct in accordance with the instructions given, (See Table). If the ignition is timed so that the contact breaker points break too early the engine will knock and over-heat. If, on the other hand, the timing is too late, the engine will lose power and over-heat also.

In the event of the magneto appearing to be at fault, attention is directed to the following parts :—

The rocker arm of the contact breaker must work quite freely, and the platinum points must be clean and free from pitting. If pitted, they should be trimmed with fine emery cloth or a small file. The contact breaker points should show a gap of about the thickness of a post-card (or half millimetre). The carbon brush at the high tension terminal must be quite free in its guide, and the spring be sufficient for it to form good contact with the collector ring. The latter should be kept free from oil. The high tension wire must not be chafed or nipped tightly, as this is likely to cause a "short circuit."

CARE AND MAINTENANCE OF TYRES.

A special booklet for " Excelsior " owners is issued by Messrs. Dunlop Rubber Co. Ltd., Fort Dunlop, Erdington, Birmingham, and if you did not receive a copy with your machine, we will be please to supply same on application. This booklet not only gives useful hints and tips on the care of tyres, but a list of the correct pressures for all " Excelsior " models.

MEGAPHONE SILENCER.

The patented Megaphone type silencer fitted to " MANXMAN " models is so constructed as to make it a simple procedure to detach the baffles for cleaning. Remove silencer from the exhaust pipe, and inside will be disclosed the 5/16″ 26 thread nut. This can be unscrewed with a box spanner and the entire baffle section tapped out. In replacing, use blacklead on the thread of bolt and nut, securing baffles. Should it be found that the nut is obstinate, it will be advisable to soak the thread in penetrating oil over-night.

MAINTENANCE HINTS.

The performance of the engine is dependent upon the efficient co-operation of three important factors, namely, carburation, ignition and lubrication.

In order that the excellent qualities possessed by EXCELSIOR " MANXMAN " engines may be fully appreciated, it is very important that the conditions controlled by these three factors should be satisfactory.

POINTS TO REMEMBER.

Do not use the exhaust lifter for governing the speed of a machine. Such a practice leads to burning of the exhaust valve seating, increases the petrol consumption, and may cause serious damage to the engine.

It is better to change down into third gear early and to allow the engine to " rev " rather than to hang on to top gear until the last possible moment.

If you decide to fit a sidecar or discontinue its use, remember that a different set of gear ratios will be needed. The necessary reduction or increase may be obtained by the use of different engine sprockets. (See Tables).

Always obtain your spares direct from us or from one of our recognised dealers. We accept no responsibility whatever for breakage or consequential damage resulting from the use of spare parts which are not of our manufacture.

CARBURATION.

Read carefully the instructions in the Carburetter chapters. The proportion of air to petrol drawn into the engine through the Carburetter is extremely important. and is governed by the size of jet nozzle in the Carburetter. If the mixture is too rich, *i.e.*, the proportion of petrol is too great to that of air, misfiring will occur at slow engine speeds, and black smoke will issue from the exhaust pipe. If, on the other hand, the mixture is too weak, *i.e.*, the proportion of petrol is too small to that of air, " popping back" will take place in the Carburetter and the engine will misfire or stop altogether. Too rich a mixture will be caused either by the use of too large a jet in the Carburetter or by flooding of the Carburetter, which in turn may be due to any one of the following causes: —

1. Dirt between float needle and its seating.
2. Bent needle.
3. Punctured float.
4. Float needle binding in lid of float chamber.

Too rich a mixture will not cause serious damage to the engine, but, on the other hand, too weak a mixture may cause overheating and consequential damage. It is desirable to keep the mixture on the rich side rather than on the weak. This is due to the fact that the richer the mixture the cooler will the engine run, within limits. A weak mixture can be due to any of the following causes :—

1. Dirt or water in petrol.
2. Insufficient head or supply of petrol.
3. Air lock in the petrol tank.
4. Low petrol level in float chamber due to the level being incorrectly adjusted.

STARTING UP.

With a **cold engine**, depress the Carburetter Tickler, close Air Valve, open Throttle about one-eighth, ignition about three-quarter advanced, when, if the ignition system is in good order, no difficulty should be experienced in obtaining an " easy " start.

With a **warm engine** it is unnecessary to flood Carburetter, but the Air Lever should be closed.

If the Float Chamber is unduly flooded, excessive richness of mixture will prevent the engine starting. Open Throttle fully and revolve engine smartly until excess of fuel is exhausted ; then proceed as before, without again flooding.

LOCATION OF TROUBLE.

ENGINE STOPS SUDDENLY.

As far as the Carburetter is concerned, this can only be caused by :—

(1) Shortage of fuel.
(2) Broken or obstructed petrol pipes.
(3) Tank cock inadvertently closed.
(4) Obstructed jets.
(5) Broken or detached throttle valve cable.

All these points are readily checked by depressing the Float Chamber Tickler, when, if the Carburetter is in order, petrol will be seen to emerge from round the Mixing Chamber ; at the same time ascertain that the Throttle Valve is working.

If no petrol issues from the Carburetter when the Tickler is depressed, ascertain that there is fuel in the tank. Remove petrol pipe union from Float Chamber. If no flow, either pipe or petrol cock filter is obstructed, the cure for either being obvious.

If this is in order, remove Float Chamber Cover and see that the Float Needle is not bent and is working smoothly. Withdraw the Float and inspect Float Chamber and passage in Float Chamber neck for water or foreign matter.

If the foregoing are in order it will be necessary to remove the jet.

MIS-FIRING DUE TO EXCESS OR LACK OF FUEL.

Excess of Fuel.—Punctured Float, foreign matter between Needle Valve and Seating, Needle Clip out of position, Main Jet or Pilot Jet unscrewed, Mixing Chamber Union Nut loose, causing a leakage of petrol round Jet Block.

Lack of Fuel.—Partial obstruction of fuel supply ; obstruction in Carburetter passages or in jets. If the obstruction is only due to water or small foreign bodies in the jets, this can frequently be cured by placing the palm of the hand over the air intake of the Carburetter when the engine is running, at the same time opening the Throttle lever.

The engine will cease to fire for a few seconds, and then, if the obstruction is cleared, will resume firing regularly.

If this is of no avail, the fuel line and Float Chamber must then be inspected. If this is unavailing the only procedure is to remove the jets and clear the obstruction. Vent holes in Tank Filler Cap or Float Chamber cover obstructed.

LOSS OF POWER AND OVERHEATING

May be due to the following causes :—

(a) Inadequate lubrication will readily cause trouble, due to oil not circulating properly, or absence of sufficient oil in tank, or choked filters.
(b) Leakage at the joints between cylinder head and cylinder barrel. If leaking, the copper washer should be **annealed** or **renewed.**
(c) Gases escaping past valves. If the valve seatings become pitted or dirty, they should be ground in. See instructions under " Grinding-in Valves."
(d) Leakage past piston rings.
(e) Unsuitable or faulty type of sparking plug.
(f) Weak or broken valve spring. If the springs have lost their temper and become too weak, new springs should at once be fitted. It will be noted that the ends of the valve spring that lie nearest to the engine are weaker than the other ends on account of the heat which they have to withstand. When replacing springs, therefore, after removal at any time, care should be taken to place the compressed or weaker end next to the cylinder face, otherwise both ends will be affected by the heat, to the detriment of the springs.
(g) Tappet clearances and valve and ignition timing should be checked.

POSSIBLE CAUSES OF ERRATIC RUNNING.

1. Stopped petrol pipe or water in petrol. Petrol not turned on or tank empty.
2. Choked jet or stopped fuel passages in Carburetter. These can be cleared with a piece of fine wire, such as strands of Bowden cable. When the petrol supply is at fault,or the jet is choked, the trouble may be readily diagnosed, as the engine suddenly develops misfiring or blowing back through the carburetter, and can only be run with the air supply reduced.
3. Sparking plug points out of adjustment or dirty. Clean the plug with petrol and check the gap at the points. This should be about the thickness of a postcard and under no circumstances should exceed 1/32 in.
4. Contact breaker points pitted or incorrectly adjusted. See instructions under " Ignition " for cleaning and adjustment.

HINTS AND TIPS FOR "MANXMAN" AMAL CARBURETTER.

(Needle Jet Type).

MAINTENANCE OF THE CARBURETTER.

To maintain the efficiency of the Carburetter, you are strongly advised to clean it periodically. This is best done by entirely dismantling and washing each part in clean petrol, and in so doing, the following points should be observed :—

If the Jet Block is tight, it should be tapped out by means of a wooden stump in the mixing chamber.

Re-new any worn parts, as : Needle Valve, if the head has a distinct ridge at the point of seating ; Throttle Valve, if excessive side play is present ; Mixing Chamber Union Nut Washer, if worn or damaged ; Taper Needle and Clip, if it is possible to rotate the Needle freely in the clip.

Be sure that all Pilot passages are clear; this is done best by inserting a fine bristle.

In re-assembling, no brute force is necessary. Make sure that Taper Needle is re-fitted in correct groove and securely locked by clip ; that it enters the central hole in top of Jet Block ; that Needle Valve enters top of Float Chamber Cover easily ; that Mixing Chamber is fitted vertical and pushed right home on engine stub ; that Washer is good, if flange fitting to cylinder ; that Needle Valve Clip V registers correctly in groove. It will, of course, be necessary to re-set Pilot Adjusting Screw.

You are strongly recommended to purchase from an Official Service Stockist who exhibits the sign shown here.

NEEDLE JET CARBURETTER. (How it Works).

The Petrol Tap having been turned on, petrol will flow past the Needle Valve U until the quantity of petrol in the Chamber R is sufficient to raise the Float T, when the Needle Valve U will prevent a further supply entering the Float Chamber.

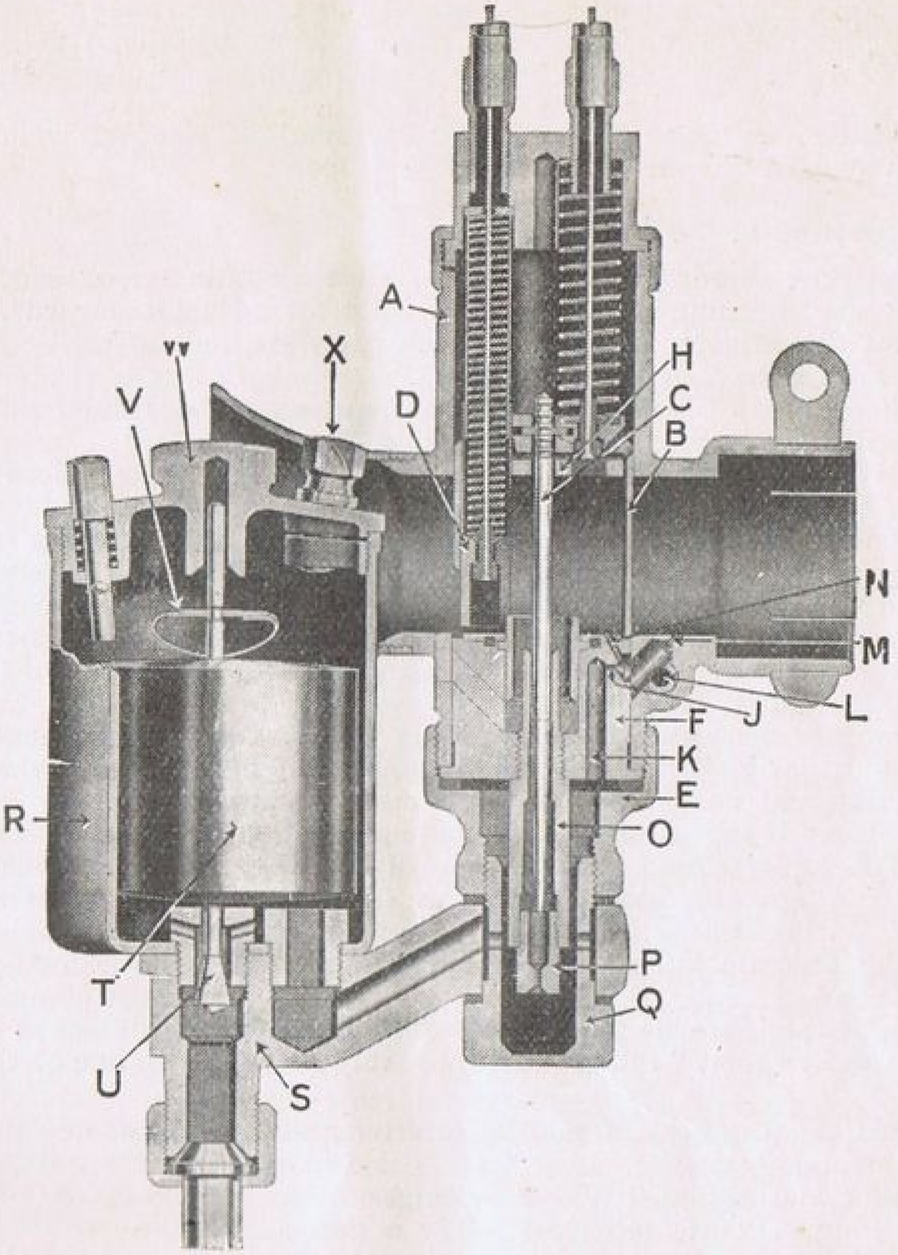
The action of the Float can readily be understood, for; as the quantity of fuel in the Float Chamber is used, the Float T will drop, carrying with it the Needle U, and admitting a further supply. Thus, automatically, the petrol level is kept constant. No alteration should be made to our standard petrol level.

The Float Chamber, having filled to its correct level, fuel passes along the passages, through the diagonal holes in the Jet Plug Q, when it will be in communication with the Main Jet P and the Pilot Feed Hole K ; the level in these Jets being, obviously, the same as that maintained in the Float Chamber.

Imagine the Throttle Valve B very slightly open. As the piston descends, a partial vacuum is created in the Carburetter, causing a rush of air through the Pilot Air Hole L and drawing fuel from the Pilot Jet J.

The mixture of air and fuel is admitted to the engine through the Pilot Outlet M.

The quantity of mixture capable of being passed by the Pilot Outlet M is insufficient to run the Engine. This mixture also carries excess of fuel. Consequently, before a combustible mixture is admitted, Throttle Valve B must be slightly raised, admitting a further supply of air from the main air intake.



The further the Throttle Valve is opened, the less will be the depression on the Outlet M, but, in turn, a higher depression will be created on the By-pass N, and the Pilot mixture will flow from this passage as well as from the Outlet M.

The mixture provided by the Pilot and By-pass system is supplemented at approximately $\frac{1}{8}$th throttle by fuel from the Main Jet system, the Throttle Valve cut-away governing the mixture strength from here to $\frac{1}{4}$ throttle. Proceeding up the throttle range, mixture control by the position of the needle takes place from $\frac{1}{4}$ to $\frac{3}{4}$ throttle, and thereafter the Main Jet is the only regulation.

The Air Valve D, which is cable-operated on the Two-Lever Carburetter and Hand-operated on the Single-Lever Carburetter, has the effect of obstructing the main through-way, and, in consequence, increasing the depression on the Main Jet, enriching the mixture.

TUNING THE NEEDLE JET CARBURETTER.

There are four ways in which the quality of the mixture supplied by an AMAL Carburetter can be varied, and these are given hereunder, in the order in which the adjustments should be made.

1. Main Jet ($\frac{3}{4}$ to full throttle).
2. Pilot Air Adjustment (closed to $\frac{1}{8}$th throttle).
3. Throttle Valve cut-away on the air intake side ($\frac{1}{8}$ to $\frac{1}{4}$ throttle).
4. Needle position ($\frac{1}{4}$ to $\frac{3}{4}$ throttle).

This diagram clearly indicates the part of the throttle range over which each adjustment is effective. The Carburetter having been carefully fitted, the general tuning can be carried out. The following sequence must be observed :—

1. **Obtain Main Jet Size** by selecting the smallest size Jet which gives the maximum speed. The air lever should be ¾ open.

2. **Pilot Adjustment.**

To weaken slow running mixture, screw pilot air adjuster outwards.

To enrich slow running mixture, screw pilot air adjuster inwards.

Screw pilot air adjuster home in a clockwise direction.

Place gear lever in " neutral."

Slightly flood Float Chamber by gently depressing the Tickler until fuel can be observed over-flowing from the Mixing Chamber.

Set Magneto half advance, Throttle approximately ⅛ open, close Air Lever, start the Engine and warm up.

After warming up, reduce the Engine revolutions by gently closing the Throttle.

The slow running mixture will prove too rich unless air leaks are present.

Very gradually unscrew the Pilot Air Adjuster.

The engine speed will increase and must be again reduced by gently closing the Throttle until, by a combination of Throttle positions and Air adjustment, the desired " idling " is secured.

It is sometimes necessary to retard fully the Magneto before good " idling " results, particularly when the Magneto runs at engine speed, or when excessive valve overlap and very early ignition timing is employed.

Throttle Stop. If it is desired that the engine should continue " idling " with the Throttle Lever closed, the position of the Throttle Valve must be set by means of the Throttle Stop Screw, the Throttle Lever being in the " closed position " during this adjustment. Alternatively, if the screw is adjusted clear of the Throttle Valve, the engine will shut off in the normal way by the Control Lever.

Do not take the Throttle Stop Screw out completely.

Failure to secure good " idling " will probably be traced to one of the following causes :—

Air leaks at the Junction of the Carburetter and Engine, or due to worn inlet valve stem and guide.

Faulty Inlet and Exhaust Valve seatings.

Sparking Plug. Points too close. Try a gap .025".

Sparking Plug oily.

Too much Ignition Advance.

Magneto Contacts dirty or too close.

Examine Contact Breaker.

Examine Slip Ring for oil.

Examine for Carbon Brush jamming in holder, or glazed on contact face.

Examine for fractured Brush Holder.

Examine for High Tension Cables for shorting.

Magneto Insulation may be broken down, or the interior mechanism wet.

3. **Throttle Valve Cut-away.**

Given satisfactory " idling," set the Magneto Control at half-advance. Air Lever fully open.

Very slowly open the Throttle Valve, when, if the Engine responds regularly up to one-quarter throttle, the Valve Cut-away is correct.

A weak mixture is indicated by spitting back through the Air Intake with blue flames, hesitation in picking up, which disappears when the Air Lever is closed down, and this can be remedied by fitting a Throttle Valve with less cut-away.

A rich mixture is shown by black smoke from the exhaust. Engine stops, or nearly stops, when the Air Valve is closed. The remedy for this is a Throttle Valve with more cut-away.

Each AMAL Valve is stamped with two numbers, the first indicating the Type No. of the Carburetter, and the second figure the amount of cut-away on the intake side of the Valve in sixteenths of an inch.

Thus 6/4 is a Type 6 Valve with 4/16 in. or ¼ in. cut-away.

The standard valve for Single Cylinder Engines is No. 5.

4. **Needle Position.**

Needle positions are counted from the top of the needle. and the groove nearest the needle top is No. 1.

With air full open.

Open the Throttle half-way.

Note if the Exhaust is crisp and the engine lively.

Close Air Valve slightly below throttle, exhaust Note and Engine Speed should then remain practically unaltered.

Weak Mixture. Raise Needle in Throttle Valve, IF—Popping back and spitting occur with blue flames from Carburetter intake.

Test by lowering Air Valve gently. Engine revolutions will rise when Air Valve is lowered slightly below the Throttle Valve.

Rich mixture. Lower Needle in throttle valve. IF—Engine speed does not increase progressively as the throttle is raised ; Smoky Exhaust and heavy laboured running ; on closing Air Valve slightly below throttle valve, tendency to miss-fire and eight-stroke is present.

The normal needle setting is with the Needle Clip in No. 3 groove.

Having found the correct Needle position, the carburetter setting is now complete, and it will be found that the driving is practically automatic once the Engine is warmed up.

For a Semi-automatic Setting. Where extreme economy is desired, lower the Needle one groove further after carrying out this range of tests.

For Speed Work the Main Jet may be increased by 10%, when the Air Lever should be fully open when on full throttle.

" Rich mixture "—General indications are—heavy thumpy running, emission of black smoke from the exhaust, the inside of the carburetter becomes blackened, and as the throttle is opened, heavy " blowback " of fuel is observed from the carburetter air intake.

" Weak mixture "—Difficult starting, tendency for the engine to fire back through the carburetter, indicated by blue flames from the carburetter air intake. Carburetter becomes sensitive to " drive," and constant use has to be made of the air lever, engine knocks readily and runs hot, with loss of power. The electrode of the sparking plugs shows indications of intense heat, and the mica insulation becomes white, polished exhaust pipes become rapidly blued.

FUELS.

All Standard model " MANXMAN " are not designed to run on straight petrol. We recommend 50 - 50 Petrol - Benzol, or Cleveland " Discol."

GEAR BOX.

ALBION COUNTERSHAFT GEARS.

Model H. The Four-speed Gear Box is of very simple design, and is covered by British patent number 330164/30. The movement of the gears is controlled by a striking lever which produces a straight through motion in the operating fork.

By this means it is impossible to get two gears at once, however much slackness or wear occurs in the control; thus overcoming, of course, one of the chief objections to many four-speed gear boxes actuated by cams of small design.

The materials from which the various components are made are of the highest class, the shafts and gears for example are from the best class Sheffield steel.

The gears consist of four pairs of pinions, always in constant mesh, two pairs of which are capable of sliding along their respective shafts in a group, reductions being obtained by means of face dogs and splines.

The mainshaft pair of sliding gears are mounted on splines on a sleeve which rotates on the mainshaft, and which carries at its extreme end the final drive sprocket. Top gear is obtained by means of face dogs on the mainshaft sliding gear engaging in dogs on the gear fixed to the mainshaft. For third gear, the group of gears is moved along until one of the layshaft sliders engages in splines mounted on the layshaft, a continuation of the movement engages the other layshaft slider on further splines on the layshaft, giving second gear, and for bottom, the gears are moved still further across the box until the second mainshaft gear engages by means of face dogs with a pinion free to rotate on the mainshaft sleeve.

Generous bearing surfaces have been provided, and the lubrication of these bearings has been carefully arranged to give a positive feed to each, so that as long as oil is kept in the box there is absolutely no fear of a seizure taking place. Each gear is locked positively inside the box.

The clutch is of the cork insert type, consisting of eight friction surfaces, thereby assuring a smooth uptake of the drive, and at the same time providing ample area for any loads likely to be encountered, and not affected by oil drag or slip.

The tension on the plates is maintained by four self-locking springs. Three adjustments are provided ; No. 1 on the gearbox end of the operating cable, No. 2 on the operating arm, and No. 3 on the clutch itself inside the oil bath. Always allow a little play at the clutch lever.

The shock absorber is mounted inside the clutch, and consists of large grease and oil-resisting rubber washers working between steel faces. This shock absorber has been in production for a number of years now, and has proved itself superior to any other type of shock absorber tried.

The 4-speed Albion Gearbox, incorporating special " Excelsior " features, is packed with light grease at the works, and we recommend the addition of ⅛th pint of engine oil after the first 1,000 miles, and a similar amount every subsequent 2,000 miles.

The foot-change mechanism on all "E" models is partially enclosed and lubricated from the box direct. On all "F" model " MANXMAN," the foot-change mechanism is totally enclosed and positively lubricated from the box.

FOOT OPERATED GEAR CHANGE.

The foot-change mechanism on all " E " models is partially enclosed and lubricated from the box direct. On all " F " model " MANXMAN " the foot-change mechanism is totally enclosed and positively lubricated from the box. Lifting the lever up engages lower gears, and pressing down engages higher gears, step by step (neutral is between low and second).

The clutch is a heavy duty 4-plate cork-lined, not affected by oil drag or slip. The tension on the plates is maintained by four self-locking springs. Three adjustments are provided, No. 1 on the Gearbox end of the operating cable, No. 2 on the operating arm, and No. 3 on the clutch itself inside the oil bath. Always allow a little play at the clutch lever.

If for any reason the cover of the oil bath has been removed to inspect clutch, before re-fitting, scrape faces quite clean and bright, using **Chemico Joining Cement** on both surfaces when re-assembling. Allow cement to stand about 10 minutes before re-fitting cover.

INSTRUCTIONS TO USERS.

We do not presume to tell you how to start your engine, apart from suggesting that you do not abuse your kick starter when your engine will not start, and that you look for your trouble elsewhere, but offer the following advice on getting into motion from rest :—

Have your engine running slowly, declutch by lifting handlebar lever, slip the gear smartly into low, then open the throttle steadily, at the same time letting the clutch in **slowly**. No useful uprpose will be served by letting in your clutch with a bang, in the other hand, quite a lot of damage can be done to tyres, chains, etc., even when an efficient shock absorber, such as ours has proved to be, is fitted. Furthermore, your engine may not like it and may stop. A gradual contact gives a gliding start.

When changing to a higher gear, declutch, move the gear lever and let clutch in easily ; the same procedure obtains in changing from a higher to a lower gear with the exception that a slight pause is made in order to allow the engine speed to increase. The length of the pause can only be determined by the rider himself judging the increase in engine revolutions to speed up approximately the gear reduction in relation to the road speed.

DO NOT ATTEMPT TO START FROM STANDING WITHOUT DECLUTCHING FIRST.

When ascending a hill, do not assist the engine, when she labours, by slipping the clutch ; changing down will save your engine and clutch. As the clutch, when new, settles down, it will be found that adjustment to the push rod is necessary. This is done by means of the adjusting pin and nut in the clutch lever at the kick starter end. There should be 1/32nd inch between the ball in the clutch lever and the push rod; if this is not maintained the two may, through the above-mentioned settling down, come into contact and hold the clutch slightly out. This will mean a slipping clutch, and eventually burnt out corks. On the first sign of clutch slip, look at the adjustment.

When new corks are required, it is best to return the parts to us so that we can grind the faces true. If this is impossible, then soak the corks in boiling water for a few minutes. This makes them pliable and easy to push into the holes, tucking the edges in with a screwdriver. They should then be tapped flat and level.

Chains should have not less than ⅜″ up and down movement in the middle of the run at the tightest spot. Turn your wheels round several times and check in various places for this. Always check the chain adjustment and alignment after tightening the holding down bolts, as, owing to a variety of causes this action sometimes has the effect of tightening or loosening a chain. After adjusting the chains, see that the Gear Locations in the Box register up with the positions on the side tank control quadrant, making the necessary adjustments on the control rod

LUBRICATION.

This is very important and about ⅛th pint should be added every 1,000 miles or so. We specially recommend Wakefield Patent Castrol X.L., Mobiloil D, and Aero Shell for these Boxes. Grease should not be used as it may quite easy get in oilways and stop the free passage of oil, thereby causing a grave danger of seizure.

The clutch sprocket, when free, runs on ball bearings, and these should be lubricated occasionally by clutching as far as possible and running a few spots of oil down the side of the sprocket between the corks. The only other places for lubrication are the clutch cable—which should be free from sharp bends, and, when the side tank control is used, the various joints.

DISMANTLING.

If it is necessary to remove the clutch, the procedure is as follows : Unscrew the four spring bolts with a screwdriver ; this will permit the removal of the complete outside plate, exposing the nut holding the clutch centre to the shaft. This is a right hand thread and may be unscrewed with a tube spanner. The gears cannot be removed until the mainshaft has been withdrawn, and to do this the clutch must be taken off (see clutch above).

Remove two bolts holding on bearing cap and remove cap complete with clutch actuating lever. The mainshaft nut is **left hand,** and must therefore be unscrewed in a clockwise direction. The cover bolts may now be removed and the cover lifted off. Do not prise cover by means of a screwdriver, as this damages the face of the cover and destroys the joint, causing oil leaks. A gentle tap on the clutch end of the spindle with a mallet will loosen it. The kick starter mechanism comes away with the cover. The mainshaft can now be withdrawn, followed by the layshaft, layshaft gears, mainshaft sliding gears and fork in one block. The withdrawal of the mainshaft sleeve and sleeve gear completes the dismantling as far as is necessary for practically everything.

In all cases, when assembling, make sure that the ball of the operator which juts out of the Box, fits into the operator lever which is in the cover.

The chain sprocket is mounted on the high gear sleeve by means of splines and locked by key washer or screw. These are unscrewed with an anti-clockwise movement.

Always use the correct size of chain for the sprocket fitted as other size chains will not run correctly and will cause excessive wear.

GUARANTEE AND SERVICE.

All our Gears are made well above the safety limit, but it is impossible to make gears to stand stresses far above normal put upon them on account of inexperience. For example, it would be very dangerous to coast down hill with engine stationary and engage clutch with **low** gear in to start engine. If coasting is practised, **high gear must always be engaged** and **clutch let in very gradually.** Manufacturers are always in a position to judge between a genuine defect and a breakage through misuse; in every case the user is given the benefit of the doubt; a fair and square deal is all that we ask. In all cases of complaints, parts must be returned to us, carried paid, stating the number and letter stamped on the box, and date the machine was purchased.

The frictional area of the clutch is more than sufficient for any loads likely to be encountered in motor cycles of the power for which the boxes are fitted. Do not slip the clutch, it is bad for corks and is bad practice—change down—that is why the Gear Box is there.

HINTS AND TIPS TO MAINTAIN THE HIGH EFFICIENCY OF RACING " MANXMAN " MACHINES.

This chapter has been compiled by the Experimental Department, who will be pleased to assist riders to maintain their machines to give the highest efficiency. The Racing Branch of the Experimental Dept. is specially equipped to service Racing " Excelsior " machines. You can have your engine brake-tested and power curve plotted for a nominal charge, and should your engine prove to be below standard, we will be pleased to advise you on the necessary course of action to return the engine to its original state of efficiency. When Spare Parts are ordered for Racing " MANXMAN " models, wherever possible every care is taken to supply the correct parts promptly, but to ensure prompt service it is absolutely essential for you to quote the Engine as well as the Frame number. We are continually developing and improving the performance of all " MANXMAN " engines, and in particular the Racing engine. Since the first season, such items as improved cams have been designed and, are available at list prices. The owners of Racing " MANXMAN " models are invited to communicate with the Experimental Dept. on any problem or enquiry they may have. Spares orders must, however, be addressed for the attention of the Service Department.

" Tuning " is a word, which, when applied to a motor cycle, simply means maintaining the highest efficiency of the machine as a whole. The necessity to deal with every part of a Racer is very important. We have ample evidence of cases where the performance of a very excellent engine was ruined by such " items " as binding brakes, insufficient oil in the Gearbox, trapped control wire and unsuitable sparking plug, or incorrectly proportioned fuel, and dozens of other causes.

The " MANXMAN " Racing Engine is designed to give off and maintain considerable power, consequently it is made from the finest materials, but abuse will destroy the tune and possibly cause damage to vital parts. If yours is a Racing Engine, treat it as such, keep it in good condition, learn to understand every part of the machine, and you will have your share of successes.

Motor Cycle Racing is a great sport, and a good loser is sometimes a better man than a winner. At the end of this section will be found a table giving data which you will find useful in your racing.

The Gear Ratios of the Racing " MANXMAN " are based on our own T.T. and Continental experience. They are, therefore, suitable for this type of racing, but for short circuits, such as Donington, we recommend a lower gear, and we are in a position to supply a large assortment of Engine, Gearbox and Rear Wheel Sprockets to effect the necessary change. This information is included in the tables.

The general design and other information has been dealt with in the foregoing chapters. It will, therefore, pay you to read the whole booklet carefully. Having stressed the importance of the cycle parts, we will cover these first.

Steering being vitally important, maintain the adjustment and condition of the steering head bearings and wheel alignment. Check the latter before each race, by the aid of a straight edge if available, or a piece of string stretched along the wheels about 6″ above the ground, remembering to make the necessary allowance for the front tyre being narrower than the rear tyre. Carefully go over the brake adjustments; they must neither bind nor provide too much movement when fully applied. The Racing brakes have alloy shoes for their light-weight and stiffness, also to assist in the dissipation of heat developed by the continued application of the brakes; therefore, it is important to allow sufficient clearance on the adjustment to provide for the expansion of the shoes, particularly if the race to be engaged in requires very frequent braking. If there is insufficient clearance, binding will follow very quickly and absorb valuable horse power, and further, in the case of the front brake, seriously affect the steering.

Go over all nuts and bolts systematically, starting at the front axle and working back. Do not make the mistake of thinking that because you tightened this or that nut last time it need not be done again.

The security of footrests is very important; that is why we provide slotted lock nuts and drilled pins for wiring. This also applies to the brake anchorage.

For the convenience of working on the machine, the Racing " MANXMAN " is fitted with a substantial rear stand, which is kept in place by a spring. For actual racing we recommend the removal of the stand, with beneficial effect on the steering.

LUBRICATION OF RACING ENGINES.

Earlier in this book we gave our recommendations for lubricating oils. This information did not apply to Racing engines, for which, unlike the standard engine, we recommend a **Castor base oil,** such as **Patent Castrol " R," Mobiloil " R," or super Shell Heavy.** The lubrication system of the Racing engine differs only in minor respects from that of the standard. The rate of oil circulation is slightly higher and a direct feed is taken to the rear of the cylinder, a jet of oil impinging on the thrust face of the piston when at or about bottom dead centre. External differences are, on all Racing models for 1935 and 1936, a large bore flexible pipe connects the bevel gear case to the timing case. This is to ensure rapid draining of oil to the sump. On models F.R.11 and F.R.12, the oil feed from pump to cam gear is by the medium of an external flexible pipe. This has been found a slight improvement in respect to oil cooling.

The racing engine constructional details are in the main similar to the standard engine dealt with earlier in the book, but in a number of cases the material used and the treatment thereof differs from the standard article, even though it closely resembles same. The racing connecting rods are subjected to considerably more heat treatment, and are of heavier section than the standard rod. The cylinder heads are cast either from aluminium bronze or in bi-metal, which means in the latter case the sphere, ports, etc., being cast in an aluminium bronze alloy, this shell being overcast with the fins in a silicon alloy, which has the advantage of reducing the weight considerably without in any way affecting the efficiency of the head; in fact a cylinder head of this type, particularly when used in conjunction with an alloy finned cylinder barrel, can very often employ a higher compression ratio with beneficial results.

The sizes of exhaust and inlet valves, valve springs and the collars for same, are individual only to the racing engine, and cannot be fitted to the standard engine without considerable machining operations. It is as well to point out that, in any case, fitting Racing parts to standard engines very frequently spoils the performance.

SPARK PLUGS.

On leaving the works, every Racing " MANXMAN " has a tally secured to the engine giving advice on the type of spark plug to be used. A reprint of this tally is given below :—

IMPORTANT.—The Cylinder head of this engine is arranged for BOTTOM Seating Plug.
Under no circumstances must a Plug-Washer be used.
Use B.R.51 for all purposes other than warming up.

The cylinder heads of both 250 c.c. and 350 c.c. Racing engines are designed and made for a **bottom seated spark plug,** which means that instead of sealing the plug in the normal way with a C/A washer, the plug seats on its bottom face directly in contact with the metal of the cylinder head at a point where it is best able to pick up and transfer heat to the outside via the body of the plug. Further, there is less tendency for over-heating of the plug threads, due to gases being forced around the threads between the plug and the cylinder head until they are finally trapped by the normal plug sealing washer.

It is vitally important that under no circumstances must a spark plug, either for warming up or racing, be screwed into the head with an ordinary washer under the shoulder. It is equally important that only the correct type of plug is used.

Both Lodge and K.L.G. plugs are specially made in certain types for our bottom seated heads, and we strongly advise the use only of these types. If you cannot obtain the types quoted in the tables, please write to us direct, or through your Dealer.

Owing to the extremely high compression ratios,the spark plug must be of a type designed to withstand the extremely high compression pressures. It therefore follows that to indulge in any full throttle practice on a " soft," or warming-up plug, will only promote over-heating and possibly a serious seizure of the piston and/or rings.

Regarding the fuel used, at all important races such as the T.T., Manx Grand Prix, etc., a fuel is supplied by the recognised Petrol Companies carefully mixed in the correct proportions. If, however, you are mixing your own fuel, it will pay to have a graduated measure and give a little more than the ordinary care to the proportioning of the Benzole and Motor Spirit.

LUBRICATION OF CHAINS.

The lubrication of the primary chain is via an adjustable drip feed taken from the return oil pump feed between the pump and the entry to the tank. The lubrication of the rear chain is taken care of by the excess oil from the gearbox being thrown out by the centrifugal action of the gearbox sprocket, the box being arranged to lead a small quantity on to the sprocket, providing, of course, the oil in the gear box is kept at its correct level. The oil recommended for the gearbox is a castor base oil, either Patent Castrol " R," Mobiloil " R," or Super Shell Heavy. The correct level for oil in the gear box is sufficient to cover the layshaft, which is the lower shaft in the box.

IMPORTANT NOTE.

In arranging the compression ratio of the Racing " MANXMAN " engine, it is sometimes necessary to use one or more aluminium plates underneath the cylinder, to arrive at the best ratio for the particular engine. Do not remove these plates with the idea that it will improve the performance of the engine—very likely the speed will be lower, the heat developed higher, and possibly the valves will come in contact with the piston and do serious damage. If any compression ratio modifications are contemplated and you are not in a position to obtain our advice, it is as well to remember that there must be at least 7/32nd inch clearance between the exhaust valve head and the crown of the piston when the latter is at top dead centre. In the case of the inlet valve, the clearance must be at least 3/16 inch, so that in effect you may remove the plates or machine part of the cylinder away to raise the compression and find it necessary to file the piston crown to secure the above clearances, only resulting in lowering the compression back to its original figure, or possibly lower.

EXHAUST SYSTEMS.

With certain models of racing " MANXMAN " machines, the exhaust system incorporates a megaphone. This is more common to the 350 c.c. engine. The megaphone exhaust or flared end to the exhaust pipe are not fitted simply with the idea of making more noise, and if your machine is delivered to you with a certain length straight exhaust pipe, do not imagine you can improve the performance by fitting something in the nature of a megaphone at the end of it, neither does it follow that increasing or decreasing the length of the pipe or fitting one of a larger or smaller bore will be beneficial to the performance. We have carried out many dozens of tests on exhaust systems alone, and the Racing "MANXMAN" is delivered with an exhaust system tested and calculated to give the best results, torque, acceleration and maximum power. Very often an exhaust system with a megaphone will improve the top speed range, but hopelessly upset the acceleration in lower gears. For a straight race, a megaphone may be tried and possibly used with advantage if maximum speed only is the consideration, but for a road racing circuit, or for that matter any race with corners where the speed drops below half the maximum speed, it is safe to say that the megaphone will be a definite deterrent to the low down performance of the engine, unless, of course, the engine details such as valve timing have been designed consistent with a megaphone fitted.

AMAL T.T.34 AND T.T.35 CARBURETTERS, AS FITTED TO MODELS E.R.11, E.R.12, F.R.11 and F.R.12.

The "choke" or effective bore of the carburetter is of great importance for maximum speed. The design in this carburetter is such that the maximum volume of air may flow through to charge the cylinder together with the maximum depression or suction on the jet to supply the fuel and atomise it.

The choke of the T.T.34 model may have its smallest diameter between the throttle barrel and the outlet of the carburetter, and not immediately over the jet, as in previous designs. This has been done to minimise any restriction caused by the needle and has increased the power at full throttle to the level of the famous Amal Track Racing Carburetter whilst retaining the quality of mixture at small throttle openings.

Now about the *needle* control to the jet; don't go away with the idea that all you require in a racing carburetter is that it will give you greatest power at full bore, and that in racing you are always on full throttle. Remember there are "Governor's Bridges," and also that you have to "get up" to full bore. Perfect carburation throughout the range of opening the throttle means ACCELERATION clean and snappy. This is where the needle control plays its part; you have a large main jet for power and for cooling the engine, and unless it is controlled it may give you a woolly rich mixture at small throttle openings—bad for acceleration and plugs. The needle reduces the flow of petrol above the main jet, and being taper, it reduces it most at small throttle openings, and as the throttle is opened, so the taper allows a bigger flow until the throttle is about ¾ open, when the needle ceases to have any effect, and the main jet is fully in play. The needle is attached to the throttle by a clip, the clip embracing one of seven grooves. This enables you to tune on the needle once you have set the main jet for power, by lowering the needle to get less petrol and *vice versa*, in its relation to the throttle opening. The needle is controlling the fuel flow in a needle jet, which has an accurately made bore, and this screws into the bolt that holds the float chamber to the mixing chamber. The standard needle jet bores are numbered 107 for types 25 and 15 T.T. models and 109 for type 10, but in all cases when alcohol fuels are used the bore is increased to 113, and so marked.

The *throttle* valve surrounds the choke block in the carburetter, and when it is open leaves a perfectly shaped passage. The throttle also surrounds the main jet outlet in the primary air tube, and is, therefore, a variable choke maintaining the suction on the jet as the throttle is closed down. The actual suction at smaller openings can be controlled by the "cutaway" on the lower edge on the air intake side of the throttle, a smaller "cutaway" increasing the mixture strength, and *vice versa*.

Throttles with different "cutaways" can be supplied, the number of the "cutaway" being the height of the "cutaway" from the bottom edge measured in sixteenths of an inch.

COMPENSATION AND AIR CONTROL.

The main jet does not spray directly into the choke bore of the mixing chamber. It first passes through the needle jet and is there partially atomised by a blast of primary air, and passes up as a rich mixture through a primary choke, which can be seen at the base of the main choke. The richness of the mixture as it passes through the primary choke can be handlebar-regulated by the air control at the side of the carburetter, less air being admitted to richen the mixture for starting or atmospheric conditions demanding more liquid fuel to give the correct mixture strength. As the engine speed increases at a given throttle opening so the mixture would tend to get rich, but as the air flow through the primary choke above the main jet also increases, there is a damping effect on the flow of liquid and a compensated mixture is obtained.

THE FLOAT CHAMBER.

The question often arises, "Should I have a double float chamber ? " The answer is definitely " Yes " for 350 c.c. machines and over if an alcohol fuel is used, but otherwise " No." The main jet of the Amal is submerged below the bottom of the float chamber, so a feed of liquid fuel is assured even when cornering at an angle. When racing, there is a froth of fuel in the float chamber due to vibration, but with the jet in its position there is no danger of lack of supply. The float chamber bracket is stiffened to resist this vibration. A single Amal racing float chamber will effectively deliver 5 gallons per hour, and generally speaking, a 500 c.c. racing machine on the gears will not use more than at the rate of 3 gallons per hour, so there is a margin of safety.

FUEL.

We are often asked which is the most suitable fuel to use, and we answer that unless specially ordered otherwise, Models E.R.11, E.R.12, F.R.11 and F.R.12 are fitted up with a compression ratio, suitable for a fuel consisting of 50% pure Benzole and 50% No. 1 Motor Spirit. If it is desired to run on an alcohol fuel for track races or reasons of local spirit supply, we would advise you to communicate with us, and we will advise on the compression ratio and in some cases a special piston to use. We do not list special pistons in the spares.

We always take straight petrol benzol mixture 50—50 as a basis to work on for jet size, and then give a percentage increase on the number of the jet for other fuels, for example :—

When using Discol P.M.S.2 increase the jet no. by approx. 60%
,, ,, ,, R.D.1 ,, ,, ,, ,, ,, ,, 80%
,, ,, Pratts Racing Spirit ,, ,, ,, ,, ,, ,, 200%
,, ,, Jap Racing Fuel ,, ,, ,, ,, ,, ,, 150%

To work out for example for P.M.S.2 where the petrol benzol jet is 200 :—

$$\text{Increase on } 100 \text{ is } 60$$

$$\therefore\ ,,\quad ,,\quad 1\ ,,\ \frac{60}{100}$$

$$\therefore\ ,,\quad ,,\quad 200 \text{ is } \frac{60}{100} \times 200 = 120$$

$$\therefore\ 200 + 120 = 320$$

320 being the jet size to use for P.M.S.2 when 200 was used for petrol benzol.

When using " alcohol mixtures " we cannot say the size of increase, and these sizes must be tried by experiment, always bearing in mind that there is a danger of over-heating in a weak mixture, even though the machine is running well—the sparking plug is a good indication. If after a fast run at full throttle you stop the engine at once and take out the plug, if it is grey at the end put in a bigger main jet. The colour of the plug should be a polished jet black for safety.

JETS.

The pilot jet, for starting off with, is unlike the standard Amal touring pilot jet because the adjustment regulates the fuel flow and not the air. This adjustment gives a wider range for any fuel which is mixed with air coming through a small hole under the carburetter—this mixture for " idling " and " starting off " passes through into the carburetter outlet just behind the throttle, and is again mixed with air coming under the throttle through the main bore.

The main jet can be got at easily without disturbing the float chamber by removing the hexagon cap in the holding bolt. In shape the jet is like the T.T.32 carburetter jet, but it is marked in c.c. flow instead of the T.T.32 cypher, as this c.c. flow figure simplifies calculation. However, if you have been used to the old numbers, the corresponding sizes are as follows :—

T.T.32 No.	T.T.34 in cc. flow	T.T.32 No.	T.T.34 in c.c flow	T.T.32 No.	T.T.34 in cc. flow	T.T.32 No.	T.T.34 in cc. flow	T.T.32 No.	T.T.34 in cc. flow
32	100	50	250	63	400	77	600	95	900
33	110	51	260	—	410	78	620	—	920
35	120	52	270	64	420	80	640	97	940
36	130	53	280	65	430	81	660	—	960
38	140	54	290	66	440	82	680	98	980
39	150	55	300	67	450	84	700	100	1,000
40	160	56	310	68	460	85	720	105	1,100
41	170	57	320	69	470	86	740	110	1,200
43	180	—	330	70	480	88	760	115	1,300
44	190	58	340	—	490	89	780	118	1,400
45	200	59	350	71	500	90	800	122	1,500
46	210	60	360	72	520	91	820	127	1,600
47	220	61	370	74	540	92	840	130	1,700
48	230	62	380	75	560	93	860		
49	240	—	390	76	580	94	880		

To get carburation for any stated fuel when the choke bore is correct for the peak revs. of the engine and the correct needle jet for the fuel to be used, the procedure is simple. Start off with an assumed setting, and then tune as follows. There are four phases :—

(1) Main jet for power at full throttle ;
(2) Pilot jet for idling ;
(3) Throttle " cutaway " for take off from the pilot jet ;
(4) Needle position for snappy mixture at ¼ to ¾ throttle ; then final idling adjustment of the pilot jet.

Always tune in this order, then any alteration will not upset a correct phase.

LOCKING DEVICES.

Vibration causes screws to come undone, so we have devised simple and quick locking devices that are sure, *viz.*, a screw in the mixing chamber cap to lock the ring at the top, also a spring to hold the float chamber holding screw from vibrating loose. For the petrol pipe union we leave you to make your own device.

INSTRUCTIONS FOR TUNING AMAL ROAD RACING CARBURETTER.

TYPE T.T.34.

SEQUENCE OF TUNING.

(1) Main jet size. (2) Pilot jet adjustment. (3) Throttle valve " cutaway." (4) Needle attachment.

1. MAIN JET SIZE.

This should be determined first ; the smallest jet which gives the greatest maximum speed should be selected, keeping in mind the safety factor for cooling. (*The air lever should be fully open during these tests*).

2. PILOT JET ADJUSTMENT.

Before attempting to set the pilot adjuster the engine should be at its normal running temperature, otherwise a faulty adjustment is possible, which will upset the correct selection of the throttle valve. The pilot adjuster which controls the amount of fuel passed, is rotated clockwise to weaken the mixture, and anti-clockwise to enrich it. Adjust this very gradually until a satisfactory tick-over is obtained, but take care that the achievement of too slow a tick-over—that is, slower than is actually necessary—does not lead to a "spot" which may cause stalling when the throttle is very slightly open.

(3) Having set the pilot adjuster, open up the *throttle* progressively and note positions where, if at all, the exhaust note becomes irregular. If this is noticed, leave the throttle open at this position and close the air lever slightly; this will indicate whether the spot is rich or weak. If it is a rich spot, fit a throttle valve with more *cut-away* on the air intake side (or *vice versa* if weak).

(4) This tuning sequence will affect carburation up to somewhere over one-quarter throttle, after which the jet *needle*, which is suspended from the throttle valve comes into action, and when the throttle is opened further and tests are again made for rich or weak spots, as previously outlined, the needle can be raised to enrich or lowered to weaken the mixture, whichever may be found necessary.

With these adjustments correctly made, and the main jet size settled, a perfectly progressive mixture will be obtainable from tick-over to full throttle.

NEEDLE JET.

It is not necessary to alter the needle jet when tuning, but before attempting to set the carburetter, the rider should make sure that the correct needle jet is fitted. The following are the needle jets which should be used :—

Racing "Manxman," 250 c.c.: Petrol-benzol fuel; needle jet .1075
" " 350 c.c. " " " " " .109
" " Both Models; used with alcohol fuel " " .113

ALCOHOL FUELS.

When alcohol fuel is used, the needle jet mentioned above must be fitted, and it is also necessary to increase the main jet by the following amounts :—

P.M.S.2 fuel 60% greater flow than for petrol.
R.D.1 fuel 80% to 100% greater flow than for petrol.

When calculating the increase of jet size for alcohol be sure you reckon on the number that represents cc. flow, and not the cypher number. Generally speaking, if the number is below 130, the number is sure to be the cypher number, which must be converted into cc. flow from the conversion table in this list. If you have any T.T.32 spare jets which are marked in cypher, these can always be used in a T.T.34 carburetter, provided that they are the right size by comparing them with the conversion chart.

APPROXIMATE SIZES AS A GUIDE FOR PETROL-BENZOL FUEL.

Engine at average peak revs.	Effective bore of Carb. at back of throttle.	Throttle Valve	Needle Jet.	Needle position.	Main jet in cc. flow.
250 cc.	1″	5	.107	4	250
350 cc.	$1\frac{1}{16}$	5	.109	4	270

USEFUL SPARES TO HAVE WHEN TUNING UP CARBURETTER.

	each
Needle Jets for use with alcohol fuels (same needle jet for all carburetters)	1/9
Jet, any size calibration according to estimated size	1/-
Throttles with different cutaways for types 25 and 15	3/10
" " " " " type 10	4/3

TECHNICAL DATA

STANDARD GEAR RATIOS.						SIZES OF CHAINWHEELS.			
Model		Top Gear	Third Gear	Second Gear	First Gear	Engine Sprocket	Clutch Sprocket	Gear Box Sprocket	Rear Wheel
E11 AND F11	Solo	6-2	8.06	11.16	17.23	18	40	20	56
	Sidecar	6.82	8.88	12.27	18.95	17	40	20	58
E12 AND F12	Solo	5.38	6.99	9.68	14.95	19	40	18	46
	Sidecar	6.0	7.8	10.8	16.68	17	40	18	46
F14	Solo	4.38	5.69	7.88	17.17	20	40	20	46
	Sidecar	4.86	6.32	8.74	13.5	19	40	20	46
ER11		6.2	6.7	8.68	12.09	19	42	20	56
FR11		6.22	6.77	8.7	12.129	18	40	20	56
ER12		5.36	5.84	7.53	10.45	20	42	18	46
FR12		5.11	5.56	7.15	9.96	20	40	18	46
ALTERNATIVE SIZES CHAINWHEELS AVAILABLE. ☛						17, 18, 19, 20	40, 42	½″ × .305″ 19, 20	56, 57, 58 ½″ × .305″
								⅝″ × ¼″ 18, 19, 20	46, 48 ⅝″ × ¼″

TECHNICAL DATA

Model	Bore m.m.	Stroke m.m.	Displacement c.c.	Compression Ratio	Weight complete	B.H.P.	R.P.M.	Approx. Fuel & Oil Consumption		Spark Plug Fitted Standard	Alternative Recommendations
								Fuel	Oil	Lodge	K.L.G.
E11	63	79	247.7	7.5		17	6500	85	2000	H.53	831LR
F11	63	79	247.7	7.5		17.5	6500	85	2000	R.14	831 or LB1
E12	75	79	349	7.25		21.5	6000	80	2000	H.53	831 or LB1
F12	75	79	349	7.25		22	6000	80	2000	R.14	831 or LB1
F14	82	94	496.6	7	350	30	5250	75	1750	R.14	831 or LB1
ER11	63	79	247.7	10	298	22	7250	45	750	warming H.53 Racing BR51	B831LB warming B731 racing
FR11	67	70.5	248.6	9.5	295	22.5	7350	45	750	warming A14-1 Racing BR51	B831 warming B731 racing
ER12	75	79	349	9	310	28	7000	40	750	warming H.53 Racing BR51	B831LR warming B731 racing
FR12	75	79	349	8.75	300	29	7000	40	750	warming A14-1 Racing BR51	B831LR warming B731 racing

TECHNICAL DATA

Model	Valve Timing				Valve Clearance Engine Cold		Ignition Timing	Chain Sizes		Carburetter Type	Standard Jet
	Inlet		Exhaust		Inlet	Exhaust		Front	Rear		
	Opens	Closes	Opens	Closes							
E11 ...	35°	60°	62°	20°	.008	.002	42	½ × .305	½ × .305	Amal 76/109	130
E12 ...	35°	55°	60°	21°	.008	.004	42	½ × .305	⅝ × ¼	Amal 76/112	150
F11 ...	35°	60°	62°	20°	.008	.004	42	½ × .305	½ × .305	Amal 76/109	130
F12 ...	40°	62°	62°	34°	.008	.004	42	½ × .305	⅝ × ¼	Amal 76/111	150
F14 ...	44°	55°	62°	38°	.008	.004	40	½ × .305	⅝ × ¼	Amal 89/014	170
ER11 ...	35°	55°	60°	25°	.008	.004	42	½ × .305	½ × .305	Amal 15 TT34	250
ER12 ...	40°	55°	62°	21°	.008	.004	40	½ × .305	⅝ × ¼	Amal 10 TT34	270
FR11 ...	40°	62°	62°	35°	.008	.004	40	½ × .305	½ × .305	Amal 15 TT35	240
FR12 ...	40°	62°	62°	35°	.008	.004	40	½ × .305	⅝ × ¼	Amal 10 TT35	270

TECHNICAL DATA

R.P.M. AND ROAD SPEED.

M.P.H.	250 Gear 6.2	350 Gear 5.38	500 Gear 4.38
25	2020	1738	1415
30	**2424**	**2085**	**1698**
35	2828	2433	1981
40	3232	2780	2264
45	3636	3129	2549
50	4040	3478	2830
55	4444	3820	3115
60	4848	4170	3397
65	5252	4522	3680
70	**5656**	4868	3962
75	**6060**	5213	4240
80	6464	**5560**	4528
85	6868	**5909**	4813
90	**7372**	6258	**5098**
95	—	**6607**	**5379**
100	—	6956	5760

30 m.p.h. Legal Speed Limit.

Double squared : approximate maximum speeds, standard models.

Single squared : approximate maximum speeds, racing models.

GEAR BOX REDUCTIONS, WITH KICK START.

Ratio No.				
Standard	1	1.3	1.8	2.78
10	1	1.3	1.8	2.14
11	1	1.4	1.67	2.14
12	1	1.4	2.15	3.3
13	1	1.4	2.15	3.0
14	1	1.4	1.98	3.3
15	1	1.4	1.98	3.0
17	1	1.42	1.98	2.78

RACING GEAR BOX REDUCTIONS, WITHOUT KICK START.

1	1	1.09	1.28	1.65
2	1	1.09	1.28	1.8
3	1	1.18	1.4	1.8
4	1	1.18	1.4	1.96
5	1	1.18	1.4	2.13
6	1	1.09	1.4	1.8
7	1	1.09	1.28	1.95
No. 8 Standard ...	1	1.09	1.4	1.95

TO DETERMINE THE TOP GEAR RATIO—

Multiply the number of teeth on Gear Box Sprocket by the number of teeth on the Engine Sprocket and divide the total into the multiplication of the number of teeth on the Clutch and Rear Wheel Sprockets.

Rear Wheel and Clutch : 56 × 40 = 2240 = 6.22
Gear Box and Engine : 20 × 18 = 320 Gear Ratio.

TO DETERMINE THE INTERMEDIATE RATIOS—

Multiply the Top Gear Ratio by the Gear Box Reduction thus—
Top Gear Third Reduction
6.2 × 1.3 = 8.06 Gear Ratio.