# THE AUTOCYCLE

## and how to get the best from it

of THE MOTOR CYCLE

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# YOUR AUTOCYCLE
## AND
## HOW TO GET THE BEST FROM IT

By
THE STAFF OF
THE MOTOR CYCLE

*Illustrated with 59 drawings*

ASSOCIATED ILIFFE TECHNICAL BOOKS

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# Foreword

RIDING an autocycle is so simple that anyone who can ride a pedal cycle will feel at home on an autocycle in a matter of minutes. Tending an autocycle is also simple. There are, however, various little hints and tips on riding and maintaining an autocycle which come with experience, and the aim of this handbook is to pass on the accumulated knowledge of autocycles which members of *The Motor Cycle* Staff have gained during their now wide and lengthy experience.

The title, " Your Autocycle, and How to Get the Best from It ", gives a good general indication of the contents, but, as will be found from the chapter headings overleaf, every facet of ownership is embraced, from the actual purchase, through learning to ride efficiently, to decarbonizing the engine. Running costs, insurance, how the engine works, securing day-in, day-out reliability—these are a few of the many subjects, each discussed in a readable, understandable form.

This is not a textbook, but a friendly, helpful guide, written with the object of enabling owners to obtain the maximum enjoyment and service from that most economical, ever growing more popular, little vehicle, the autocycle.

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# Abbreviations Used in This Book

*(As recommended by the British Standards Institution)*

| | |
|---|---|
| A.C. | alternating current |
| c.c. | cubic centimetre |
| D.C. | direct current |
| in | inch |
| mm | millimetre |
| m.p.g. | miles per gallon |
| m.p.h. | miles per hour |





CHAPTER 1

# The Autocycle: What It Is

WHAT is an autocycle ? The generally accepted answer is that it is a machine on the lines of a bicycle with pedals, pedalling gear and an engine not exceeding, in size, 100 c.c. An essential of an autocycle is that there are pedals and pedalling gear. It is these which differentiate the autocycle from a motor cycle.

In the old days the term used for autocycles such as we know to-day was motor-assisted bicycles. This, while it can be correctly applied to some machines, notably to certain tiny engined mounts developed on the Continent, is not applicable to the standard British autocycle, because in this case the small yet powerful engine does far more than assist—once started, it does the work and the pedals become rests for the feet, plus, in some instances, the means of applying the rear brake.

Once under way, an autocycle is controlled by a little lever on the right handlebar. Pull it towards you and the engine develops more power—for accelerating, climbing a hill or defeating a head wind, as the case may be. Close this lever, the throttle control, by pushing it away from you and the machine will stop. There is also a clutch, operation of which connects or disconnects the engine from the back wheel—disconnects it if the lever is pulled towards the left handlebar, on which it is mounted, thus enabling the engine to be kept running while the autocycle is stationary at, say, traffic lights.

Control is so utterly simple that anyone who can ride a pedal cycle can equally well ride an autocycle. Many a time we of *The Motor Cycle* Staff have heard old ladies exclaim in wonderment: " Why, I could ride that ". Not only could they do so—and hundreds of elderly people, some over seventy years of age, have taken to autocycles—

but the cycling without effort which is the natural prerogative of ownership spells a fresh and often undreamed of pleasure in life. No longer do head winds and hills tax the cyclist's energy and constitution; no longer is a journey too great to be undertaken.

Where a cyclist's normal radius from home, except on tours, may have been 20, 30 or, at the most, 40 miles, now he or she can explore entirely fresh country and even, on the annual holiday, tour the most distant parts, the Mancunian visiting Land's End and the Londoner, the Lakes.

This is where the autocycle scores so heavily; it is a key to the beauty of this country of ours at a cost comparable with that of shoe leather. And it is not necessarily a slow means of locomotion. Many machines will tour along at 15, 20 or something close to 30 m.p.h. The owner can travel at cycling speed admiring the countryside, the engine providing the propulsion and thus making the journey joyous relaxation, or forge ahead at a speed which over give-and-take roads will result in an all-in average of 20 to 25 m.p.h.

What about hills ? An autocycle will take a 12-stone rider up gradients of 1 in 7 to 1 in 8 without any pedalling being necessary. This means that except in extremely hilly country, or where a steep hill is approached via a sharp corner, it is a case of free-wheeling all the way.

Although the elderly have been mentioned it is not only those no longer in their first youth to whom this continuous free-wheeling can be a boon. There is that added radius to one's travels—the hundreds of additional square miles which can now be explored—and there is the higher average speed, which to many can mean much. The youngster will often find that an autocycle spells fresh freedom and, incidentally, not only is there no cheaper form of personal motor transport, but also it is a most excellent stepping-stone from a bicycle to a motor cycle.

Thousands of autocycles, of course, are used as a healthy, carefree method of getting to and from office or factory. And it is a fact that the rider of an autocycle or motor cycle remains singularly free from such ailments as colds and influenza. It is also a fact that, generally, use of an





autocycle is very much cheaper than travelling by public transport *and* there are no queues, no waiting, no standing and no over-crowding.

On the saving effected by means of an autocycle, a lady living in Leatherhead, Surrey, and engaged on house-property work in Kensington, approximately 20 miles away, kept a careful account over a period of 15 months. At the end of that time, setting all her expenses for the autocycle—the price of her second-hand machine, petrol, oil, licences, insurance and repairs—against the sums she would have had to expend on fares, she found that the autocycle had not only paid its way, but, except for just under 7s., paid for itself. Had she counted all the small fares, such as, but for the autocycle, would have been involved on her trips from the office to the Kensington shops, it would, she said, have more than paid for itself. Autocycles were cheaper when she made her purchase than they are to-day, but that does not alter the fact that the machine proved a remarkably good investment.

The convenience aspect is important. In the case enumerated, shopping was mentioned, but what about running up to the pillar box or to golf ? There are various daily tasks which an autocycle can lighten, while as for sport, often it is the very thing that is needed. Just think of returning home following a football match or speedway meeting, of the evening rise on that distant fishing stream which often has had to be missed because the last bus will have gone, of visits to friends which are now both possible and easy. . . . There is little need to enlarge, because everyone can think of purely personal directions in which ownership of an autocycle will make all the difference.

Lastly, there is the strictly utilitarian mission of the autocycle, the delivery of goods. Machines on the lines of tradesmen's bicycles are available. They offer speedy, reliable and economical delivery of light goods, can increase the delivery area and can enable the lady who forgot to order fish for dinner to be made a customer for life at a cost so small as to be laughable. A point that will especially appeal to the trader is that with many autocycles there is a replacement engine scheme.

CHAPTER 2

# What It Costs

At the time this edition goes to press, the average price of a new autocycle in Britain is £44 14s. 5d. This is the basic price. On top—unfortunately !—there is purchase tax, which comes out at 27 per cent of the basic price. Thus the average figure a purchaser in these islands has to pay is approximately £56 16s. 1d. (there is no purchase tax on the machines exported). The prices of the 98 c.c. autocycles are very much the same since the cheapest costs, with tax, £50 9s. 4d., and the dearest, which is fitted with an engine unit incorporating a two-speed gear, £69 17s. 0d.

Obviously, to have a sparkling new autocycle is more pleasurable than to buy one which has seen a fair amount of service and whose appearance betrays the fact. And there is the point that an autocycle is so simple and so robust that even the man or woman who has no mechanical bent can purchase a new autocycle without any fear that harm will come to it owing to mishandling. On the other hand, in normal times it is the initial depreciation that is heaviest. Often, therefore, a useful saving can be effected by buying a second-hand autocycle. Quite likely the machine belongs to someone who, having once become accustomed to using an engine, has graduated to a motor cycle. Such a machine may only have covered a thousand or two thousand miles and be, to all intents and purposes, brand-new, although at a figure pleasantly below the original list price.

Anyone with a knowledge of pedal cycles should gain a fair idea of the general condition of a second-hand autocycle that is on offer—the state of the cycle parts alone is likely to afford an inkling regarding the machine as a whole. Even so, if there is a knowledgeable friend available, the prospective purchaser is obviously wise in getting him or her to give the machine the once-over. Many dealers, if





asked, and often unasked, will give, say, a three-months' guarantee on the machine. This covers the provision of free parts to replace any which prove faulty.

Taxation on an autocycle works out at the equivalent of 4d. a week. Licences end with the quarter, that is, on March 24, June 30, September 30 and December 31 or, of course, the year. Licences ending on December 31 cost as follows: From January 1, 17s. 6d.; February 1, 16s. 11d.; March 1, 15s. 4d.; March 25, 13s. 10d.; May 1, 12s. 3d.; June 1, 10s. 9d.; July 1, 9s. 3d.; August 1, 7s. 8d.; September 1, 6s. 2d.; October 1, 4s. 10d.; November 1, 3s. 3d.; December 1, 1s. 8d. A quarter's licence, it will be noted, costs 4s. 10d. and a two-months' licence (which must end with the quarter) 3s. 3d. and a one-month's licence (which follows the same rule), 1s. 8d. On top, of course, there is a driving licence. This costs 5s. a year.

Under the Road Traffic Act it is necessary to insure against the risk of bodily injury to third parties. As might be expected, this is not very costly in the case of an autocycle. The so-called " tariff " insurance companies quote 19s. 6d. for a third-party policy on an autocycle of single-geared type, £1 9s. for third-party, fire and theft and £3 8s. for a " comprehensive " policy. The last type of policy covers the risk of accidental damage to the autocycle. The term " single-geared " refers, of course, to the drive from engine to back wheel, not to any two- or three-speed pedalling gear.

These policies are not issued for covering autocycles which are constructed or adapted for the carriage of goods. Such machines are treated by the tariff offices as if they were motor cycles and, therefore, are subject to an appreciably higher premium. There is also the " D.U." insurance policy, which is a Lloyd's policy sponsored by motor-cycle manufacturers and dealers. The " D " stands for dealer and the " U " for the Manufacturers' Union. These policies are obtainable through dealers who sell motor cycles and autocycles. The premiums are: 18s., third-party; £1 10s., third-party, fire and theft; and £2 7s., comprehensive. One or two autocycle manufacturers have their own special insurance policies.

It will be noted that the law only requires insurance against the risk of injury to third parties, but one is more likely to scratch, say, the wing of a car than to bump into a human being and the insurance policies cover all third-party risks.

Which form of policy is taken out is a matter each individual must decide for himself or herself. Many believe in paying the extra for fire and theft, while some like to take out the "full comprehensive" policy so that if they damage their machines that, too, will be covered.

The task of licensing an autocycle is quite simple. Insurance comes first, since it is necessary to produce a certificate of insurance or an insurance cover note to the licensing authority. The cover note, as the term implies, is a form of certificate showing that the machine is covered which the insurance companies issue pending the machine being registered and licensed. Generally, it is valid for ten or fifteen days. Just as soon as the machine has a registration number, the insurance company can issue the policy and the insurance certificate.

Where the autocycle is new and unregistered, an R.F. 1/2 form should be obtained from a money-order post office, which can also supply the address of the local motor taxation office. After filling in the form, the applicant can either visit the taxation office in person or, what is generally easier (there may be a queue at the licensing authority), do the whole thing by post. With a new machine it is necessary to forward (1) the completed R.F.1/2 form; (2) the appropriate duty; (3) the insurance cover note; and (4) evidence of purchase, such as the agent's receipt.

If the autocycle is second-hand and already licensed, the new owner should obtain the registration book from the vendor, fill in his or her name and address in the space provided—not forgetting to sign at the point where it says "Usual Signature"—and post the book to the registration authority whose address appears on page 2 of the book. The registration will then be transferred to the new owner. In this case the insurance certificate does not have to be produced, but it will have to be when a fresh





licence is taken out. When this latter occurs, the vehicle having been transferred, it will be necessary to use the R.F.1/2 form mentioned earlier, not the R.F.1A form which applies to licence renewals where there has been no change in the vehicle or its owner and which is thus the form that will be required in future.

Should the licence of the second-hand machine have expired, the registration book still has to go to the registration authority named on page 2, but may be accompanied by the R.F.1/2, the insurance certificate or cover note and the money (the postal order or cheque should be made out to the *local* registration authority, which may not be the one to whom the book is sent; the book comes back via the local authority and, if all the foregoing are enclosed, it will be accompanied by the licence).

The law is precise on the subject of the holder in which the licence is carried. It must comprise a sheet-metal tray with turned-up edge, a stout cover of transparent white glass, a metal ring cover and a rubber packing ring that renders the holder waterproof. The licence holder must be fitted in a conspicuous position on the near side in front of the "driving seat". Any standard licence holder such as is supplied by accessory firms meets the requirements. Note the word "glass" in the foregoing; it is possible in the case of a second-hand machine that the previous owner had an accident with his circle of glass and fitted celluloid instead.

Now that we have discussed the cost of insurance and licences, let us turn to running costs. Many autocycle owners have kept careful accounts. The following are three fairly typical logs. One came from a reader of *The Motor Cycle* living in Leeds, the second from an autocycle owner in Bacup, and the third from an owner on the outskirts of London.

No. 1 covered 4,000 miles in six months. His bills for petrol and oil amounted to £3 9s. 9½d. Replacements cost 2s. 2d. and accessories £2 5s. 10d. The last figure included a speedometer which, while it adds interest to one's runs, is not necessary by law. (Only machines over 100 c.c. have to be fitted with a "speed indicator" and then only if they have been registered for the first time after September 30, 1937.) In this reader's case the cost of licences and insurance came out at £1 16s. 4d. Even with the cost of speedometer included, his cost per mile, neglecting depreciation, worked out at four-tenths of a penny a mile. Omit the speedometer, on the basis that it was unnecessary and should be treated as a present from himself to himself, and the cost was approximately three miles a penny. Incidentally, this gentleman bought his autocycle because he had exhausted the area within his range by pedal cycle. On one of his trips he climbed Red Bank in the Lake District.

Our friend in Bacup covered the majority of his 5,600 miles on hilly, open moorland roads. His petrol and oil bill was £4 2s.; parking batteries cost 2s.; repairs, 17s. 3d. and insurance and tax, £2 13s. 9d. Insurance was with a company which at the time did not have a special rate for autocycles. Even so, his cost per mile was only three-tenths of a penny a mile—ten miles for 3d.!

The South Harrow rider covered 6,000 miles on £4 12s. worth of petrol and oil. Tax and insurance were £1 4s. 6d. and engine decarbonization, repairs, etc., approximately £1. This comes out at fractionally more than one farthing a mile, neglecting depreciation.

Lastly, it is interesting to find one of the *The Motor Cycle* Staff undertaking a Continental tour on a 98 c.c. autocycle. He covered 654 miles in all and found that 4½ gallons of petrol sufficed for 550 of those miles. He had no tyre trouble—no trouble of any sort—and the only adjustments he had to make, in spite of the rough Continental roads, were to use the hand-operated adjuster of the front brake—a moment or two's job—and, on one occasion, take up the slack that developed in the rear chain. It will be realized from this that an autocycle can be a key to the Continent as well as to the beauties of Britain.

What may astound many is the low cost of running an autocycle.



CHAPTER 3

## How the Engine Works

OF all internal-combustion engines, the three-port two-stroke such as is fitted to autocycles is by the far the simplest. There are only three moving parts—the piston, the connecting-rod and the crankshaft. Sometimes people find that the very simplicity of the engine makes it difficult to understand.

Let us start with the first principles. Imagine that you are pedalling a bicycle. There are the pedals, the crank, the chainwheel and the chain to the back wheel. As you thrust down on the right-hand pedal the chainwheel is caused to revolve, carrying with it the chain which, in turn, causes the back wheel to rotate. The crankshaft of our autocycle engine can be likened to that chainwheel and crank; your leg is the connecting-rod of the engine and the pressure developed at your knee, the force of the explosion in the autocycle's cylinder. Fig. 1, on the next page, shows the bicycling and Fig. 2 the elements of an autocycle engine. Push down on top of the piston, which is what the pressure in the cylinder does, and the crankpin at the lower or "big-end" of the connecting-rod moves round, carrying with it the wheel—the flywheel—and the chain that passes the drive to the back wheel.

Why the engine does not halt when the piston reaches the bottom of the stroke is that the flywheel, having been given a powerful thrust by the explosion, has been set spinning—it stores up sufficient energy to carry the piston up the cylinder again, when there is the next explosion. The engine is called a two-stroke because every time the piston reaches the top there is an explosion, that is a power stroke once every two strokes of the piston.

Fig. 3 shows the cylinder, piston, connecting-rod, crankshaft and crankcase of a two-stroke engine in some

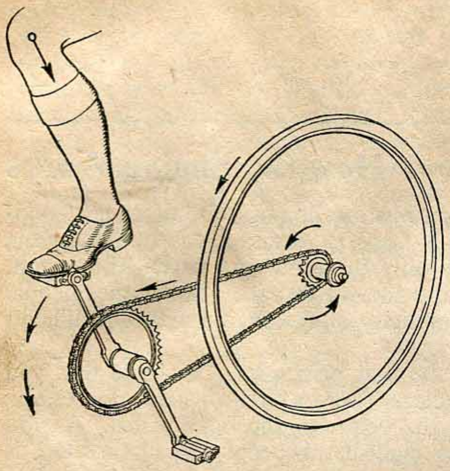


*Fig. 1—Pedalling—an action which is familiar to all !*

detail, but still in a diagrammatic form. Solely for clarity, the engine is shown with the cylinder arranged vertically instead of horizontally, which is a usual disposition in an autocycle. The parts are lettered to show which is which. No difficulty will be experienced in grasping how pressure in the combustion chamber—the space between the crown of the piston and the cylinder head—causes the crankshaft to rotate. The cylinder is ribbed on its head and all the way up in order that it may be kept at a safe—as opposed to too high—working temperature, the fins passing heat to the air, dissipating it by conduction, radiation and convection. In other words, the engine is air-cooled.

It will be noticed that the piston crown has a hump. This is the deflector, whose purpose, as will be

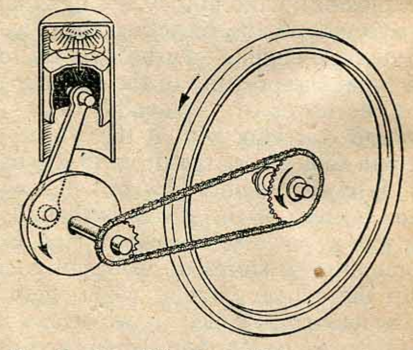


*Fig. 2—No difficulty will be experienced in understanding how the engine of an autocycle drives the back wheel, particularly if this drawing is compared with Fig. 1*





seen in a minute or two, is to deflect the fresh petrol-air gas upward and away from the gas which has already been burnt. Not all two-strokes have deflector-type pistons, though all have some arrangement for deflecting the incoming gas and thus preventing its leaving the engine via the exhaust without being used. The crankcase is an aluminium box, closed at its upper end, or "mouth", by the cylinder. In the cylinder are a series of holes and

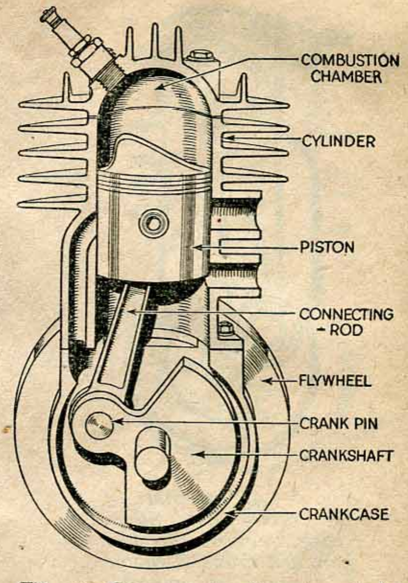
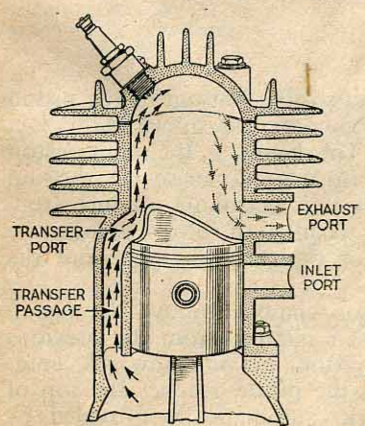



*Fig. 3—Components of a two-stroke engine such as is fitted to autocyles*




one or more passages. The former are the means of entry and exit for the gases and are called "ports". Fig. 4 shows the various ports in the cylinder.

Next look at Fig. 5. The piston in this diagram is shown

*Fig. 4—The three ports in a simple two-stroke engine—the inlet, transfer and exhaust ports*

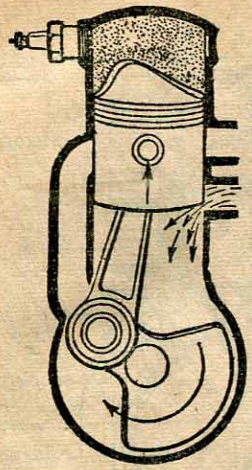


*Fig. 5—At the start of the cycle, the piston, rising, uncovers the inlet port and draws a charge of gas into the crankcase. At the same time the upper side of the piston compresses the charge from the previous cycle*

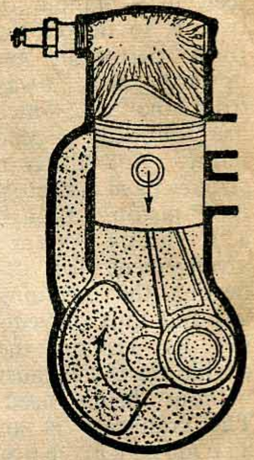


*Fig. 6—The compressed charge is ignited; the piston, descending, now compresses the charge waiting in the crankcase*

moving upwards. As it does so, the bottom of the piston uncovers the inlet port. The crankcase, as we know, is a box closed by the cylinder. This being so, the rising piston causes a partial vacuum in the crankcase—a vacuum which, as the port is uncovered, petrol-air mixture from the carburettor rushes in to fill. In other words, the crankcase is being used as a pumping chamber and the rising piston as a pump.

Already in the combustion chamber above the piston there is a charge of petrol-air mixture from the previous cycle of operations. The piston, moving upwards, compresses this charge. When the piston reaches the top of its stroke, an electric spark, automatically provided by





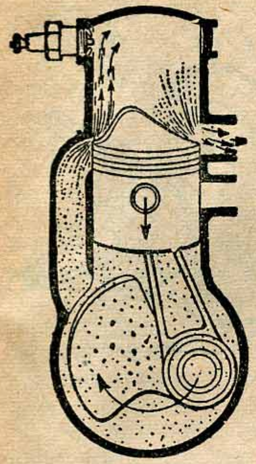


*Fig. 7—Continuing downwards, the piston first uncovers the exhaust port, so releasing the burnt gas. Then the transfer is opened and the new charge rushes up from the crankcase to the combustion chamber*

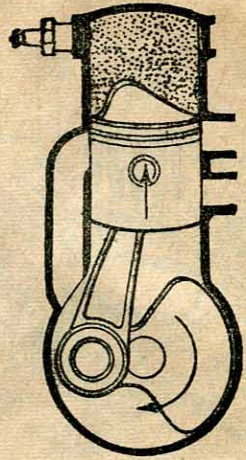


*Fig. 8—The piston, rising again, starts a further cycle of operations*

the magneto, ignites the compressed charge. Down goes the piston (Fig. 6). As it travels downwards, it uncovers, first, the exhaust port (Fig. 7), thus letting out the burnt gas which passes to the silencer. At the same time it covers the inlet port and starts to compress the petrol-air mixture waiting in the crankcase. Before the exhaust port has been fully uncovered the piston starts to uncover the transfer port, whereupon the compressed mixture in the crankcase rushes upwards into the combustion chamber. The deflector on the piston forces this fresh mixture upwards and away from the exhaust. Now the transfer of the mixture completed, the piston rises again (Fig. 8) and, just as soon as the inlet port is

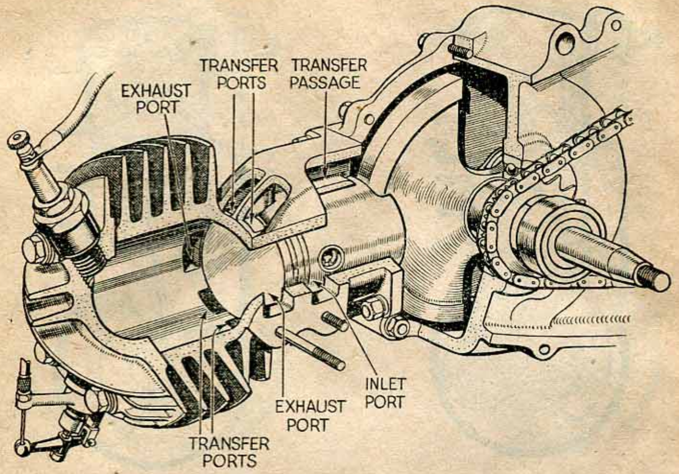



*Fig. 9—In this drawing is shown the construction o, the Villiers Junior-de-luxe engine, which is fitted to thousands of autocycles*

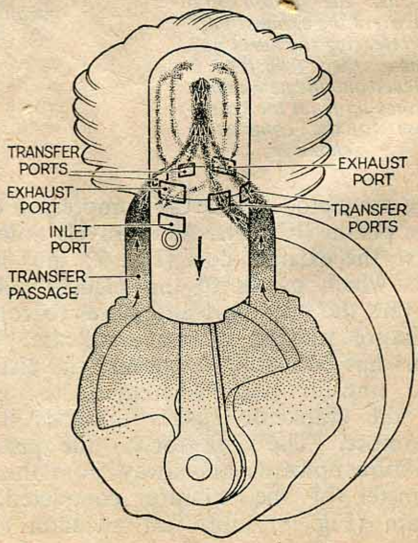



*Fig. 10—Gas flow in the Villiers Junior-de-luxe engine, which has a flat-topped, as opposed to a humped, or deflector, piston*





uncovered, a fresh cycle of operations will start. It is all delightfully simple.

All standard two-stroke engines of autocycle and motor cycle types function in this manner. They are called three-port two-strokes, the three ports being the inlet, the exhaust and the transfer. Many engines have twin exhaust ports and two or more transfer ports, but they are still termed " three-port ".

Fig. 9 shows the internal economy of the Junior-de-luxe Villiers engine which is fitted to large numbers of autocycles. In this case there are two exhaust ports, one each side of the cylinder, and, at right angles to these, four transfer ports. These transfer ports are so arranged that the four streams of fresh petrol-air mixture meet and travel upwards towards the cylinder head, away from the exhaust ports. Thus they are deflected upwards without the need of a deflector-type piston. Fig. 10 shows, in diagrammatic form, the gas flow in the Villiers Junior-de-luxe " flat-topped-piston " engine, and Fig. 11 that in the Mark 2F, the latest engine, which, incidentally, is shown in detail on page 95. The earlier Villiers autocycle units had deflector-type piston engines.

The advantages of the later-type engines is that they develop more power, are smoother and, having no lop-sided lump of metal in the form of a deflector, the pistons retain their shape under heat and the engines do not suffer from loss of power after a spell of really hard driving.

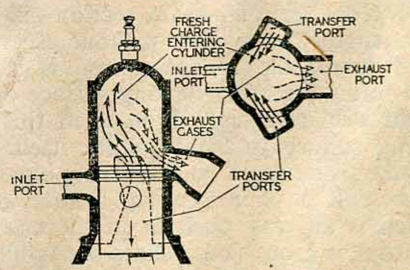



*Fig. 11—Port arrangement and gas flow in the latest Villiers autocycle unit, the Mark 2F*

CHAPTER 4

# Engine Features

SO far, the illustrations have been largely diagrammatic. Now let us examine the various parts of an autocycle engine and see how they all go together to form the remarkably efficient little units of the present day.

Fig. 12 shows the crankshaft, connecting-rod and piston of a Villiers Junior. The crankshaft is built up from a sturdy steel forging in which is pressed a special steel crankpin. As will be seen from the drawing, the crankshaft consists of a thick semi-circular member, a web diametrically opposite carrying the crankpin, and a long shaft—the engine mainshaft—which is tapered at its outer end for carrying a big outside flywheel, the flywheel magneto. That semi-circular member is called a bobweight and its purpose is to balance the piston as the latter moves inwards and outwards. Thanks to this counter-weight and the large flywheel, the engine runs extremely smoothly.

In the previous chapter the lower end of the connecting-rod was mentioned as being the big-end; it follows that the other end which is joined to the piston is called the little end, or the small end. The connecting-rod is a steel forging of I cross section—beam section—so that it has maximum strength and rigidity without excessive weight. The big-end eye of the connecting-rod is hardened and ground and forms the outer bearing surface of a series of rollers—eight steel and eight bronze, in this case. The inner bearing surface is the crankpin itself. Thus, the engine has what is termed a roller-bearing big-end. At the little end there is a plain bearing, a tube of phosphor bronze which is an easy push fit in the connecting-rod. Into this phosphor bronze bush slides the tubular steel pin, the gudgeon pin, which links the little end to the piston. Little spring rings, called circlips, go at each end of the





gudgeon pin; they slip into grooves cut inside the holes in the piston—the gudgeon-pin bosses—and prevent the gudgeon-pin working to one side and scratching the cylinder walls as the piston goes to and fro.

The piston, it will be noticed, has grooves cut around it between the gudgeon-pin and the piston crown—grooves which are filled with square-section rings, the piston rings. The object of these rings, which are of springy cast-iron, is to make the piston a gas-tight fit in the cylinder. This could be achieved by the piston itself, as is in fact the case with tiny two-stroke engines used for model aircraft, speed boats, etc., but, by the use of these replaceable rings, long engine life is assured; also, it can be appreciated that a plain piston which was a perfect fit when cold might expand to such an extent when it became hot owing to hard driving that it would not slide freely up and down the cylinder bore—might in fact become too large for the cylinder and seize. With an aluminium-alloy autocycle or

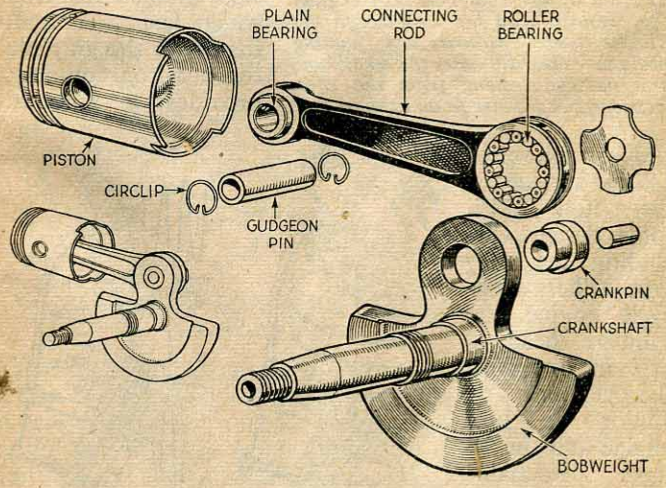



*Fig. 12—Crankshaft, piston and connecting-rod of the Villiers Junior-de-luxe engine. In the small drawing on the left the parts are shown fitted together*

motor cycle piston the expansion under heat is considerable and piston rings are, therefore, a necessity.

Aluminium is employed in the Villiers Junior, the engine under review. It enables the piston to be light and, owing to its high conductivity, promotes cool running. The grooves round the piston are not continuous, but each is fitted with a little peg, the object of which is to prevent the piston ring working round and its ends, owing to the springiness, perhaps catching in one of the ports.

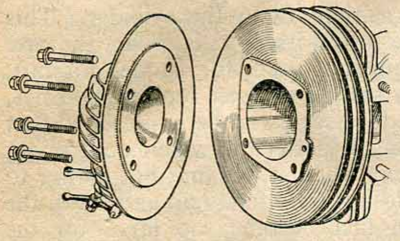


*Fig. 13—Detachable aluminium cylinder head of the Junior-de-luxe engine. The cylinder head fits straight on the cylinder barrel without any jointing medium. The fifth hole, the small one, is a passage leading from the compression-release valve to an exhaust port*

The cylinder, as we know, is ribbed for cooling purposes: cooling fins, these ribs are called. The material is a special close-grained cast-iron which lasts well and, thanks to the graphite the cast-iron contains, provides a smooth, almost frictionless bearing surface for the piston. With some designs, including the old-type Villiers autocycle engine, the cylinder head is cast in one with the cylinder. The Junior - de - luxe engine and the 2F have detachable aluminium - alloy cylinder heads (Fig. 13). The reason

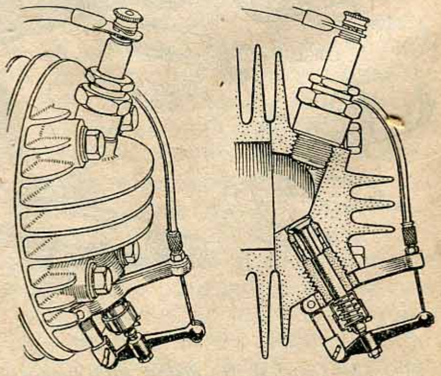


*Fig. 14—Construction and general arrangement of a compression-release valve*





here is not lightness, but cool running, which helps to ensure a smooth, efficient engine free from the need of frequent decarbonization and from that anvil-like noise called " knocking ".

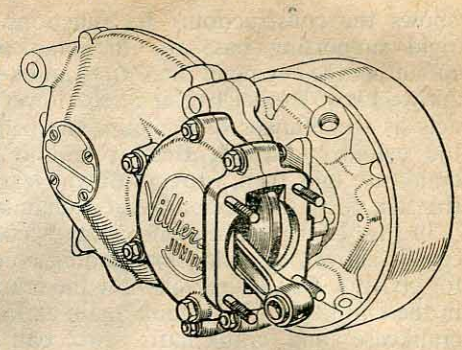


*Fig. 15—Crankcase assembly of an autocycle engine*

Screwed at an angle in one side of the cylinder head is the sparking plug and, at a similar angle in the other side, a little mushroom-shaped valve called the compression release. Fig. 14 shows the construction of the compression release, the main purpose of which is to facilitate starting the engine. As the name suggests, operation of this valve releases the pressure which is created in the combustion chamber as the piston moves upwards (or outwards, depending upon the mounting of the engine in the frame). We shall have more to say about the compression release when we come to the discussion on riding methods.

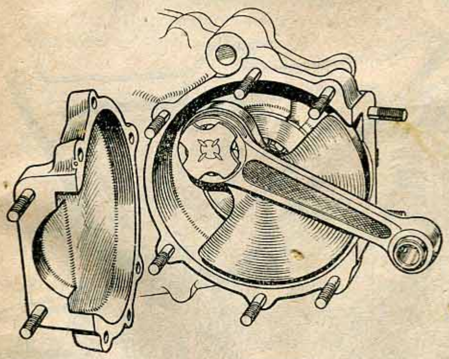


*Fig. 16—How the crankshaft assembly is mounted in the crankcase*

The aluminium " box " which forms the crankcase is hardly a box such as the average being knows. Fig. 15

shows the construction. Its functions are to provide a rigid supporting base for the crankshaft, a means of mounting the engine in the frame, and a pumping chamber. As we know from Chapter 3, the lower side of the piston acts as the plunger of a pump, the piston on moving up the cylinder drawing fresh petrol-air mixture into the crankcase and then, moving down, transferring it via the transfer ports to the combustion chamber.

In Fig. 15 the aluminium casting which forms the crankcase is shown, also the surrounding components. This is for clarity. Fig. 16 reveals how the crankshaft is mounted in the crankcase. Now look again at Fig. 9. It shows the crankcase and crankshaft; two ball bearings support the crankshaft, and then there is the chain sprocket for the drive to the clutch and back wheel. Between the engine sprocket and the ball bearing mounted in the crankcase—

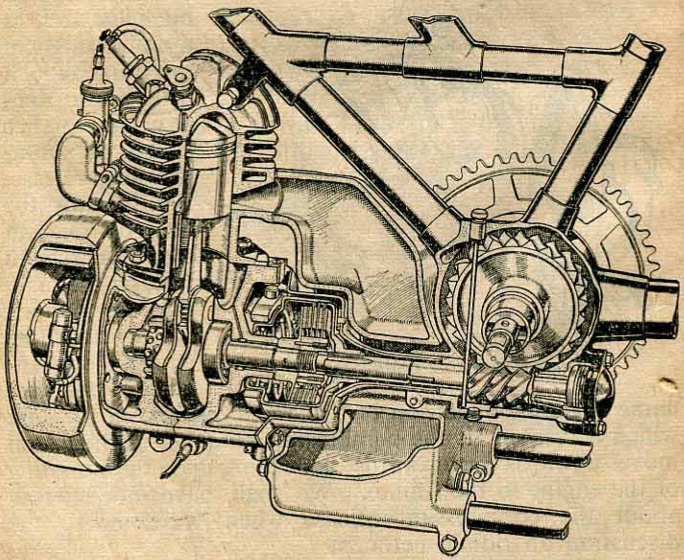


*Fig. 17—Detail construction of the Scott engine fitted to the Cyc-Auto. This machine has a worm gear as the primary drive*





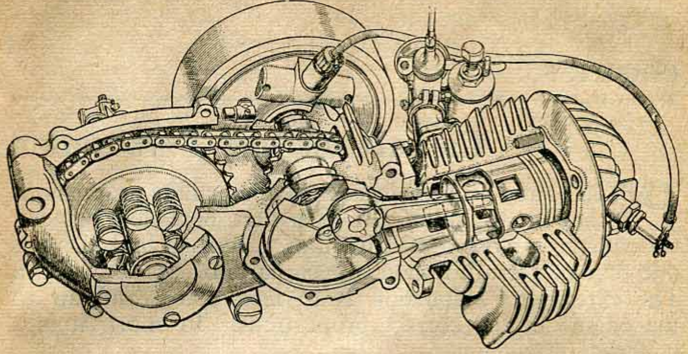


*Fig. 18—In the Brockhouse-Excelsior Spryt engine there are special plugs at the transfer ports which are carefully machined to deflect the gas, thus obviating the need for a humped, or deflector, piston*

just beside the bearing—is a phosphor-bronze bush, one of larger diameter than the gudgeon-pin bush considered earlier and not nearly so long. This is a press fit in the crankcase and is provided in order to prevent petrol-air mixture being forced out of the crankcase when the piston descends. In other words, it is what is termed a " gas seal ".

That completes the discussion of the engine, since the magneto, the carburettor and transmission are covered in other chapters. It will have been seen that there is nothing very difficult to understand in this simple, most efficient little engine, as regards either its construction or method of operation.

All three-port two-strokes are on similar lines and, if the points raised in this chapter have been grasped, the other makes of engine will be readily understood. For example, examine the special drawings of that excellent little Scott engine fitted to the Cyc-Auto (Fig. 17) and the well-known Brockhouse-Excelsior Spryt (Fig. 18), also the cut-away drawing of the Mark 2F Villiers on page 95.

CHAPTER 5

# Carburettor and Carburation

PETROL and air have to be mixed in definite proportions if they are to ignite. In order that there shall be what we call an explosive mixture it is necessary that there is one part of petrol to about fifteen parts of air—by weight. The carburettor's function is to feed petrol and air to the engine in the correct proportions. In short, it is a metering instrument.

Fig. 19 shows pictorially the petrol system of a two-stroke. The drawing is simple and diagrammatic, but nevertheless very close to actuality. Supposing that we turn on the tap beneath the tank, pulling down the little lever. Petrol will flow down the pipe and enter the float chamber. It will be noticed that as it enters the float chamber it passes a little cone which is the bottom end of a vertical rod; also, that attached to the rod is a cylindrically shaped float, which is a light, hollow, brass buoy.

Obviously as the float chamber fills with petrol the brass float will start to rise. When the level in the float chamber reaches a certain definite height prescribed by the carburettor designer, petrol flow will be cut off by that little cone having reached its seating. As the engine uses up some of the petrol in the carburettor, so the level in the float chamber will drop; the float will fall a trifle, the needle valve (as it is called) will open and petrol will flow in. Thus the level in the float chamber, just like that in a water cistern, is kept constant no matter what demands are made—always assuming, in this case, that the owner does not forget that occasionally it is necessary to replenish his tank.

From the float chamber, petrol flows along a duct to a vertical pipe capped by a small screwed stopper or jet. The outlet from this jet is level with the bottom of the air intake. Let us assume that the throttle—the brass cylinder





that can be moved up and down and acts as a tap—is in the position shown in the drawing, that is, the " tap " is partly open. Further, let us imagine that the piston of the engine is moving up the cylinder, which means, we recall, that there is a partial vacuum in the crankcase. Air will rush into the crankcase from the air intake, passing over the jet as it makes its way there. Now ponder for a moment what occurs when a hand sprayer of the type used for ridding a room of flies is used or, if you are more familiar with scent, when a scent spray is operated. Again, air rushes over the top of a small nozzle or jet. The result, as you well know, is that anti-fly preparation (or scent !) streams out of its container and is mixed with the air to form a mist. This is exactly what happens when air flows through the carburettor of our two-stroke engine; it

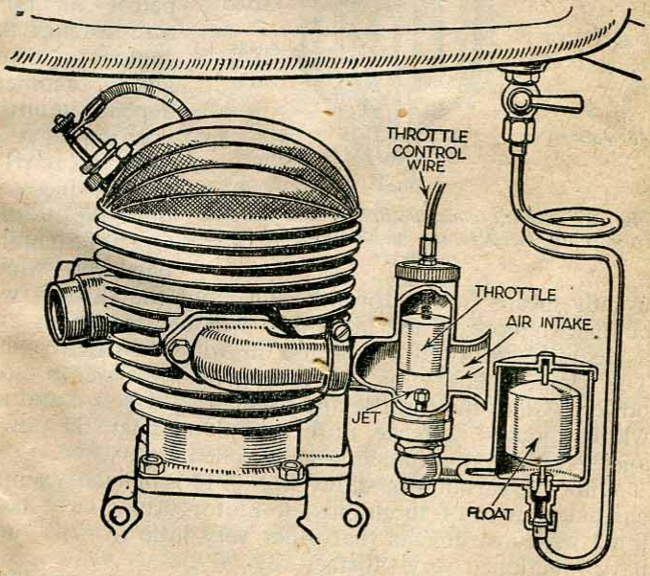



*Fig. 19—A diagram revealing how the petrol is fed from the tank to the carburettor and thence to the engine*

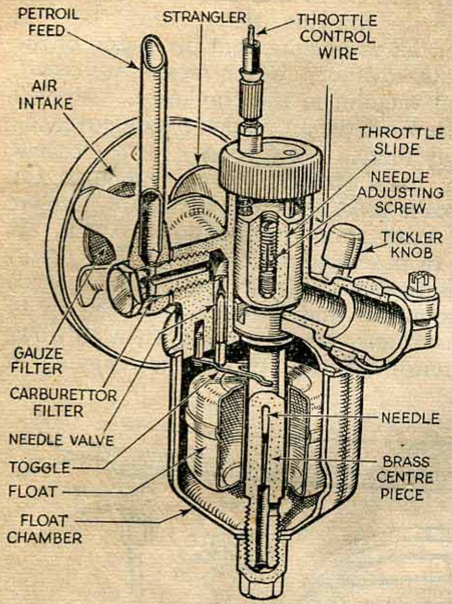



*Fig. 20—Detail construction of the Villiers carburettor fitted to the majority of autocycle engines*

passes over the jet, picks up petrol and carries it into the engine in the form of globules so minute as to form a mist.

A carburettor thus vaporizes the petrol as well as mixing it with the air in the correct proportion. What quantity of petrol - air mixture reaches the engine at any given moment depends upon the position of that cylindrically-shaped piece of brass, the throttle. Open the handle-bar lever—which usually means pull it towards you—and the throttle will be raised: more of the air intake will be uncovered and a greater quantity of petrol and air will reach the engine. The result, of course, is that the engine will develop more power. Close the throttle and no charge of petrol and air will be induced. Hence, in this simple manner, the power and speed of the machine are controlled.

While the carburettor shown in Fig. 19 is of such a simple character, tens of thousands of motor cycles have been fitted with instruments that differ very little from it—and have functioned very satisfactorily.

As a matter of fact, the carburettors employed on modern autocycles are not very different. Fig. 20 shows the Villiers





instrument, such as is fitted on the majority of autocycles. In this case the float chamber is arranged below the mixing chamber and the petrol pipe is attached by a banjo-shaped union, or connector, to a lug which extends outward from the top of the float chamber. Petrol, on entering the carburettor, has to pass the cone-shaped end of a little needle; it flows into the float chamber, causing the brass float gradually to rise until, the petrol level having reached its proper height, the float presses the needle on its seat by means of a little brass plate or toggle, and cuts off any further supply until the engine has consumed some of the petrol, when the float settles a trifle and more petrol is allowed to enter.

So far, then, the method of operation is similar to that of the crude, diagrammatic carburettor we considered earlier. Now look at the brass tube running up to the mixing chamber—the "brass centre piece". Note the hole near the bottom to allow the entry of petrol, the small diameter of the outlet at the top of this tube and how, protruding from the throttle slide, there is a tapered needle which operates inside the tube. Thus, instead of there being a plain hole as the jet, there is a ring-shaped orifice. Since the needle is attached to the throttle slide and is tapered, the larger the throttle opening the larger becomes the effective area of the jet. This is to ensure that there is the best possible mixture of petrol and air at all throttle openings.

A further advantage is that the tapered needle, since it can be adjusted to protrude a greater or lesser distance from the throttle slide, affords a means of adjusting the carburettor so that it provides, respectively, a mixture less strong in petrol (a weaker mixture) or stronger in petrol (richer). This is accomplished by a screw of quick-thread type protruding down the throttle slide from the upper end. Instructions for carrying out any adjustments in this regard are given on page 67 (Fig. 40).

Two other features of the carburettor concern the fact that when an engine is cold a higher proportion of petrol to air—in other words, a richer mixture—is necessary for starting purposes. Referring to the drawing of the Villiers carburettor (Fig. 20), we see a little knob on top of the float chamber and, protruding downwards from it, a short rod. Turn on the petrol tap and press down this little spring-loaded device, the carburettor tickler. The float chamber will fill steadily, raising the float, but, instead of the latter eventually pressing the toggle upwards and cutting off the petrol supply, it is held down a fraction by the tickler. In short, we are artificially raising the level of petrol in the float chamber, which is called "flooding the carburettor". If we keep our finger pressed on the tickler the carburettor will flood, petrol spurting forth from the little hole provided for the purpose. The normal rule, when the engine is cold, is to keep the tickler pressed down until petrol just starts to exude. Incidentally, jabbing the tickler up and down is both unnecessary and undesirable. It does not result in the carburettor flooding more rapidly—the contrary is the case—and it may cause damage.

Lastly, on the Villiers carburettor, there is a little shutter at the air intake. This is the strangler and, when the rod which operates the strangler is pulled upwards, the air intake is blanked off except for a very small area. We therefore have a further means of enrichening the mixture for starting purposes. Usually, when an engine is to be started from cold, the rider both operates the strangler and floods the carburettor. As soon as the engine has started, the strangler is moved so that it is about half open and, unless the weather is very cold, it is opened fully after merely a few seconds.

Another type of carburettor employed on autocycles is the Amal, the general design of which is shown in Fig. 21. In this case, as in the diagrammatic carburettor on page 32, the float chamber is at the side of the mixing chamber. The petrol, it will be seen, enters at the top of the float chamber and passes to the mixing chamber by two ducts. Again, there is a tapered needle attached to the throttle slide and arranged to slide up and down a brass centre tube, called, in this instance, the needle jet. At the bottom of this tube is a little screwed plug; it is inverted and has at the bottom a tiny hole. This is called the jet. All petrol en route to the engine has to pass through this jet,





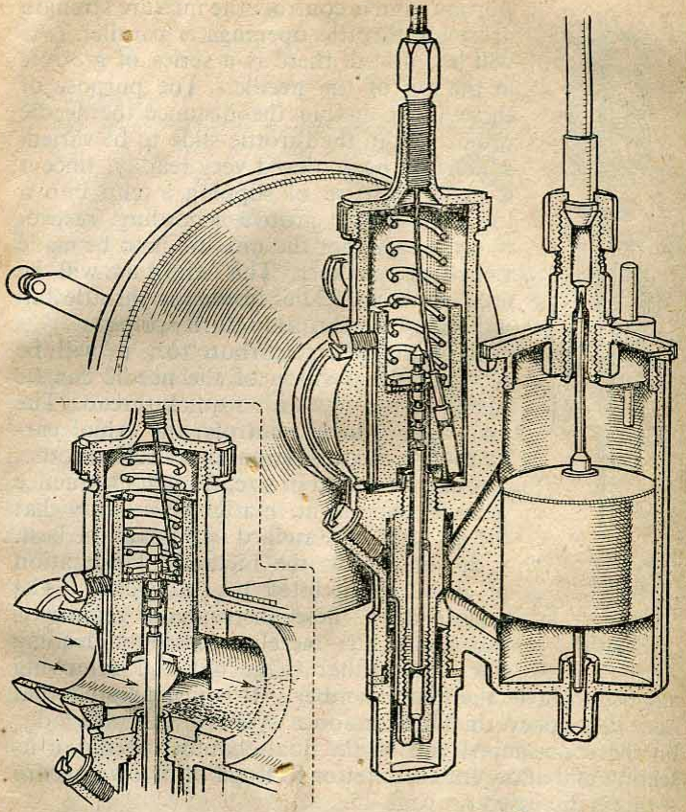


*Fig. 21—A sectional view of the Amal carburettor employed on autocycles and lightweight motor cycles*

which is of such a size that, when the throttle is full open, just sufficient petrol is passed to give a proper petrol-air mixture.

At intermediate throttle openings the mixture strength is controlled by that tapered needle in its "needle jet". The needle tapers over part of its length only. The upper

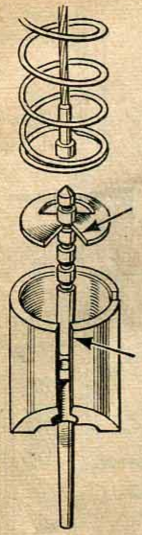


*Fig. 22 — How the jet needle of the Amal carburettor is adjusted*

portion which controls the mixture strength at small throttle openings is parallel. As will be noticed, there is a series of grooves at the top of the needle. The purpose of these is to enable the distance the needle projects from the throttle slide to be varied, which can be achieved very readily, since it is merely a case of slipping a clip into a lower or higher groove according, respectively, to whether the mixture is to be made richer or weaker. This clip, as will be seen from Fig. 22 lies inside the throttle and is held by the throttle return spring.

In the Villiers carburettor, it will be recalled, the position of the needle can be varied by a screw with a quick thread. The main jet, which controls the Amal carburettor's mixture strength at full throttle, can also be varied in size, though in practice it is as near as no matter a certainty that the jet fitted as standard will prove the best.

So much for the method of operation of carburettors fitted to autocycles. The maintenance these instruments require is just about nil—merely occasional cleaning out of any filter (page 65) and removing any sediment in the float chamber. It is just possible that once in the proverbial blue moon a speck of dirt will lodge on the cone-shaped end of the float-chamber needle or its seating and allow the carburettor to flood of its own accord —this is discussed on page 75.

The main jet *can* get choked, though this is most unlikely. Should it be necessary to clear a jet, try blowing through it. If necessary, use a bristle to clear the obstruction—not a pin or needle, which is likely to enlarge the hole and spoil the running.



CHAPTER 6

# Ignition and Lighting

IN the chapter discussing how the engine works it was mentioned that when the piston reaches the top of its stroke an electric spark, automatically provided by the magneto, ignites the compressed charge. Let us now delve more deeply into this side of matters.

First, for strict accuracy, it should be stated that, because the petrol and air mixture takes a very short, yet appreciable, period of time to become completely ignited, the spark is arranged to occur a little before the piston gets to the top of its stroke. This is necessary in order that the full power of the burning charge shall be harnessed. The distance before top dead centre is only a fraction of an inch—generally, either $\frac{3}{16}$ or $\frac{1}{4}$ in.

On autocycles and, indeed, on the vast majority of two-stroke motor cycles, the magneto is combined with the flywheel of the engine (Fig. 23). It is mounted on the end of the crankshaft and thus there is no need for a chain or other form of separate drive. The magnets are built into the inside of the revolving rim of the flywheel, while mounted on a stationary plate is the ignition coil; there are also lighting coils, but these will be touched on later.

The majority of people are aware that, when a coil of wire is rotated in a magnetic field, an electric current is generated in it. In the case of a flywheel magneto, as has just been mentioned, the magnets rotate and the wire is stationary, but the result is precisely the same: current is generated in the thick wire of the ignition coil just as soon as the flywheel revolves. But this current is of low pressure —low tension or voltage—and, if we are to have a spark a high voltage is necessary. So round these coils of thick wire are wound thousands of turns of thin wire. Our physics lessons taught us—or, if we are young, are perhaps teaching us at this very period—that if a current flowing in the thick wire is suddenly interrupted a high-tension current is induced in the thin wire.

This is what our flywheel magneto does. It includes in its internal economy a device for interrupting the flow of current through the low-tension winding—in other words, a contact-breaker. Every time that the piston reaches the point in its upward or outward stroke at which the spark is required, a humped cam on the revolving shaft operates a little rocking lever at the far end of which is a contact. As a result, a high-tension current is induced in the fine wire and thus current flows along a thick rubber-covered cable, the high-tension cable, to the sparking plug and, jumping across the gap at the points of the plug, provides the necessary spark.

Fig. 23 shows (among other things) the contact-breaker of a Villiers flywheel magneto and Fig. 24 that of the Miller. Since, like water in a pipe, electricity has momentum and

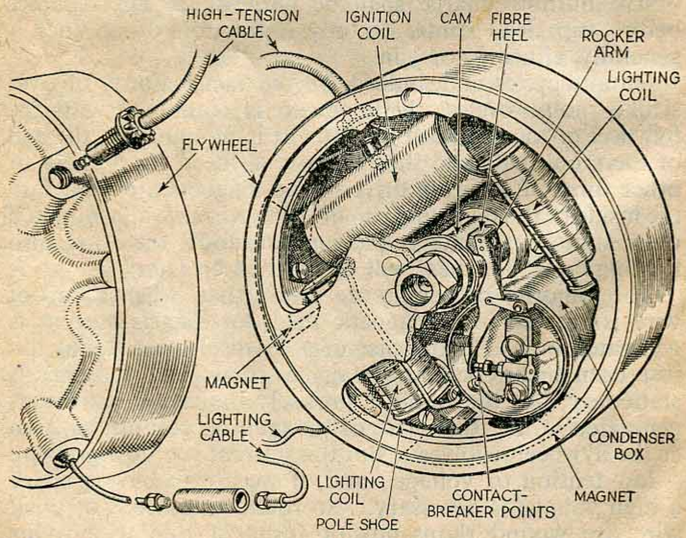



*Fig. 23—A cut-away view of the Villiers Junior-de-luxe's flywheel magneto*





possesses an inherent desire to carry on along the "pipe line", some device is necessary to absorb the build-up of energy which occurs when the contacts separate. Otherwise there would be sparking at the contact points—not of the same potency as the high-tension spark at the plug, but arcing that would soon cause the points to become

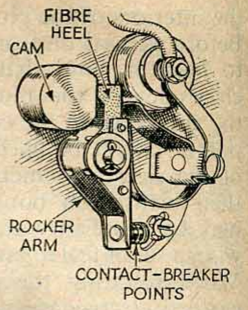



*Fig. 24—General layout of the type of contact-breaker fitted to the Miller flywheel magneto*

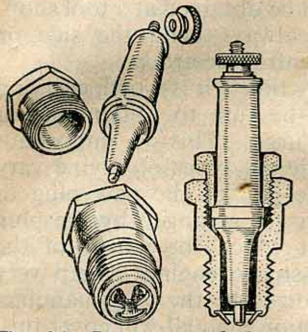


*Fig. 25—Part-sectional drawing of the Lodge sparking plug fitted to Villiers autocycle units*

damaged. A buffer is therefore connected across the points in the form of an electrical condenser, built up of alternate sheets of metal foil and an insulating medium. Assuming that the contact-breaker points are free from dirt or serious pitting, any very heavy sparking at the points when the engine is running is a sign that the condenser or its connections are at fault.

Now let us glance at a fairly typical sparking plug (Fig. 25). The high-tension cable is attached to the terminal at the top which is arranged to be part and parcel of the central electrode. The material insulating this central electrode from the steel body of the plug, and thus from the side (earthed) point or points, is generally, in these days, of sintered aluminium oxide, although in appearance it might be mistaken for a form of china. These modern insulators, in addition to their high dielectric property, are remarkably strong mechanically and capable of standing up to great heat. A further advantage is that the internals of such plugs can readily be cleaned at garages by means of their special plug-cleaning machines, which, in effect, sand-blast the interiors of the plugs, thus removing all oil and carbon. Before we pass on from the subject of plugs, it is important to bear in mind that the spark gradually eats away the electrodes of the plug. Therefore, every now and then the gap between the central electrode and the side point or points should be checked by feeler gauge to see that it is of the size recommended by the makers of the engine in their instruction book. A feeler gauge of the right size may be supplied with the tool-kit on the machine; otherwise, a set of feeler gauges should be obtained at a tool shop. When resetting the plug gap, always bend the side or earthed electrodes—never the central electrode.

If a new plug is required at any time—it is worth carrying a spare carefully wrapped up—be sure to obtain one of the precise type the makers urge. This is important, because the requirements of different types of engine vary considerably. Secondly, set the gap of the new plug to the recommended gap if the gap, as arranged by the plug manufacturer, differs from that which the maker of the engine urges. With some two-stroke engines a gap very much smaller than that standardized by the plug manufacturer is desirable. Your instruction manual will cover this. Incidentally, a difference of, say, a couple of thousandths of an inch, whether larger or smaller, does not matter.

The lighting side of a flywheel magneto is even more simple than the ignition side. In this case there is a pair of coils mounted diametrically opposite each other on the stationary back plate of the flywheel (Fig. 23, page 38). Unlike the ignition coil, there is only a single winding in each case—not a secondary as well as a primary winding. The current generated, when the lighting switch is turned on, is taken direct to the lamp bulbs—hence, the term "direct lighting system" employed for this type of lighting. This is a little misleading because the current is not direct (D.C.), but alternating (A.C.) which means that, unless a rectifier is fitted, it cannot be employed for charging a battery, nor for operating an electric horn. Hence, with autocycles, a dry battery mounted in the headlamp is employed for parking purposes at night and the horn one fits is of the ordinary bulb type.



CHAPTER 7

## Lubrication

NO lubrication system could be more simple than that of an autocycle engine. All the rider has to do is mix oil with the petrol in the correct proportion. The engine sees to the rest, inducing its quota of oil with every charge of petrol and air and passing it, in the form of "petroil" mist, to every bearing surface—the cylinder walls, the little end, the big-end and the main bearings.

As has just been indicated, the name "petroil" is given to this system, which is standard on nearly all two-stroke vehicles whether autocycles, motor cycles or cars. If the engine is working hard as, for example, when the vehicle is slogging up a hill, automatically it induces more petroil and thus more oil. The oil the engine receives per revolution is directly proportional to the throttle opening. Hence, in addition to being a simple system, it is an excellent one.

The only objections that can be raised against petroil are, first, that normally the petrol and oil have to be mixed before being poured into the tank, that the oil in the petrol has a propensity for creeping which can result in a certain degree of messiness and that if the machine is ridden down a long hill with the throttle closed the engine receives no lubricant and has to rely on whatever quantity clings to the respective bearing surfaces. This last need not be an objection, because the rider, realizing that oil only reaches the engine when the throttle is open, will appreciate the desirability, in such circumstances, of opening the throttle occasionally.

Manufacturers differ a little in their recommendations as to the amount of oil to be mixed with the petrol. Generally the proportion advised is 1 in 16, which means half-a-pint of oil to every gallon of petrol, but it may be

1 in 20 or 1 in 24. The maker's instruction booklet will give details and, as a rule, instructions are also to be found on the tank itself.

Usually the best practice is to have the petrol and the correct quantity of oil poured into a two-gallon petrol tin and the tin shaken. No great amount of shaking is needed and, once the petrol and oil have been mixed in this way, they remain mixed indefinitely. Indeed, a member of *The Motor Cycle* Staff drained the tank of a two-stroke which had been lying by for nearly ten years; the contents of the tank were still perfectly mixed petroil. Hence there is no object in shaking the machine sideways previous to a run, as is done by some who imagine, quite wrongly, that the oil in the petrol is liable to sink.

There is, however, one well worth-while hint over petroil-lubricated machines, namely, that when the machine is to be left for any length of time, the petroil tap should be turned off some three hundred yards previous to the end of the journey. The reason for this is simply that otherwise heat from the engine will cause petrol in the float chamber to evaporate, leaving behind an excess of oil. This heat drives off the lighter and more volatile fractions in the petrol—the easy starting fractions. By leaving the float chamber more or less empty, we only have to turn on the tap to have petroil of the correct proportion—petroil which ensures the easiest possible start.

Why it is desirable to mix the petrol and oil in a separate tin and then pour the resultant mixture into the tank is that if petrol is poured into the tank and then neat oil, or vice versa, the oil will fall to the bottom and may flow along to the petroil tap, perhaps to choke the tap, the pipe to the carburettor and even the carburettor jet.

Some tanks are so arranged that the petrol and oil can be poured in separately without any risk of this occurring. In such cases the oil is either trapped by a baffle or automatically flows down below the level of the petroil tap and, the petrol washing over the surface of the oil when the machine is in motion, there is automatic mixing. The instruction booklet covering the particular machine will give generally details of any such arrangement.





Of course, it is not always possible to have the petrol and oil mixed before being poured into the tank, even though the makers of the particular machine urge its necessity. Several schemes are possible in such circumstances. The best is to carry a pint-size lighter-fuel tin containing partially diluted oil. Pour into the tin the correct quantity of oil for one gallon of petrol—or half a gallon, as is desired—add petrol (or petroil from the tank of the machine) to make the tin nearly full and shake vigorously. This diluted oil can be poured straight into the tank of the machine when the time comes to refuel. Pour it in after turning off the petroil tap and then have the petrol squirted in on top. With this plan there is little or no chance of the petroil tap or pipe becoming choked. Here it may be mentioned that, while one should keep fairly closely to the quantity of oil the makers recommend, it is not necessary to worry to the extent of the odd teaspoonful.

Another, though not nearly so good, method of replenishing is this: turn off the petroil tap, have the petrol poured in and add the oil little by little, shaking the machine sideways each time oil is added.

Neat oil in the fuel pipe, tap and carburettor can cause a lot of trouble—hence the reason why manufacturers emphasize the subject of proper mixing. Rectification of the trouble should be on the following lines: first, close the petroil tap and shake the machine vigorously sideways; secondly, remove the petroil pipe and blow through it; thirdly, clear any obstruction in the tap by gently thrusting a length of wire up it after turning it to "On"; fourthly, if neat oil drips from the carburettor, take the carburettor to pieces and remove the oil from the float chamber, any ducts between the float chamber and the mixing chamber and the jet. It is quite a job, so it is better to take a little care over the mixing.

One final point: use the lubricant the makers of the engine recommend or, should this not be available, the equivalent grade of some other well-known brand.

CHAPTER 8

# Transmission and Cycle Parts

IN their general construction, autocycles are very like pedal cycles. The adjustment of the rear chain from the engine unit is similar, so is that of the steering head, wheels and pedals. The main differences lie in the fact that an autocycle has a clutch, the brakes are, as a rule, of the internal-expanding type—though even this form of brake is fitted to some bicycles—and, on some makes, there are spring forks.

Figs. 26 and 27 show two types of spring fork. The second is not, strictly speaking, a "spring" fork since the suspension medium is rubber bands, which last well and give a particularly comfortable ride. The chief points to remember about such front forks are that care should be taken to see that they are lubricated regularly, and that any side play that develops should be taken up. If these small tasks are not seen to, the steering will suffer and, of course, wear will become rapid.

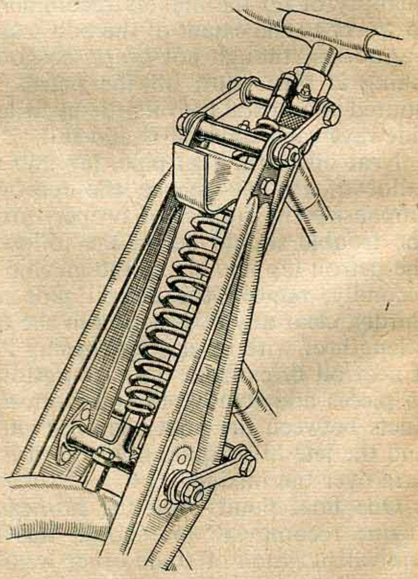


*Fig. 26—A neat, effective type of central-spring front fork with a link action*





Construction of a typical internal-expanding brake is shown in Fig. 28. The parts marked A are the shoes, which may be of steel or aluminium and carry, riveted to them, the woven-asbestos friction linings B. These shoes are mounted on the stationary shoe-plate and linked together by a pair of coil springs. At the top, in the drawing, there is a pivot C and at the bottom, linked with the brake operating lever, is the brake cam D. The small illustration at the bottom reveals how operation of the lever causes the cam to move, forcing the brake shoes outwards and thus into contact with the brake drum which is part and parcel of the road wheel. Those coil springs, it will be realized, not only hold the brake shoes in place, but also act as return springs, letting the brake off when the handlebar lever is released.

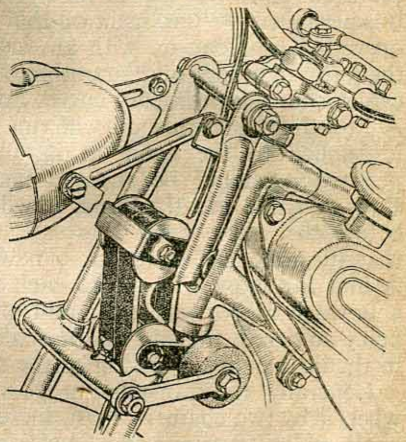


*Fig. 27—Rubber bands form a simple, but most effective suspension medium for front forks. This is an Excelsior design*

The ends of the brake lining are chamfered off, as indicated in the top left-hand drawing. This is particularly important in the case of the end which, otherwise, might tend to ruck up—turn back on itself—on the brake being applied. Where a brake is harsh or lumpy in action, and the cause is not seriously worn linings or the ingress of grit, it is as well to examine the leading edge to see whether a little easing down with a coarse file is desirable.

A smear of grease at the shoe pivot and on the cam makes for smooth, easy operation. Preferably this should be H.M.P. (high melting point) grease. The bearing for the cam spindle can do with a spot of oil occasionally. But let it only be one or two spots, because it is most important that no lubricant reaches the brake linings, since oily or greasy linings naturally have little or no stopping power. For the latter reason it is important not to over-lubricate the hubs.

Brake adjustment requires little discussion, since about the only point which could be overlooked is the desirability of checking, when the adjuster has been screwed up, that the brake does not rub in the " off " position. However, it is perhaps as well to mention that any pivots in the brake-operating gear can do with an occasional spot of oil and that, for lightness and smoothness of operation, Bowden cables should run in easy curves and should be lubricated. A little light machine oil will run down inside the casing if applied to the cable at its upper end. In passing, perhaps it should be stressed that, once a strand of a Bowden cable has fractured, it will probably not be long before the whole cable " gives ". Thus there is warning that the time has come for a new " inner " to be fitted. A hint for those who see to such tasks themselves is that a Bowden nipple will never pull off its cable if, when it is being soldered, the end of the cable is splayed out radially in the little cupped portion of the nipple.

Generally, the transmission from the engine to the back wheel is by two chains. First, there is the so-called primary chain which transmits the power from the sprocket on the engine shaft to the clutch. We will discuss the clutch in a minute or two—it is, of course, the device which enables the rider to disconnect the engine from the back wheel. Lastly, there is the rear driving chain.

The primary chain is totally enclosed in a cast-aluminium oil-bath case. It is endless and non-adjustable. If, after thousands and thousands of miles, it is worn to the extent that it clatters or the transmission is rough, a new one is fitted. Such chains, however, last almost indefinitely provided that one small, very easy task is seen to periodically—pouring a little of the correct lubricant into the primary chain case. With one design of autocycle, there is a worm gear as the primary drive (Fig. 17, page 28).

Fig. 29 shows a very simple form of clutch, such as is





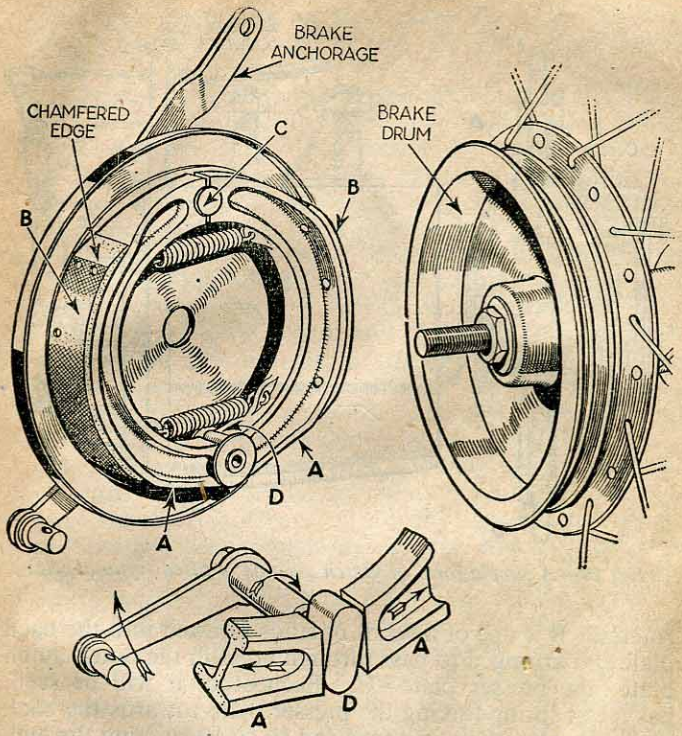



*Fig. 28—How an internal-expanding brake functions*

fitted to autocycles. The clutch sprocket, driven from the engine by the primary chain, is marked D. This has attached to it the friction material, which can take the form of woven asbestos, riveted to it or pressed into holes in the form of inserts, or a series of cork inserts. The latter is the usual, though not universal, arrangement in the case of autocycles. A is the back plate, which is attached to the shaft that carries the sprocket for the final drive to the rear wheel. Rotate this back plate, and, therefore, the final-drive sprocket, and the rear wheel

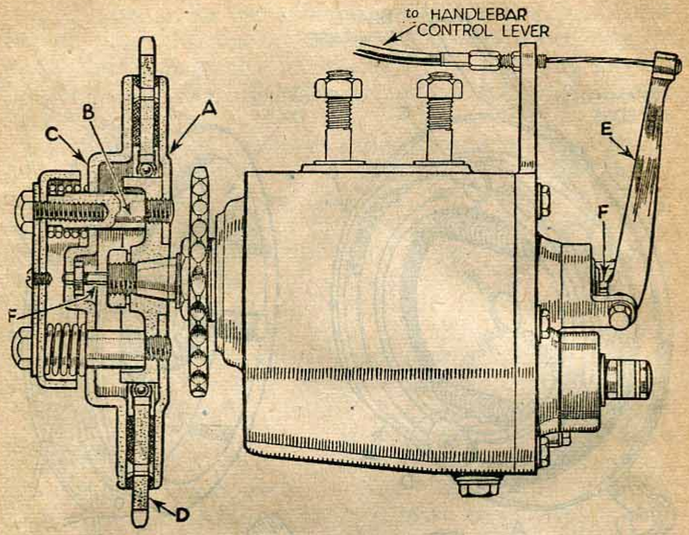



*Fig. 29—A simple form of clutch such as is fitted to autocycles*

rotates. B is one of a series of studs screwed into the back plate and arranged to pass through holes in the outer clutch plate—the presser plate—C. Each stud, it will be seen, has a coil spring forcing the presser plate towards the back plate. Lastly, there is a steel rod (F to F) running through the clutch mainshaft and arranged, at one end, to push on the inner side of the presser plate and, at the other, to be operated by a lever linked by Bowden cable with the control on the handlebar.

In the drawing, the clutch is shown fully engaged; this means that, if the engine is running, the back wheel is rotating—the engine is driving the back wheel. Let us trace afresh just what is occurring. The engine is driving sprocket D, the springs around the studs B are forcing the presser plate C towards the back plate A and, in so doing, are squeezing the sprocket plate, which carries the friction surfaces. Because of that friction material gripping





the presser plate and the back plate, all three—the clutch sprocket, the presser plate and the back plate—revolve as one.

Now let us operate the handlebar clutch lever. Pulling it towards the handlebar, we cause lever E to move inwards, thereby pushing that long rod, F–F, against the middle of the presser plate C. This causes the coil springs to become compressed and results in these springs no longer squeezing the presser plate inwards. Hence, no longer is there any pressure to cause those friction surfaces to grip. Pulling the clutch lever right up against its handlebar, we free the clutch sprocket, which therefore will revolve on the ball bearing, on which, as will be seen, it is mounted—will revolve idly, exerting no driving power. The clutch is now disengaged, which is exactly what we do when we are held up in traffic and wish to keep the engine running ready for the moment when we get on the move again.

Let us assume that the engine is running and we wish to get under way. Gently, very gently, we release the clutch lever on the handlebar. Gradually the coil springs start pushing the presser plate against the clutch sprocket and into contact with the back plate. At first, when all three are in contact, the pressure being low, the clutch does no more than start to grip. A little more pressure from those springs and, while there is still slipping, some power is transmitted from the clutch sprocket to the back plate and presser plate. The clutch is thus taking up the drive. The machine starts to move. And when, finally, the full pressure of the springs is exerted, the clutch is right home and there is a non-slip drive between the engine and the back wheel.

Friction, as everyone knows, results in heat and, like all normal automobile and motor cycle clutches, this is a friction clutch. Excessive slipping of the clutch, such as if one tries to use the clutch as an infinitely variable gear on some impossible hill, can cause so much heat that the friction material chars and is finally ruined.

Clutches, therefore, are devices which should be used, rather than abused. Their purposes on an autocycle are for getting under way, to enable the engine to be kept running when the machine is held up in traffic and to allow the machine to be pushed or pedalled without the engine being started. There is usually a little trigger device on the clutch lever which enables the clutch to be held permanently out of engagement. It should not be used for unnecessarily long periods with the engine running and, if the machine is put away for, say, the night, the clutch lever should be released.

Let us look once again at the illustration of a clutch (Fig. 29, page 48). Imagine that the friction linings on the clutch sprocket have worn to the extent that they are half their present thickness. Unless the Bowden control cable is adjusted to suit—is slackened off—the clutch push-rod, F–F, will prevent the springs from pressing the plates together and the clutch will not grip properly and may not grip at all. This matter of correct clutch adjustment is discussed in detail in Chapter 11. There must be slight free movement in the clutch-control cable when the clutch is supposed to be right home, yet not so much that the clutch exerts any grip in the " out " position afforded by the little trigger.

Many autocycles are fitted with a rear stand which, when off duty, is clipped to the bottom tip of the back mudguard. There is a very easy method of using such a stand—one which obviates any real lifting. Stand at the side of the machine, with the latter leaning slightly towards you, and lower the stand. Then place the toes of one foot on the cross-bar of the stand and, holding the machine upright by this means, move to the rear of the machine. Finally, pull the machine backwards on to the stand—a straight, light pull. To take the machine off the stand is merely a matter of standing beside the machine and pulling it forward by means of, say, the carrier.

Before we pass on to the exciting subject of learning to ride, it should perhaps be emphasized that, with the higher-than-cycling speeds which riders of autocycles usually employ, fittings such as horn and licence holder may in time work loose. The sensible owner will make a practice of checking the tightness of all bolts, screws and nuts once a month or once every two months according to the amount the machine is used.



CHAPTER 9

# Learning to Ride

THERE are few more pleasurable sensations than that of riding a powered two-wheeler for the first time—an engine instantly responsive to the movement of one little lever, the throttle.

Fig. 30 shows how the handlebar controls of a typical autocycle are arranged. On the left will be seen the clutch control with its little trigger, also a brake control. The latter, as illustrated, is for the front brake, while its opposite number on the right handlebar is for the rear brake. Equally, of course, the front brake control could have been on the right, and that of the rear brake on the left; or the rear brake might have been of the back-pedalling type.

Only two other handlebar controls are provided: the throttle lever and the compression-release lever. Alongside the petroil tank, as we may recall from the chapter on carburettors and carburation, there is probably a rod linked to a strangler on the carburettor. In one or two cases, no separate control is provided; instead, there is a little thumbpiece on the strangler itself.

Let us familiarize ourselves with the controls of our particular machine, preferably doing so with the maker's handbook beside us. Then, sitting in the saddle with the machine on the stand we try operating the clutch lever. Grasping the main portion we pull the lever towards the handlebar. Suddenly the spring-loaded trigger clicks home. Next release the lever—the trigger holds out the clutch, which is revealed if we press on the pedals, for they revolve easily, without rotating the engine.

Now let us place the left hand over the whole clutch lever, the forefinger on the trigger. A slight pull—really squeezing the lever and the handlebar—and the trigger disengages. Gently, very gently, we release the clutch

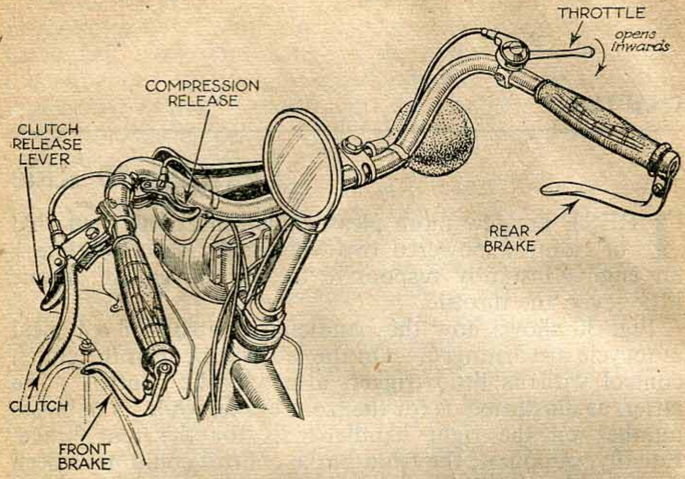



*Fig. 30—Typical control layout of an autocycle. The front-brake control may be on the right handlebar and that for the rear brake on the left. With some autocycles, there is a back-pedalling rear brake*

lever, holding the trigger, of course, so that it does not click home.

After practising letting in and disengaging the clutch, let us try the other levers, operating the brake controls so that we are sure to find them without having to look down. Next, there is the throttle lever, which normally opens inwards, that is, towards the rider; when it is pushed forward as far as it will go, the throttle is shut. Let us note what the total movement is, since then we shall know what is " one-quarter throttle," " half-throttle," and so on.

Now let us try something a little more elaborate, transferring the left hand from the compression-release lever to the clutch. A reason for this suggestion is that adoption of the scheme allows a particularly easy starting method. Briefly, it is this: the rider pushes the machine a couple of yards with the clutch engaged and the compression release raised, drops the compression release, the engine





fires and he or she grasps the clutch, whereupon it is a case of getting aboard at leisure. However, we will go fully into the question of starting in a minute.

Now, having accustomed ourselves to the riding position and the position and purpose of the controls, the next thing is to get the feel of the machine on the road. Raise the clutch lever until the trigger clicks into its notch and thus holds the clutch disengaged. Then pedal the machine up the road and round a corner or two. Only a very few hundred yards need be covered for the rider to become accustomed to the general feel of the machine and to try the brakes. It will be found that, while the weight of an autocycle is often at least thrice that of a pedal cycle, so low is the centre of gravity, thanks to that low-set engine, that the machine gives one a remarkable feeling of confidence.

We have arrived at the great moment when we can try the machine under its own power. Turn on the petroil tap, close the strangler, flood the carburettor by keeping a finger on the little plunger at the top of the float chamber —remove your finger as soon as petroil starts to exude— and open the throttle lever one third of its total travel.

For the first " go " we will adopt the most widely used method of starting—pedalling. Raise the clutch and either click it in the " out " position or hold it out. Pedal off the machine and, when the speed is seven or eight miles an hour, release the clutch. The engine should fire. Ride along, opening and closing the throttle to control the machine, also to become accustomed to its use. After about 100 yards—more, perhaps, if the weather be cold— open the strangler fully. The strangler is used only for starting purposes; for all normal running it is left fully open. When starting a hot engine, do not flood the carburettor or use the strangler. If the engine is barely warm, slight flooding can be desirable.

Control of the machine is by the throttle. The clutch is only used if it is desired to stop or for, say, turning round slowly in the road. Keep your hand away from its lever unless you are about to declutch.

To stop, close the throttle and apply the brakes as necessary. When the speed has dropped to about six miles an hour, raise the clutch. If it is desired to keep the engine running when the machine is stationary, open the throttle a fraction at the same time that you declutch. Try stopping with the engine running. Pause a moment with the clutch out and the engine throttled down to the point that it turns over slowly.

Now, try getting on the move, just as you would have to do if you had been held up at traffic lights. The engine is running. Give a twirl or two of the pedals to help the machine get under way and, as the machine moves off, gently let in the clutch and at the same time open the throttle a little. A few attempts and you will move off effortlessly and smoothly. Usually, the initial fault is that the clutch is let in jerkily.

Of course, you will have your first ride on some quiet stretch of road. Over the matter of stopping, remember that the front brake is more effective than the rear one. The reason for this is that a result of application of the brakes is to transfer weight to the front wheel, thus causing the front tyre to grip the road better. The only point is that one should not use a front brake hard if the front wheel is locked over, since this might start a front-wheel skid. If ever you have to brake really hard, endeavour to have the machine on an even keel.

What about the pedals ? Such is the power of the average autocycle engine that the pedalling gear is seldom employed. It is employed in the starting method just described and to help the clutch when a restart is made. On hills it is seldom required, since, as has been mentioned, an autocycle engine will generally take machine and 12-stone rider up any hill which is not steeper than 1 in 8. If a hill is very steep or, because of a sharp corner at the bottom, has to be approached extremely slowly, some pedalling may be necessary. The important point is to pedal before the engine flags. For a given throttle opening the power the engine develops depends upon the speed at which it is running. Let the engine revs become very low and the power, even on full throttle, will be low. Hence, early, rather than late, pedalling may save one a lot of energy. The pedalling should be aimed merely at keeping up the engine revs.





Now for other starting methods. Pedalling off the machine calls for some effort, particularly if the engine does not fire immediately the clutch is let in. Pushing the machine a couple of yards with the clutch home and the compression release raised is easy. Further, this gives an almost certain start. Immediately the compression release has been dropped, transfer your hand to the clutch lever. Declutch on the engine firing. Then board the machine and, after settling yourself comfortably in the saddle, get on the move just as if you were setting off from traffic lights.

Another method, one which is a little rough on the transmission unless one gets up to nearly running speed, is to push the machine with the compression release raised and when, on the lever being dropped, the engine fires, get aboard. With one make of runabout which has footrests instead of pedals, the easiest method on the model that is not fitted with a kickstarter is to treat the machine very much as a child's scooter. In this case there is no compression release, so the clutch is raised, the machine scooted a yard or two and then, the rider keeping his weight on the footrest, the clutch is released.

With an autocycle, yet another method of starting is to pedal off and, with the left thumb on the compression-release lever and the remainder of the hand on the clutch control, release, first, the clutch and, secondly, the compression-release.

For the majority of autocycles that gentle push-start, followed by declutching, is generally the easiest, and it is far more simple than might be gathered from mere words. So much for the initial stages; in the next chapter will be discussed the finer points in handling the machine, also—less interesting—some legal points in connection with ownership.

CHAPTER 10

## Finer Points in Riding: Legal Matters

CONTROL should be by the throttle—this was stated in the last chapter and it is a fact that the difference between an expert rider of an autocycle and the poor hand lies mainly in the manner in which they use their throttle levers. Movement of the throttle should be gentle, and the degree of opening should be that required by the conditions of the moment—so much and no more.

When the machine is ridden away after a traffic halt, there are, it will be recalled, three tasks: Slight pedalling, letting in the clutch and opening the throttle. One rider may fling his throttle wide open, thus screaming his engine and causing his clutch extra work in bringing the engine speed and road speed into harmony. Your good rider will open the throttle gradually as the clutch begins to bite and will almost literally glide off the mark.

In much the same way, if he has to accelerate from a low speed after, say, rounding a sharp corner, he will open the throttle gently. Instead of the engine suddenly being given great gulps of mixture and snatching at the transmission to the detriment of both, it will be coaxed up to the higher speed. The throttle, too, can be used for rounding a bend. A machine has added stability when the back wheel is driving.

Having worked up to the speed he wishes to use, the expert rider will often throttle back slightly. With many machines, once the speed has been raised a reduced throttle opening will enable that speed to be maintained.

Warning that the clutch should not be used as if it were a gear has been given already. This means that it should not be half-in and half-out for longer than is necessary. It does not imply that it should not be eased when it is desired to turn round in the road or if, for some other





reason, it is necessary to ride very slowly for a moment or two. To have the engine snatching at the transmission is thoroughly bad, and the good rider avoids this by his skill in handling the throttle, perhaps by slight pedalling and, in the final resort, by momentary use of the clutch.

Woffling along for any length of time with the clutch partly in is a certain method of causing the clutch to heat up and, if this practice is persisted in, a result may be that the friction surfaces are ruined. Therefore, in a long, slow-moving traffic queue, the best thing is to stop the engine and use the pedals.

On steep hills, the expert rider makes sure that, as far as possible and safe, he keeps up his engine speed. He avoids approaching the foot unnecessarily slowly, picks up speed where the conditions permit and, in short, makes the best use of his machine and the particular stretch of road. And, if his engine starts to flag, he begins pedalling as soon as the speed of the machine has dropped to the point at which, with the pedalling-gear ratio fitted, he can help the engine. By this scheme extremely steep hills can be climbed without any heavy slogging. Leave the pedalling until the engine nearly conks out and the effort required will be large.

What is to be done if the hill is so steep that, even with pedalling, the machine will not get to the top ? This question can sometimes be answered by another: " Is there a side turning ? " If there is one, it may be that it offers the opportunity of a restart that will carry one to the top. Should there be no help in this connection, nor some easy way round, the machine can, as a last resort, be walked to the top. Start the engine—if necessary on the stand—and then walk beside the machine, using the engine to pull it, but not you, up the hill. Keep the throttle opening as low as you can, because this method involves use of the clutch—unless you are going to run ! The small throttle opening will heat up the clutch much less than would a large one. But do not adopt this method for miles on end—two or three hundred yards, yes, but if there is any great distance stop for ten minutes after each few hundred yards to let the clutch cool down. Let it be emphasized that the scheme is not a good one, but there may be an occasion when something of the sort is essential.

As with letting in the clutch, braking should be carried out gently. If a rapid stop is necessary—which should seldom be the case if the rider has his wits about him—the brakes should be applied with gradually increasing pressure. And remember that, just like the clutch, the brakes, if used for any great length of time, will heat up. On long descents it will often pay to raise the compression release—either part way or full, whichever gives the greater braking effect. With some engines, raising the compression release provides a most useful auxiliary brake, enabling one on steep hills to save the brakes considerable work. There is no objection to this practice, but keep the throttle shut, except—do you remember the chapter on lubrication ?—that on any very long descent the compression release should be dropped every now and then and the throttle opened momentarily. The reason, it will be recalled, is that otherwise the engine will receive no lubricant. Generally, it is best to declutch during the moment or two that the throttle is opened for lubrication purposes.

Now for a few legal points. First, you must have a horn on your autocycle; a bell is not legal. Secondly, remember these two points—that the licence must be carried in a waterproof holder mounted forward of the " driving seat ", and the holder must have a glass, and not celluloid, front.

Occasionally, autocycles are used for carrying a child. This, from the legal angle, is permissible, but the child (one only) must be astride behind the rider and on a proper seat rigidly attached to the machine. The law does not state that pillion footrests must be fitted, although, in fact, these are more important from the safety aspect than a " proper seat ". Occasionally, too, one sees an autocycle used for towing a pedal cycle—sometimes two pedal cycles ! A solo machine may only tow another solo and then only if the latter has broken down.

While not truly " legal points ", because its contents have not the force of law, the Highway Code can be produced in a court of law with a view to showing who was right and





# OFFICIAL TRAFFIC SIGNALS

## Signals to the Traffic Pointsman

*Fig. 31—I want to TURN to my LEFT*

*Fig. 32—I want to go STRAIGHT AHEAD*

## Signals to Traffic Behind You

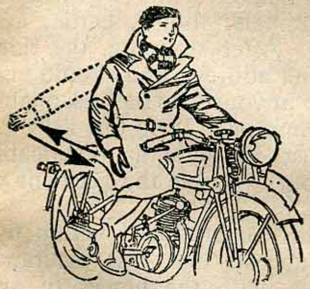


*Fig. 33—I am READY to be OVERTAKEN (the overtaking rider must satisfy himself that he can overtake with safety)*

*Fig. 34—I am going to TURN to my LEFT (alternatively as Fig. 31)*

*Fig. 35—I am going to TURN to my RIGHT*

*Fig. 36—I am going to SLOW DOWN or STOP*

who was wrong. It is well worth close study, and anyone who has the slightest claim to being a good roadman not only knows the Code but practises it unfailingly. The official hand signals are shown on the previous page. It will be noticed that the rider of an autocycle or motor cycle can use either his left or right hand for indicating that he wishes to turn left. Please note the word "wish"; a hand signal only indicates the desire to carry out the particular evolution and does not give the right to do so and thereby inconvenience others. Clear hand signals given with military-like smartness are the outward and truly visible sign of the good rider.

Before we leave this chapter, a few words on what the law demands in the case of an accident. The first duty is to stop. An "accident", from the legal angle, is an event causing damage or injury to a human being, a vehicle or one of the following eight animals: horse, cattle, ass, mule, sheep, pig, goat or dog. After stopping, the rider or driver must give his name and address, and should also show his insurance certificate to anyone who has reasonable grounds for requiring the information. If no one asks for his name and address he must—as soon as practicable and, in any case, within 24 hours—report the accident to the police.

The insurance certificate must be produced within five days. Common sense also suggests that the insurance company be advised forthwith—with the names of any witnesses.



CHAPTER 11

# Running-in Your New Autocycle

THE majority of autocycles are fitted with one of the special Villiers engine units. They are delightfully simple and designed throughout with the object of being free from petty troubles such as might mystify the novice. Not only is this so, but with a few very minor precautions these sturdy two-strokes will give of their best.

Provided that it receives properly mixed petroil and the proportions are correct, and it is not driven *too* slowly (more on this anon), an autocycle engine will automatically become run-in without thought or worry on the part of the rider. In other words, the various bearing surfaces will bed down of their own accord, taking on a high degree of polish and becoming close to frictionless.

As a rule, the purchaser of an autocycle takes delivery at the shop from which it has been bought or it is delivered to his or her house, consequently the tank will already have been filled with the appropriate mixture of petrol and oil. As was emphasized in the chapter on lubrication, it is most important that the petrol and oil are in the correct proportion and properly mixed. In the initial stages of an engine's life it is better—far better—for there to be too much oil mixed with the petrol than too little. The makers of the Villiers engine recommend one part of oil in 16 of petrol, that is, half-a-pint of oil to each gallon of petrol. This 1 in 16 can be taken as generous—indeed, a safety measure—and such a mixture is altogether admirable for running-in a new engine.

To aid the owner of an autocycle, a special little oil measure will generally be found attached to the underside of the tank filler cap. Unscrew the filler cap or press it down and turn it through a few degrees to release the bayonet catches, as the case may be, and on withdrawal

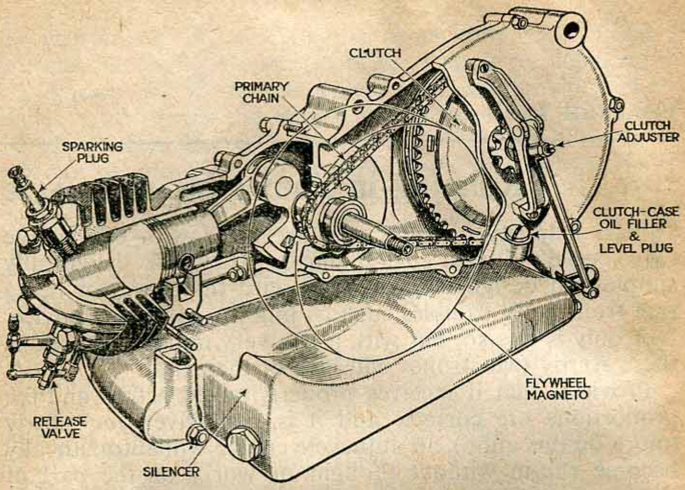



*Fig. 37—A part-sectional drawing of the Villiers Junior-de-luxe autocycle unit*

of the cap the little cylindrically shaped measure is ready for use. Information as to the number of measuresful that should be used for half-a-gallon or a gallon of petrol will be found either stamped on the filler cap or in the maker's instruction book.

Later, after the machine has run-in over a distance of, say, 500 miles, the strength of the petroil mixture can be reduced, if desired, to 1 in 20. Even 1 in 24 is used for some two-stroke motor cycles, while still leaner mixtures are employed in certain industrial engines. However, with an autocycle engine it can be taken that 1 in 16 is desirable for the running-in and nothing weaker than 1 in 20 for general running following the bedding-down period.

It is hardly necessary here to go into the question of mixing the petrol and oil since this subject was discussed in considerable detail in the chapter on lubrication. Let us, therefore, pass on to driving methods. First, it pays handsomely to drive the new machine fairly gently at first. True, the majority of 98 c.c. autocycles will travel at a speed





of approximately 30 m.p.h., but, within reason, the lighter the loads on the engine in the earlier stages the better chance the bearing surfaces will have of bedding-down nicely. Hence let the maximum speed during the first 100 miles be 18–20 m.p.h. rather than around 25 m.p.h. and avoid unnecessary collarwork, such as hard slogging up hills, particularly if a few twirls of the pedals can make the difference between the engine working hard or taking life easily. During the early stages we want to avoid both high engine speeds and the engine tugging away at something close to full throttle. For perfection, the engine should always be running easily and lightly.

As the miles tot up, the engine can be given more work to do, the amount being increased until at the end of, say, 500 miles the machine can, if desired, be driven to the limit of its performance. Not that driving flat out is a good plan; the best type of rider seldom, if ever, drives his machine to the limit, but lets it run well within itself.

Earlier in this chapter it was remarked that a machine could be driven too slowly. If the new engine never has any real work to do, soot becomes deposited on the skirt of the piston and this, by taking up the piston clearance, may cause the engine to stop owing to seizure. Hence, where all the running has been around 15 m.p.h. in flat country, it can be wise to remove the cylinder after 350 to 500 miles and wipe off any sooty deposit. Full instructions will be found in Chapter 14.

During the running-in period all parts of a machine tend to bed down. Hence it is wise to check the tightness of nuts and the correctness of all adjustments, not forgetting the steering-head bearings and the driving chain. One item which can be counted upon to bed down in the first few hundred miles, to some extent at least, is the clutch. If at any time it is found that when the throttle is opened the engine starts to buzz hard but the machine travels no faster, or very little faster, the reason is simply that the clutch is slipping. Provided that it is not a case of the rider grasping the clutch lever without realizing the fact, all it is necessary to do is to make one simple alteration to the setting of the clutch-control adjuster.

As was emphasized in Chapter 8, there must be a slight amount of free movement of the cable that operates the clutch—about $\frac{1}{8}$ in movement of the wire before the clutch lever on the engine unit starts to free the clutch. The probability is that when this buzzing occurs there is no free movement at all. With the Villiers Junior, grasp the clutch lever on the power unit (Fig. 38) and lightly pull and push on the end to which the cable is attached. If this does not move freely to the extent first mentioned, slacken the lock-nut indicated and turn the screw in the middle of the lock-nut to the degree necessary to give the required amount of free movement. Finally, holding the screw stationary with the aid of the screwdriver, turn the lock-nut clockwise until it is tight.

It is as well to keep a fairly close watch on this adjustment during the first hundred or so miles. If all the slack is allowed to disappear, and the clutch therefore slips, the wear both on the clutch-operating mechanism and in the clutch itself will inevitably be rapid.

When a machine is new there is always more likelihood of dirt reaching the carburettor than at any other time. The makers of the Villiers engine have guarded against this possibility by fitting a special filter, which, wisely, is of

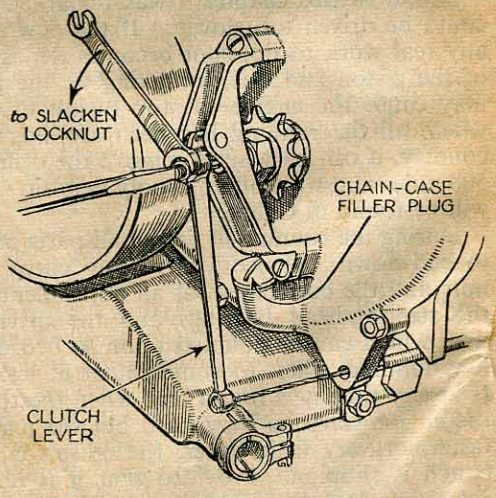



*Fig. 38—Adjustment of the clutch control to provide the necessary one-eighth of an inch free movement at the end of the clutch lever*





such design that not only does it prevent any choking of the carburettor but also it is not likely itself to become choked. This filter is at the carburettor end of the fuel pipe—in the banjo union that will be found at the end of the petroil pipe (Fig. 39). Clean this filter, or at least check that it is clean, following the first 100 miles. After that there is little chance of trouble, though obviously whenever the engine is dismantled, as, for example, when it is being decarbonized, the rider will automatically make sure that it is clean.

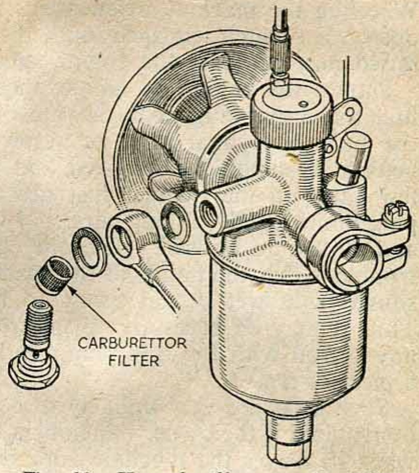



*Fig. 39—How the filter on the Villiers carburettor is dismantled for cleaning purposes*

In order to remove the filter, hold the pipe close to the union and at the same time turn the hexagon-ended plug anti-clockwise with a spanner. Fig. 39 shows how everything comes apart. Then wash the gauze and plug in a cupful of clean petrol—away from naked lights, of course—and refit it, taking care to replace the two fibre washers. The washers, it will be found, have holes of different sizes; the one with the smaller hole goes between the banjo union and the carburettor.

Another thing which is much more likely to happen in early stages of ownership than at any other time is that the rider will inadvertently make the petroil-air mixture so rich in petroil that it will not fire. This can result from flooding the carburettor and/or using the strangler when the engine is hot, excessive flooding at any time or the machine being left leaning over with the petroil tap on—leaning so that neat petroil can flow into the engine.

Wheeling the machine a few yards with the throttle wide open, the clutch engaged and the compression release raised may ventilate the engine sufficiently.

Should the engine by any chance still be unwilling to fire, the drain plug near the bottom of the crankcase—the little hexagonal plug or screw with a fibre washer behind it—should be removed and the machine pushed a few yards in the manner just described. Then screw the plug home tightly, taking care that the washer is replaced, and all should be well. The only other possible cause of trouble is that the points of the sparking plug have become soused with wet petroil owing to the excessive flooding. Thus it may be necessary to unscrew the plug, blow out any petroil with the tyre pump and wipe the points with a piece of rag.

Such tasks are very unlikely to be required and will *not* be required if the owner remembers to turn off the fuel tap when he leaves the machine and, secondly, always avoids over-flooding.

Two final points: Avoid running the engine for unnecessarily long periods with the machine stationary. In such circumstances there is no cooling draught other than that of any breeze; also, if the clutch is disengaged, some heating up of the clutch is inevitable. Secondly, if at any time a new piston is fitted, treat the engine as if it were new.



CHAPTER 12

# Maintenance Points

WHEN the Villiers engine fitted to autocycles leaves the factory the carburettor is usually set a little on the rich side to aid perfect running-in. Therefore, after the machine has covered about 500 miles it is a good plan for the owner to take it along to the agent from whom he bought it in order to have the carburettor setting adjusted. This is a simple task which will generally result in improved running and better fuel consumption.

All it is necessary to do is to alter the setting of the taper needle that is attached to the carburettor throttle (Fig. 40). The little screw has to be rotated clockwise by about one full turn according to the needs of the particular engine. The agent will quickly see to this and provide the best possible setting. Since the adjustment of the needle is very sensitive, the alteration is one for an expert rather than a private individual.

As will be seen from Fig. 41, removal of the throttle slide is quite simple. It is necessary only to unscrew the knurled ring at the top of the mixing chamber—the ring which will be found at the bottom or carburettor end of the Bowden cable—

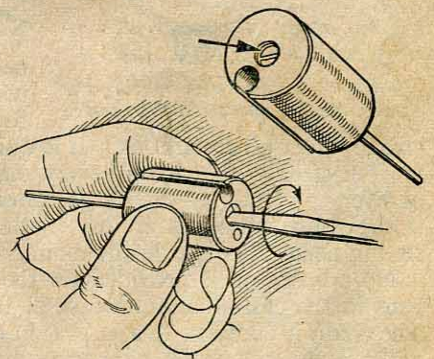


*Fig. 40—Adjustment of the needle fitted to the Villiers throttle slide*

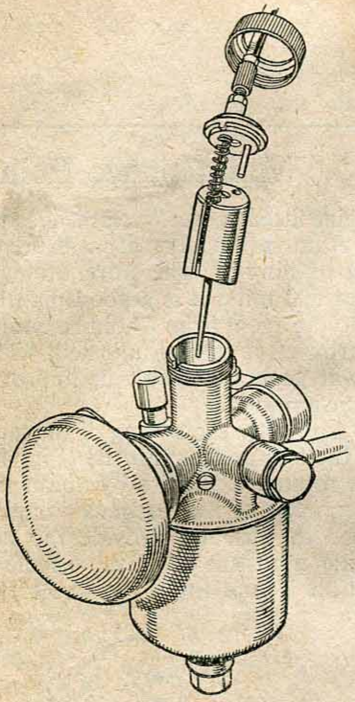


*Fig. 41—Method of removing the throttle, complete with its needle*

and then pull out the throttle complete with its needle. Replacement, too, is quite straightforward, though naturally one has to take care that the groove in the throttle slide faces in the right direction, namely, straight towards the air intake, and that the needle attached to the throttle slides home in the jet. The knurled ring should be screwed down tightly after care has been taken to see that the end-cap which it holds in place is properly home. Fingers should be used for tightening the knurled ring and not a pair of pliers, which can only cause damage.

The signs that the needle should be adjusted are a tendency for the engine to four-stroke under all conditions. It is quite usual for an engine to four-stroke—that is, fire every other revolution instead of every revolution—when it is running lightly loaded, but if the four-stroking is almost continuous the carburettor setting needs attention in the manner just described.

No adjustment is provided for the primary chain which runs in the cast-aluminium case at the side of the engine. The chain is endless—that is, it is in one continuous length without any detachable connecting links such as are found on many rear chains (Figs. 42 and 43). It is of a special type, often termed the pre-stretched type, and all it is





necessary for the rider to do is to see that the chain case contains its required quantity of lubricant.

The oil-filler plug on the Villiers Junior-de-luxe is situated just underneath the clutch lever (Fig. 38, page 64), and the lubricant recommended by the makers is Castrol D, which is a considerably thicker oil than XL. If, however, the clutch fails to free perfectly when the machine is used first thing in the morning, yet the clutch adjustment is correct, Castrol XL may be employed instead of D. This is purely to overcome any tendency for the clutch to stick and, in all normal circumstances, Castrol D should be employed. See that the machine is vertical and standing on level ground, then pour in the oil up to the level of the filler hole—this is the correct level. Finally, screw home the plug.

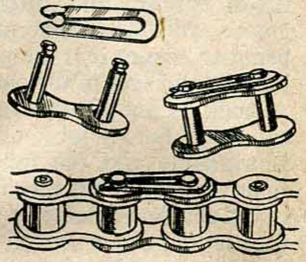


*Fig. 42—How the spring connecting link of a chain is removed. The closed end of the spring clip should point in the direction in which the chain travels*

Provided that the thicker oil, Castrol D, is used, the task is one that will require doing only about once every 2,000 miles. The reason why the thinner oil is not advised as normal practice is because there may be leakage and unnecessary messiness. All chain cases are filled before the Villiers engine leaves the factory.

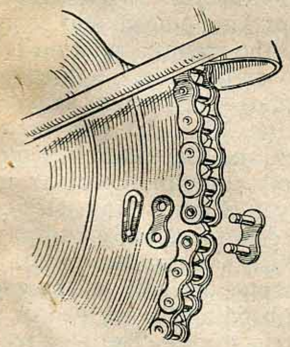


*Fig. 43—Replacement of a rear chain is, as a rule, rendered easy if the two ends are pressed home in the rear chain wheel, thus bringing them into the correct relative position for sliding home the connecting link*

When, at long last, the primary chain has to be replaced owing to wear, the teeth of the driving sprocket should be examined. If they have worn to the extent that they are noticeably hooked, a new sprocket is desirable; otherwise, the new chain will wear rapidly.

The same applies to the rear driving sprocket, which, not being enclosed in an oil-bath case, wears more rapidly. The rear chain has a fairly hard life. Ideally, it should be removed at least once every 1,000 miles, washed in a tin of paraffin and, after draining, immersed in graphite grease, which should be made liquid by slight heat, the aim being to ensure that the grease finds its way to the internal bearing surfaces of the chain.

Refitting the chain over the front, or driving, sprocket can be a finicky job, but is simple if a length of old chain is available and the following dodge is known. Before removing the chain that is to be greased, attach the length of old chain and pull this around the front sprocket; finally, use the old chain to refit the one that has been greased. A chain should be renewed when the wear is such that, if, after being washed in paraffin, it is laid flat on a board and its ends alternately pushed and pulled, there is a difference of more than ¼ in per foot.

A point that the makers of autocycle engines stress is that only the correct types of sparking plug should be used. For the Villiers Junior-de-luxe the recommendation is the Lodge C.B.3 plug. This is a long-reach, three-point sparking plug of 18 mm diameter—not 14 mm, as is fitted to the latest engine, the Mark 2F. The gap between the side or earthed electrodes and the central electrode should be approximately twenty thousandths of an inch, except in the case where only fuel containing tetra-ethyl lead is available. With a leaded fuel it can be an advantage to increase the gap to about thirty thousandths of an inch.

As was mentioned in the chapter on ignition, the gap at the plug points is adjusted by bending the earthed or side electrodes and not the central electrode. The plug recommended for the Brockhouse Spryt is the K.L.G. T/FS/50, which is of 14 mm diameter. A very small plug gap is used in the case of the Miller-equipped Spryt engine, namely, ten thousandths of an inch. This is approximately half the usual plug gap, so when a new plug of this type is





purchased the point should be bent inwards until the gap is approximately correct. For a Spryt with the Wico-Pacy magneto the plug gap should be twenty thousandths of an inch.

The task of cleaning a plug is rather different to-day from what it was a few years ago. No longer are the insulators, or the business end of those insulators, made of mica, which was liable to flake. Instead, a hard, mechanically strong material is employed in the form of sintered aluminium oxide—material so hard that the plug can be put into a machine which sand-blasts, and thus completely scours, its internal economy. The best way of dealing with a plug which will not spark owing to its being coated internally and around the points with oily carbon is to hand it to a garage for attention in a special plug-cleaning machine. The cost is only pence.

A wise precaution for any owner of an autocycle is always to carry a spare plug, either a brand-new one or an old plug which has been refurbished in the manner just described. It need hardly be stressed again that this plug should be of the correct type, but it may be as well to emphasize that a plug carried loose in the tool bag or tool box is likely to become useless. Even the tin boxes in which some plugs are sold are of little value as protection unless the plug has its points covered over and is wedged so tightly in the tin that it cannot move. Special plug carriers are sold and some, particularly those of rubber, will ensure that the plug is unharmed even if it remains in the tool bag unused from one year to the next.

If a plug has to be cleaned by the rider, there are two lines of approach depending on whether the work is carried out at the roadside or at home. In the former case, about the best that can be done is to scrape the points with a penknife, swill out the plug with petroil, shake out as much as one can, blow out the remainder with the aid of the tyre pump and finally wipe the points with clean, preferably fluffless rag. This will generally do the trick or at least ensure that the plug sparks, as it should, at the plug points.

Where a plug is of the so-called "detachable type", that is, has two hexagons, the smaller one holding the insulator in the plug body, it is possible for the plug to be split even at the roadside and the insulator and the inside of the plug body scraped clean with a penknife. However, holding the larger hexagon with one spanner and trying to unscrew the other with a second spanner is a dangerous sort of business in that the latter spanner may slip and, in slipping, break the insulator. If a plug has to be split at the roadside, leave the plug screwed tightly in the cylinder head and, holding the big hexagon with one spanner, try unscrewing the other. By this means the plug is held steady and there is much less risk. Occasionally, the smaller hexagon will unscrew easily. Then pull out the insulator, taking care not to lose any little washer there may be inside the plug body, and remove the oil and carbon with the knife, finally wiping the inside of the plug body and blowing through it.

At home, if there is a vice available, a plug can be split fairly easily. Place the plug so that the bigger hexagon is held lightly—yes, lightly—in the vice and, with a box spanner or ring spanner that fits properly, unscrew the smaller hexagon.

When refitting the plug centre, try it in more than one position relative to the plug body. The reason for this suggestion is that often the plug centre fits slightly eccentrically and, if so, one position may give the correct gap.

Before the subject of sparking plugs is left, a little more on the question of the type of plug. Earlier it was mentioned that the Lodge C.B.3 is the standard recommendation for the Villiers Junior engine. If it is found that the points of this plug become a " hard " white in appearance and the engine knocks badly (a mechanical clanking noise) although neither needing decarbonization nor running on an excessively weak carburettor setting, a plug capable of withstanding greater heat may be better. The Villiers' suggestion is the Lodge H.L.S. When petrol containing a high proportion of lead has to be used and the points become bridged, a most excellent investment, in spite of the cost, is a platinum-pointed plug. The one officially recommended is the Lodge H.L.I.P.

On the majority of carburettors fitted to autocycles





there is an air-intake filter. This may take the form of the simple gauze shown in Fig. 44 or may comprise a pan-scrubber-like arrangement of twisted wire. In the case of the Villiers gauze-type air filter, cleaning should be carried out if it is seen, from looking through the large holes in the air intake, that the gauze has become coated with dirt, which is especially likely in muddy weather.

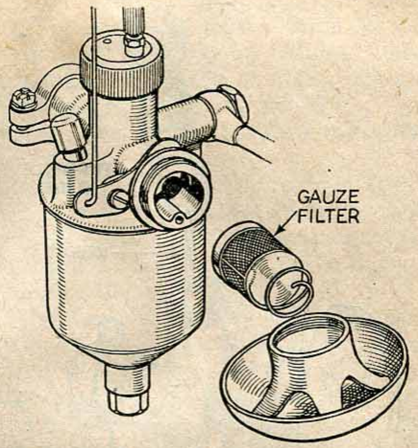



*Fig. 44—Removal of the Villiers gauze-type air filter*

Removal of the gauze is effected by unscrewing—by hand—the domed cover. As soon as the cover is off the carburettor, the cylinder of wire gauze, which has a spring attached to it, will automatically jump out. To clean it, wash it in a cupful of clean petrol.

Dust, too, can of course choke the filter, so periodical attention is desirable. In this connection, it will be realized that a choked filter means that there will be greater suction on the carburettor jet, with a result that the mixture will be too rich in petroil. Like the gauze filter, the twisted-wire type should occasionally be washed in petrol. There is no need to dip the latter in oil after washing it—as is required with somewhat similar air filters fitted to four-stroke engines—because with a petroil-lubricated two-stroke it will automatically become coated with oil.

Owing to the filter at the banjo feed union, the Villiers carburettor seldom requires cleaning out. Provided that the filter is retained and is undamaged, about the only thing which can make this necessary is failure to turn off

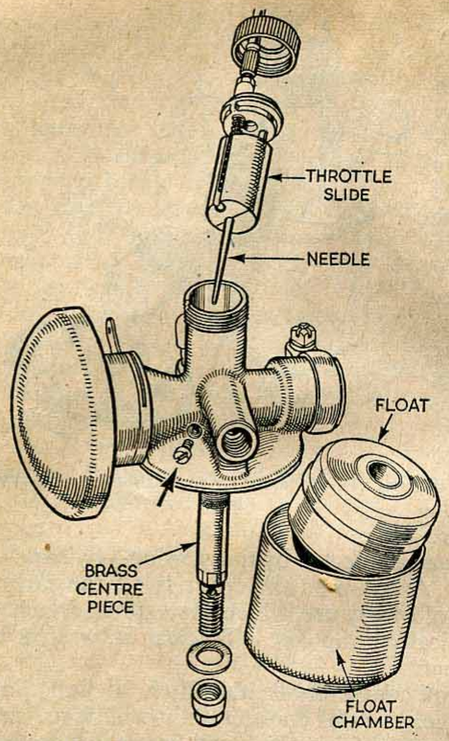



*Fig. 45—How the Villiers autocycle carburettor is dismantled. The screw indicated with the arrow is only undone if it is wished to remove the brass centre piece*

the fuel tap when the machine is being laid by for some days and then only if the weather be hot. In such circumstances the petrol in the petroil that reaches the carburettor may evaporate — as it does so, more petroil will enter the carburettor—and leave behind the oil, which may cause some clogging.

Normally, cleaning the Villiers carburettor will only involve the removal of the bottom or float chamber portion. This is achieved merely by unscrewing the hexagon nut at the very bottom. Then the float chamber will come away as shown in Fig. 45. Watch out that the fibre washer that goes between the nut and the float chamber is not lost or, of course, there will be serious leakage when the carburettor is reassembled and the fuel turned on.

The brass float is not held in any way and will fall out when the float chamber is inverted. Wash both the float and the chamber with clean petrol in order to remove





any dirt or excess oil. Any sediment adhering to the inside of the float chamber will come away with a little gentle scraping, and must be carefully removed by swilling. No loose dirt or fluff should be allowed to remain. From this it will be realized that generally it is better not to use rag for the final cleansing, but simply to swill out with clean petrol or petroil.

If the carburettor has been inclined to flood of its own accord, the probable reason is a speck of dirt on the seating of the little needle which, with the aid of the float, controls the supply of fuel entering the carburettor. Attending to this is also quite a simple matter.

Once the banjo union at the bottom end of the fuel pipe and the strangler control have been removed, removal of the carburettor is merely a question of slackening the clip that fixes the carburettor to the engine, whereupon the carburettor, except for the throttle cable, is free. The screw in the clip need only be slackened; there is no point in undoing it. As soon as this has been seen to, pull the carburettor away from the inlet stub on the engine and then undo the knurled ring and remove the throttle slide. Tie the throttle slide to some part of the machine with a piece of string so that it will not be knocked about and damaged.

Now, with the float and float chamber removed, have a look at the underside of the mixing chamber (Fig. 46). The little needle is behind that U-shaped brass plate or toggle. To get at it is quite simple, provided that the method is known. What must not be touched is the toggle's pivot pin, nor must the toggle be bent.

If the other side of the carburettor—the upper side—is examined, a little screw will be seen alongside the centre portion (see arrow in Fig. 45 on opposite page). Undo this and then press the brass centre piece that runs down and through the float chamber in an upward direction. This will come away as shown in Fig. 47, and then, on the brass toggle being swivelled round, out will drop the little needle valve.

If the pointed end of the needle is examined, it may be found that there is a speck of dirt on the tapered seating. This, if present, can be rubbed away with the finger nail. Less likely is that there is some grit on the seat on which the needle bears. Should this be so, it can probably be removed with a splinter of matchstick. Whatever means is adopted, we do not want to scratch the seating because even the merest scratch may be deep enough to let petroil pass when by rights it should be cut off.

There is nothing else that can be attended to in regard to the carburettor—indeed, it is most unlikely that the foregoing will be required.

After the carburettor has been swilled out, all that remains is to reassemble it. In this the only point to watch is that the parts are put together in the reverse order from that in which they were dismantled. Particularly note that the washer under the centre portion—the one that goes around the brass centre piece—is not lost. The chances are that it will remain inside the body of the carburettor when the centre piece is removed, but it may come away with the centre piece and must be replaced, because otherwise the special mixture compensating tube, which is part and parcel of the carburettor, cannot do its job properly. The washer is shown in the drawing.

Before replacing the throttle slide make certain that the little guide rod attached to the mixing chamber top is located in the hole in the slide. Push the throttle in the body carefully so that the needle is introduced into the centre-piece hole. Note that the little projection on the mixing chamber fits in the groove—then you are sure that the throttle slide is the correct way round. Finally, see that the end-cap goes home properly and tighten the knurled ring—by hand.

Little else need be said in regard to the Villiers carburettor. Obviously, there is no need to do any straining when refitting the various parts. It is only a case of putting them in the correct relative position as revealed in the drawings and finally tightening up that hexagonal nut at the base of the mixing chamber. This last screws on to quite a sturdy member, and therefore there is no fear that tightening it up will cause damage. However, all that is needed is to turn it until it is just tight. No force is required —merely sufficient tightness to prevent any leakage of petroil from the carburettor.





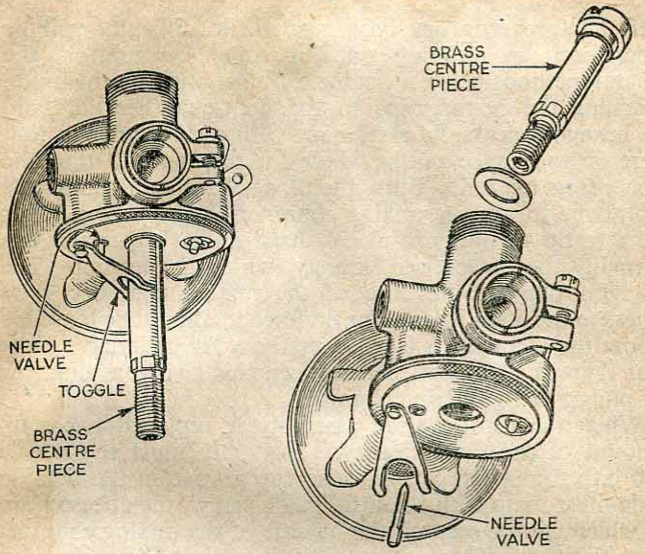



*Fig. 46 (left)—In order to get at the needle valve which controls the flow of petroil into the carburettor, the brass centre piece is pressed upwards after removal of the screw indicated in Fig. 45. In no circumstances must the toggle be bent or any endeavour made to remove the pin on which the toggle pivots*

*Fig. 47 (right)—On the centre piece being removed in the manner illustrated, the brass toggle can be swivelled, whereupon the float needle will fall out. Note the washer that goes around the centre piece. If this is lost the carburettor will not function properly*

One little point which should perhaps be mentioned is that no attempt should be made to take the brass centre piece apart. This is not designed to be split. It can be cleaned out by blowing through the holes, or, if necessary, by the use of a bristle.

When the carburettor is replaced on the engine, see that it is upright and pushed home on the inlet stub. This latter point is most important, because, if the carburettor is not right home, air will enter the engine via the slots over which the clip fits and will completely upset the strength of the petroil-air mixture that reaches the engine.

If the foregoing has been read, little difficulty will be experienced in cleaning out an Amal carburettor, the general methods being the same. When undoing the union attaching the petroil pipe to the float-chamber lid, hold the hexagon on the lid stationary with one spanner so that there is no chance of the whole lot turning and thus the pipe being twisted. Both the float-chamber lid and the cap at the top of the mixing chamber—the one that holds the throttle assembly in place—have milled edges and can normally be unscrewed merely with the fingers. The hexagon plug at the base of the mixing chamber gives access to the main jet and, for preference, should be loosened before the carburettor is removed from the cylinder. Note that there is a fibre washer between this hexagon plug, the jet plug, and the mixing chamber.

When the throttle-slide assembly is replaced a certain amount of care is necessary. Not only must the needle slip into the needle jet, but also the groove in the throttle slide must mate with the little guide screw, the cheese head of which will be seen on the outside of the mixing chamber near the top. There is no difficulty about the task; it is simply that the assembly must be aligned so that it slides home.

Usually, at the top of the mixing chamber of any carburettor fitted to an autocycle, there is a screw-type adjuster for the throttle cable. The object of this is to enable the owner, by screwing the adjuster in or out, to avoid backlash in the throttle control, yet have a throttle that closes completely when the handlebar lever is shut. Unlike four-stroke motor cycles, the throttle of a two-stroke, it is generally considered, should shut completely and not be slightly open in a so-called " tickover " position.

In passing, it may be mentioned that in the unlikely event of a carburettor float leaking—the test is to shake the float—the wise plan is to fit a new one. Also, if the float-chamber needle becomes worn and allows the carburettor to flood, it is much better to obtain a replacement than to endeavour to grind it in after the style of a valve in a four-stroke engine.

It will be realized that some wear inevitably takes place





between the throttle needle and the needle jet. If after a long mileage the fuel consumption is found to be not so good as it was, it may pay handsomely to fit new ones.

Easily the most likely source of reduced power output is that the silencer is becoming choked with soot and oil. Where the machine is used for much traffic work and there is frequent starting and stopping, any tail pipe from the silencer and any baffles in the silencing system may require cleaning out every 750 miles; with open-road riding once every 2,000 miles, that is, when the engine is decarbonized, should be sufficient. In the case of the Villiers Junior unit the tail pipe or the pipe leading to any auxiliary silencer is pushed into the rear of the cast-aluminium silencer that runs under the engine and is held in place at this point by a clip or by a flange with two nuts. On the fixings being undone the tail pipe can be pulled backwards out of the silencer. It can be cleaned out with a small flue brush or with a pull-through consisting of a wad of pan-scrubber attached to a length of wire.

If the silencer end of the exhaust pipe is blanked off, a series of holes will be found close to the blanked end. These must be cleared with a skewer or a large nail. No cleaning of the actual cast-aluminium silencer is required.

Adjustment of the wheel and steering-head bearings is carried out in the same manner as with pedal cycles. Bear in mind that a screw-jack with a coarse-pitch thread will raise a lorry and that an adjustable wheel-bearing cone, with its fine thread, can exert a pressure so great that the bearings will be ruined. This being so, the method of taking up any play in a bearing is to turn the adjusting member a fraction, tighten the locking nut, test, and repeat the sequence until there is just no play. With a wheel, one tests for play by endeavouring to press the rim sideways in the front or rear forks, as the case may be.

Where the bearings are those of the steering head, a simple method of testing is to apply the front brake and push the handlebars forward. There should be no play, without any roughness or tightness being apparent when the handlebars are swung from one lock to the other.

CHAPTER 13

# Care of Magneto and Lighting System

BOTH the lighting and ignition systems employed on autocycles are simple and troublefree. On the lighting side of the Villiers, Miller and Wipac sets there is merely one insulated cable from the flywheel magneto-cum-dynamo to the head lamp. From the latter there is a single cable that goes to the rear lamp. Naturally, these cables must be in sound condition. If a cable becomes chafed and the copper wire itself is all right, wrap the damaged wire puttee-wise with a few turns of insulation tape, which can be purchased in small rolls for a few pence.

See that the leads—the cables—are maintained in sound order and, in the case of the Villiers set, that the connection to be found a short distance from the magneto end of the lead to the head lamp is tight. This is the connector which should be undone if at any time the engine is to be removed from the frame; no attempt must be made to remove the cable from inside the magneto.

Usually, the head lamp of an autocycle contains a dry battery which supplies current for parking at night. The flywheel magneto-cum-dynamo, of course, only provides a light when the engine is running. Fig. 48 shows how the battery is mounted in the head lamp. A Villiers lamp is illustrated, and the standard battery for this is a No. 1289 Ever Ready. The battery has to be altered by the purchaser to the extent of bending the small brass contact strip in a curve outwards, just as the contact strip on the battery that is being discarded has been bent. The battery merely clips home. Hence, removal is simply a matter of pulling the battery outwards.

It will be noticed, with this lamp, that the small contact





strip has to bear on a brass disc riveted to the inside of the head lamp, while the longer or —ve (negative) strip has to press on a very similar strip that is to be found inside the head lamp just below the lighting switch. Finally, when pushing the new battery home, see that the various wires are moved out of the way.

There is no need to remove the reflector from the lamp front in order to replace the lamp bulbs. Holding the lamp front, grasp the flat, oval-shaped insulator that surrounds the main bulb and unscrew it a quarter of a turn to release the bayonet fitting, whereupon the whole main-bulb assembly comes away from the reflector. Once this has been done, the pilot or parking bulb can be removed by pulling it out, the holder for this bulb being merely a press fit. Be careful not to pull on any of the cables.

On some lamps it will be found that the little pins on the main bulb will fit into either of two pairs of grooves in the bulb holder. This is to enable the bulb to be focused and the position chosen should, of course, be that which is found to give the best driving light.

It is important that the correct bulbs are employed.

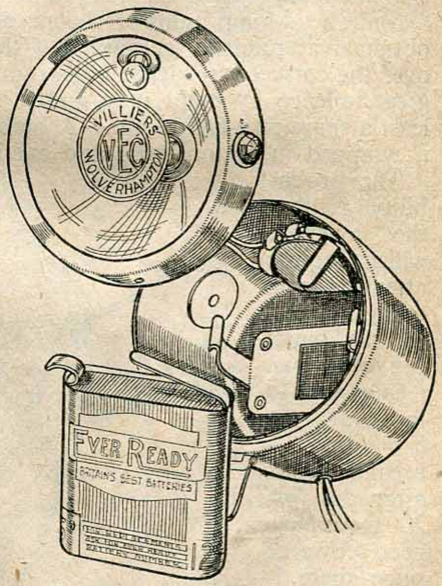



*Fig. 48—When fitting a new dry battery in the head lamp, bend the short brass strip outwards so that it presses on the circular brass disc inside the lamp body. The longer strip of brass must make contact with the similar strip on the roof of the lamp shell*

The usual main head-lamp bulb is a 6-volt 1-ampere single-contact, bayonet-fixing bulb. This is used for the lighting set of the Villiers Junior-de-luxe engine and for Miller and Wipac sets fitted to autocycles. The Mark 2F Villiers employs a 6-volt 2-ampere bulb. For the parking light a 4-volt 0·3-ampere screw-in type bulb is used. The tail lamp on the Villiers also has this type and " size " of bulb. With the Miller and Wipac sets the rear-lamp bulb may be of 6-volt 0·3-ampere. Villiers engines of the deflector-piston type used a 6-volt 0·5 ampere bulb. The instruction book issued with the particular machine will specify the lamp bulbs, or the bulbs themselves can be examined—the details are marked on them.

Main head-lamp bulbs of the necessary type are readily obtained at roadside garages, but there can be difficulty over the correct screw-type bulbs, so those who cover any great mileage by night may find it desirable to carry at least a spare rear-lamp bulb. A bulb should be quite safe if wrapped in cotton wool and carried in a tobacco tin.

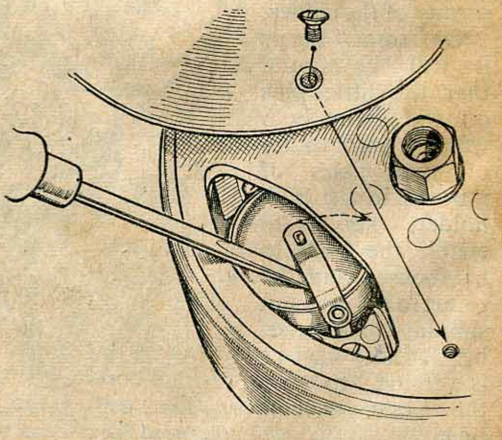


*Fig. 49—Screws secure the magneto cover plate. The clip which holds the cover of the Villiers contact-breaker housing can easily be prised upwards with a screwdriver blade*

The probability is that the magneto will not require attention from one year's end to the next. Nevertheless, it is as well to look at the contact-breaker points after the first 200 miles have been covered, since there is the possibility that the fibre pad or heel on the end of the rocker arm has





bedded down and the points require adjusting. To get at the Villiers or Miller contact-breaker, remove the disc that is attached by screws to the outside of the flywheel and forms the cover. These screws, incidentally, must be kept tight; therefore, it is as well to check them for tightness every month or so.

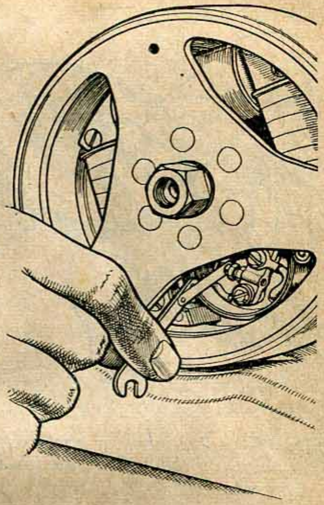


*Fig. 50—Checking the gap at the contact-breaker points*

On removal of this disc, rotate the flywheel by applying a hand to the rim until one of the holes in the flywheel is opposite the contact-breaker. In the case of the Villiers flywheel magneto the contact-breaker is contained within a special housing inside the flywheel. The brass cover of the housing is held in place by a small strip-type clip which can be slipped upwards with a screwdriver (Fig. 49).

With the Miller instrument there is no separate enclosure and the contact-breaker can be seen as soon as the aluminium flywheel cover disc has been removed and the flywheel rotated to the appropriate position. The Wico-Pacy contact-breaker is on view immediately one small circular cover plate is pulled off.

Now rotate the engine to make sure that the contact-breaker points are separated to their maximum and slide the feeler gauge between the points (Fig. 50). This gauge, in the case of the Villiers engine, is $\frac{1}{64}$ in thick. For the Miller and Wico-Pacy magnetos an 0·015 in feeler gauge is employed, which is, as near as no matter, the same.

In the Miller, Wipac and Mark 2F Villiers designs the adjustable point is on a slotted plate held by a screw (Fig. 24, page 39 and Fig. 52, page 85). On this screw being slackened off, the

*Fig. 51—Adjustment of the contact-breaker points on the Villiers Junior-de-luxe*

little plate can be moved and thus the gap between the points adjusted. With the earlier Villiers instruments the adjustable point is of screw type.

Let us trace the adjustment step by step. The gap at the contact-breaker points is correct when the feeler gauge will just slide in between them without pushing them apart. A very slight variation of the gap, as revealed by the feeler gauge, is unimportant, but, if there is an appreciable difference, adjustment is desirable. To accommodate for whatever bedding down of the fibre heel has occurred, slacken off (in the case of the earlier Villiers) the lock-nut on the contact screw, rotate the screw, say, a third of a turn so that it screws farther into its housing (Fig. 51 and Fig. 23, page 38), tighten the lock-nut and check the gap by means of the gauge. Repeat this sequence, if necessary, until it is found that the adjustment is exactly right.

It helps if two magneto spanners are available, one for the hexagon on the screw and the other for that of the lock-nut. Therefore, if only one spanner is in the toolkit, it can be sound investment to buy a second one.

With the other sets, only a screwdriver is needed, since this will attend to both the locking screw and to moving the little plate to and fro until it is in the position that gives the correct gap between the points. Avoid slackening the screw to such an extent that the plate is really loose—the latter only has to be sufficiently loose to enable it to be moved—and, after tightening the screw, see that the gap





is correct; the act of tightening a locking device can alter the setting slightly.

The contacts themselves seldom require attention. Should they become burnt they can be cleaned with a special " contact cleaner " obtainable from accessory firms. This consists of a thin flat strip of material faced with a form of emery and should be pushed to and fro between the contacts, which afterwards can be wiped with a piece of clean, non-fluffy rag steeped in methylated spirits. Only slight work is called for, and bear in mind that the contacts must remain true, one with the other.

If at any time it is found that there is heavy sparking at the contact points and that this is not due to dirt, the probability, as mentioned in Chapter 6, is that the condenser needs replacing or that there is a faulty contact at the condenser. Whether there is such sparking can be checked by running the engine with the flywheel cover and any contact-breaker cover removed, but do not be misled by slight sparking—there is always some sparking.

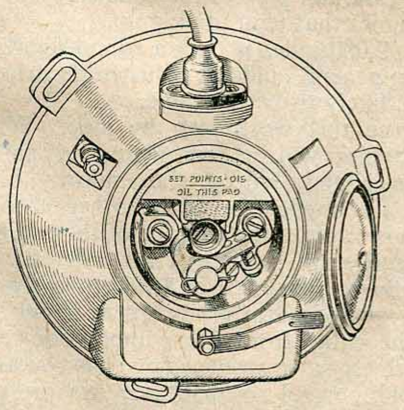



*Fig. 52—Arrangement of the contact-breaker on the Wico-Pacy flywheel magneto*

CHAPTER 14

# Decarbonizing the Engine

ANYONE with a grain of mechanical sense should have little difficulty in decarbonizing an autocycle engine. How simple and quick the task is can be gathered from the fact that a standard time for dismantling a Villiers engine, removing the carbon and putting everything together again, is 30 minutes.

If the engine is to give of its best, decarbonization should be carried out once every 2,000 miles. At the same time the exhaust system should be cleaned out. This latter task was discussed on page 79, but it is perhaps as well to repeat that, where an autocycle is used for low-speed, about-town riding, it may be needed every 750 miles, particularly if the tail pipe of the exhaust system has small passages or holes that tend to clog up.

Of course, 2,000 miles is only a round figure, but it can be taken as a general guide as to when decarbonization of the engine is likely to be desirable.

Let us trace this work step by step. While Villiers autocycle engines will be considered in particular, the general process and, indeed, the majority of the detail instructions are applicable to the other autocycle units. The first job is to clean the exterior of the engine by means of paraffin and a stiff brush. Then, after the carburettor has been removed (page 75) and tied to a frame member so as to be out of harm's way, there is the question of detaching the cable from the compression-release valve. Where the release valve on the engine has two arms, operate the handlebar control so that they are pressed together and hold them in this position by means of a pair of pliers or an adjustable spanner. This takes the load off the cable, and the hand that was used for operating the handlebar lever can now be employed for undoing the screw





at the engine end of the cable. Fig. 14, page 26, shows the two arms and the knurled screw. With the valve fitted to the Mark 2F Villiers the valve itself can be pressed down.

Any grit around the knurled screw should have been removed when the engine was washed down, so, once the lock-nut (if any) has been unscrewed half a turn, it should be possible to remove the screw merely with the fingers—provided, of course, that the two arms of the release valve are still kept pressed together. Use of pliers would damage the knurling.

As soon as the screw has been removed the inner wire of the control cable can be slid out through the little slot provided for the purpose. Now the pliers, or adjustable spanner, used to hold the two arms can be discarded and the nipple in the lower arm pressed downwards until it is free. If the nipple proves to be wedged, grasp the protruding lower portion and pull it downwards. Avoid bending or kinking the cable. Occasionally it is easiest to remove the nipple by pressing it downwards with the edge of a screwdriver blade inserted in the little slot.

Whether the silencer is removed next or the sparking plug is immaterial. What may be overlooked on the Villiers Junior units is that there is a little fixing clip or strip at the rear of the silencer (Fig. 53). Undo the tail pipe by removing any rear fixing on

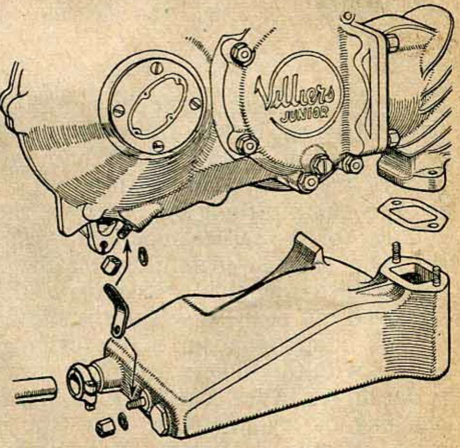



*Fig. 53—Method of attaching the silencer to the Villiers Junior engine*

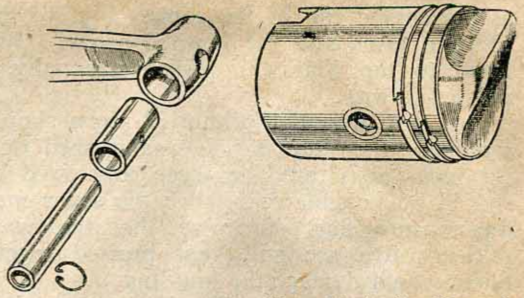


*Fig. 54 (top)—How the piston is attached to the connecting-rod*

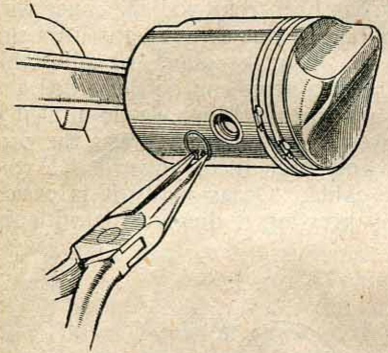


*Fig. 55 (bottom)—A pair of pointed pliers form the best tool for removing and refitting the circlip*

the pipe and slackening the clip or nuts at the front end. Then the tail pipe can be withdrawn by pulling it towards the rear of the machine. Next, loosen both nuts on the clip at the rear of the silencer and remove one. This done, remove the two nuts attaching the silencer to the exhaust port of the cylinder (on the earlier or deflector-piston Villiers engine) or the twin exhaust manifolds (on the Junior-de-luxe, flat-topped-piston engine), whereupon the rear clip can be swivelled out of the way and the silencer detached.

Now comes removal of the cylinder. As a rule, it is helpful with the Villiers Juniors to turn the front wheel first in one direction and then in the other, since this will facilitate reaching the cylinder-base nuts—the nuts that attach the cylinder to the crankcase. No adhesive jointing compound is used between the base of the cylinder and the mouth of





the crankcase, so, once the nuts have been unscrewed, the cylinder can be pulled forward without difficulty. However, there are one or two special points in this connection which will be touched upon in a minute. Before we come to these there is the query of what should be done in cases where, as on the Junior-de-luxe engine, the cylinder head can be detached from the cylinder. The answer is that, since the combustion chamber can be readily decarbonized with the cylinder head attached to the cylinder, and particularly as, in any case, it is desirable to examine the piston rings, there is seldom any great point in detaching the head, thereby breaking the joint between the head and the barrel.

Reverting to the actual removal of the cylinder, avoid twisting the cylinder sideways as you pull it forward. If the cylinder is twisted through many degrees, the piston ring ends may become trapped in the ports. As soon as the cylinder is an inch or two off the crankcase, slide your hand into the gap between the two in order to grasp the connecting-rod as the cylinder is pulled right off. This is necessary because, if the connecting-rod and piston were allowed to crash downwards, the latter would probably be damaged.

Now the piston should be removed. This is accomplished by grasping the protruding ears of one of the gudgeon-pin circlips with a pair of pointed pliers, squeezing the two ears together and pulling the circlip away from the piston. Figs. 54 and 55 make this quite clear. Note that only one circlip need be removed. The gudgeon pin can then be pushed out of the piston from the other end by means of a pencil or a wooden skewer.

Provided that the circlip is not damaged in removal, and there is little likelihood of damage if ordinary care is used, it may be employed again and again; experience shows that it is quite safe to do so. Immediately the piston of a flat-topped-piston engine has been removed, it should be lightly marked on the inside so that the engine will be reassembled with the piston the correct way up or correct way round, as the case may be.

With the Villiers Juniors the little-end bush is quite free in the small end of the connecting-rod. It may stay in place because of the oil on its outer surface. But if the machine is leant over it is possible that it will fall out. Should there be any tendency for it to slide out, remove it and put it in a safe place ready for reassembly. Place it so that you know which way to reinsert it—that it will not, unwittingly, be turned through 180 degrees. It is always better for a part that has run-in and bedded down in a particular way to be refitted the same way.

Now comes the task of removing the carbon deposit from the cylinder head and piston. The carbon adhering to the cylinder head can be chipped off with a long-handled screwdriver. Great care must be taken not to jab the cylinder bore—the polished portion traversed by the piston—since scratches will spell gas leakage and lead to loss of power. Also, where an aluminium-alloy cylinder head is fitted, it is desirable to avoid digging into the comparatively soft metal. Do the work in a good light and blow away the carbon flakes by means of the tyre pump. There is no need to remove the compression-release valve. The probability is that it will not require touching during the life of the machine.

Having completed the flaking off of all the carbon on the cylinder head, take an old penknife or, better still, old vegetable knife and scrape away any carbon adhering to the exhaust ports. Attend only to the ports. Do not insert the knife in the cylinder and cut away any of the cast-iron at the cylinder bore end; this could result in the shape of the ports being altered.

A little work with the knife will soon remove the carbon from the piston crown. What is required is gentle, careful scraping. The piston is made of aluminium alloy and is, therefore, comparatively soft. As a result, it is possible to remove aluminium as well as the carbon. Some scratching of the piston crown is inevitable, but there need be no more than light scratches if a little care is taken.

No carbon forms on the inside of the crown, such as is often the case where cast-iron pistons are fitted. Thus no work is necessary in this direction. It will, however, be





found that there is some carbon on the top land of the piston, that is, the surface which lies between the actual piston crown and the top piston ring. This should be removed by very, very careful scraping with the knife. Avoid scratching the piston ring.

During the running-in period of a new engine or an engine in which a new piston has been fitted, carbon can form on the piston skirt. This, as was mentioned in Chapter 11, is only likely if the machine is driven very gently. The carbon, as a rule, is so soft that it can be rubbed off with a rag steeped in paraffin. It is more like soot than carbon, but it takes up some of the clearance between the piston and the cylinder and can cause the piston to seize—that is, grab hold of the cylinder. Hence, if, in the early stages of a machine's life, all the runs are at roughly bicycle speeds, it can be wise to remove the cylinder at the end of 350 or 500 miles merely to wipe off this soot.

If the piston rings are free in their grooves and bright all the way round there is no need to touch them. Should, by some mischance, a ring be broken, a new one must be obtained from the dealer or the factory. Piston rings should also be replaced with new ones if the gap between their ends exceeds 30 thousandths of an inch. So far as the average owner of an autocycle is concerned, this last statement may savour of the academic, since there is the matter of measuring the gap, which involves making due allowance for the peg that prevents the ring rotating.

However, there is the golden rule that a piston ring should be scrapped if any portion of the surface that should bed down on the cylinder bore is discoloured; secondly, since the average autocycle engine is rotating at over 4,500 revolutions a minute when the machine is travelling at 30 m.p.h., a set of piston rings every 6,000 miles can be an investment, particularly if the machine is used over dusty roads.

Several methods of piston-ring removal are practised. One of the simplest is to cut three strips of very thin tin-plate, each about ¼ in wide and, say, a couple of inches long. Slip these, one at a time, under the end of the ring

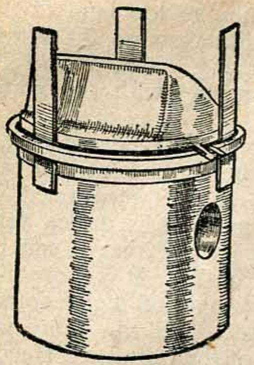


*Fig. 56—Removal of piston rings by means of three strips of thin tin*

it is desired to remove. Space these out equally round the piston's circumference and then, carefully and evenly, slide off the piston ring. Replacement can be effected by the same means. Another well-known method is to slide the blade of a penknife under the end of the ring and peel off the ring in very much the same way as one peels an apple. Figs. 56 and 57 show the two methods.

No special work is necessary previous to fitting a new piston ring except that if the groove is carboned-up it should be cleaned out. This can be accomplished by gentle scraping with a broken piece of ring. Great care should be taken not to damage the bottom or compression-retaining surface of the groove. As with other bearing surfaces, the piston rings should not be called upon to bed down afresh—in other words, if they are removed, they should be replaced in the grooves in which they were originally fitted and be the same way up. Replacement rings are of standard width, so there should be no question of having to ease them down in order that they fit the grooves properly.

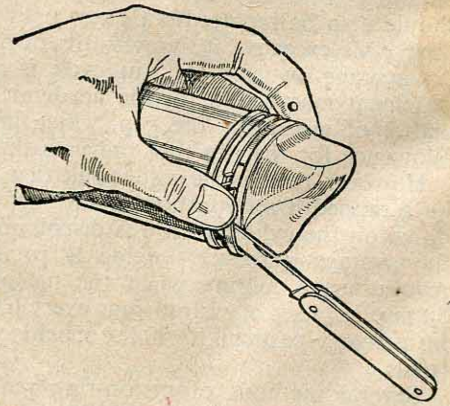


*Fig. 57—If care is used, a piston ring can be peeled out of its groove very much in the style of peeling an apple*





The foregoing covers decarbonization except for attending to the hole which, in the majority of engines, will be found running from the compression-release valve to the exhaust port. Any carbon in this hole can be removed by means of a metal skewer or the blade of a screwdriver.

Now for the assembly of the engine. The cylinder, piston, gudgeon pin and the little-end bush, if it has been removed, should all be washed in petrol, and care taken to see that both the cylinder base and its washer are absolutely clean. This washer is usually of special material and, provided that it has not become torn or rucked up, can be used over and over again. Should it be damaged, the plan is to get a new one from the works or the nearest service agent. In the same way, the washers for the exhaust ports, if of a metallic type, also last indefinitely, and in normal usage will not require replacement.

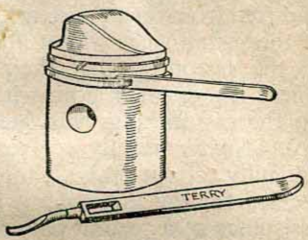



*Fig. 58—If, by any chance, a piston ring is gummed solid in its groove, use of this special tool will probably free it. Before the ring is refitted, both it and the groove should be carefully cleaned by scraping*

Now wash out the little end of the connecting-rod with a "petrolly" rag. Follow this up by replacing the little-end bush after smearing it internally and externally with clean engine oil. Next the piston is refitted. As the illustrations on page 88 reveal, with the Villiers engine of the deflector-piston type the steep side of the hump or "deflector" on the piston should be upward.

Smear the gudgeon pin with clean oil and, carefully holding the piston and connecting-rod in the correct relative positions, slide home the gudgeon pin. No force is required. So long as the holes are in correct alignment the gudgeon pin will slip into place with the ease of a knife going through butter in a heat-wave. Next, the spring-retaining ring, the gudgeon-pin circlip, is replaced, using, as before, a pair of long-nosed pliers. The only points to remember here are: first, the circlip must go right home in its little ring-like groove in the piston (which means that the groove must be free from grit); secondly, there will be little likelihood of its flying into space if it is pressed against the hole with the thumb before and during the use of those thin-nosed pliers; thirdly, if the circlip has been mauled by the pliers during the process of extraction, it will be safer to fit a new one.

No jointing compound is required for the cylinder base, but do see that the cylinder-base washer is in good order and free from dirt. The next thing is to smear the exteriors of the piston rings with a little engine oil and arrange them on the piston so that their gaps are at the pegs. Now smear the cylinder bore with a little oil (this oil and that on the piston rings will help the engine when it is started up). Next carefully replace the cylinder. There is no difficulty about this, though when the job is being tackled for the first time it is possibly as well to have the assistance of a second pair of hands to avoid any straining of the connecting-rod or any risk of damage to the piston rings.

The cylinder must be fetched up to the piston with the ports in approximately the correct position. There must be no twisting the cylinder or one of the rings may become trapped in a port. Holding the cylinder and piston true with each other, slide the cylinder on to the piston as far as the first piston ring. Then press this ring home in its groove and slip the cylinder over it. Once again no force is needed, nor must any be used.

Treat the second ring in similar fashion and fit the cylinder base on to those four studs that protrude from the crankcase. Then screw the nuts with their spring washers (if any) on to the studs until the nuts are just finger-tight and the cylinder base held just home. Tighten one of the four nuts a quarter of a turn and then the nut that is diagonally opposite. Next follow suit with first one of the two remaining nuts and then the other.

Now return to the first nut. Give this a quarter or a sixth of a turn and proceed to attend similarly, and in the





same original sequence, to the other nuts. Continue in this manner until all are tight.

The silencing system can next be replaced and then the compression-release control. Where a little advice is, perhaps, needed is in regard to the setting of the latter. It is essential, in normal running, that the valve is properly home on its seat. This means that the control wire must be adjusted so that there is slight free movement in the handlebar control before the valve starts to open.

Finally, there are the sparking plug and the carburettor, which, as mentioned previously, must be pushed right home on the inlet stub because otherwise there may be an air leak.

If, at any time, it is decided to remove the cylinder head, undo the fixing bolts before the cylinder is detached from the crankcase. The cylinder is then held firmly. When replacing the head, do so after the cylinder has been fitted on the crankcase; see that the surfaces which form the joint are free from dirt, and tighten the bolts evenly in precisely the same manner as the cylinder holding-down nuts.

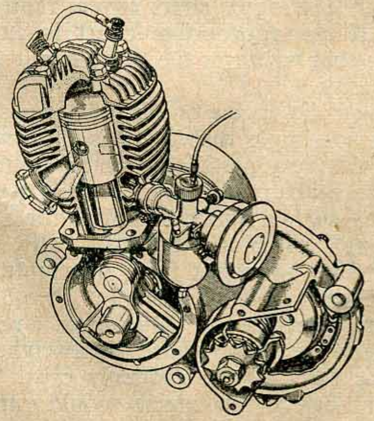


*Fig. 59—A cut-away drawing revealing the detail construction of the 98 c.c. Mark 2F Villiers autocycle unit. The near-side crankcase half has been removed for clarity*

CHAPTER 15

# Tracing Troubles

THE great secret in tracing any little trouble is to be methodical, thinking and acting along definite lines instead of darting here and there. This is so irrespective of whether the engine suddenly ceased to fire, whether it will not start from cold or hot or whether it runs badly, perhaps misfiring. On pages 98 and 99 will be found two "Tracing Troubles" charts specially designed by *The Motor Cycle* to help the user of a two-stroke engine. As will be seen, they are based on the theme of logical sequence.

One of the charts is for use when the engine fails to start, which includes, of course, the case where the engine suddenly cuts out during the course of a run and then refuses to go. The other chart covers faulty running of the engine. If the appropriate chart is employed it is almost certain that whatever the trouble is it will be traced quickly and easily.

With a two-stroke engine one is, of course, dealing with a power unit so simple that there is little which can go wrong. But this very simplicity seems at times to make elucidation more abstruse. And there is the fact that a two-stroke has such a marked ability for continuing to run even though off-colour that eventually, when trouble does occur, it may arise not from one fault, but several.

A case is cited in the handbook "Two-Stroke Motor Cycles" where a member of *The Motor Cycle* Staff went to the rescue of a man whose lightweight two-stroke, after daily use for months, suddenly cried "Enough!" He found that before the engine would run properly it was necessary (1) to replace the perished high-tension cable, (2) to fit a new sparking plug (the old one had mica insulation which had flaked), (3) to fit a new jet needle





and (4) to clean up the contact-breaker points (later, new ones were fitted). This was an altogether exceptional case of an engine which, following years of use, had suddenly died on its owner, but it does constitute a rather telling example of how, when there is more than one fault, it may be necessary to attend to a series of points. As will be seen, the "Tracing Troubles" charts will help irrespective of whether the trouble is a singleton or a combination.

There are, however, a few troubles which experience with autocycles and contact with autocycle owners suggest as being among the most frequent. One of these results from improvident use of metal polish. It is an axiom that, if air cannot get into the petroil tank, petroil cannot flow to the carburettor. To enable air to enter the tank there is a little air vent—generally a very small hole—in the top of the tank filler cap. Need it be added that this hole must not be allowed to become choked, whether by metal polish or anything else?

Where the filler-cap vent is partially choked one may have the puzzling fact that the machine will run for half a mile or a mile, stop, and after a minute or two, during which some petroil will have reached the carburettor, start up and run for, say, another half a mile. Puzzling, yet so simple!

A perished high-tension cable has been mentioned. These cables, if they are allowed to touch the hot cylinder, can become burnt through; they can also become chafed. The puzzle that arises here is that, when the plug is removed and laid on the cylinder for checking whether there is a spark, the high-tension cable is clear of the cylinder or cylinder head—in other words, the current is no longer being short-circuited. From this it will be gathered that it is wise always to arrange the high-tension cable so that it remains clear of the cylinder or cylinder head. This can be done by screwing up the plug terminal hard with the cable so placed that it is out of harm's way. If the terminal is not of the screw type, but has a clip, it may be necessary to twist the cable half a turn or a complete turn before attaching it to the plug.

Now a more detailed explanation of how to check whether

## AUTOCYCLE TRACING-TROUBLES CHARTS

### ENGINE WILL NOT START

- PETROIL DRIPS FROM MIXING CHAMBER ON DEPRESSION OF TICKLER
  - No spark at plug
    - Plug oiled up
      - Thread of metal bridging plug points
      - Damp or faulty plug insulation
      - Failure of magneto windings
    - Chafed or perished H.T. lead
      - Contact-breaker points not opening or closing properly
      - Incorrect gap at points
      - Dirty points
      - H.T. pick-up cracked
  - Stuck throttle
    - Broken throttle cable
  - Excessive flooding having caused neat petroil to enter engine
  - Spark at plug
    - Failing to spark under compression
    - Try new plug or clean old one
    - Check over ignition system
    - Ignition timing slipped
- Stuck compression-release valve
- PETROIL FAILS TO DRIP FROM MIXING CHAMBER
  - Petroil tap off
    - Empty tank
    - Choked filler cap vent
    - Petroil tap or pipe choked
    - Air lock in pipe
  - Float needle stuck
    - Passage from float chamber to jet choked
    - Jet obstructed

THE MOTOR CYCLE







### FAULTY RUNNING OF ENGINE

- MISFIRES
  - Sticking compression-release valve
    - Crankcase drain plug missing
  - Dirty plug
    - Unsuitable plug
    - Contact points dirty
    - Points not closing or opening properly
    - Water reaching plug and H.T. lead
    - Faulty H.T. lead
    - Cracked H.T. pick-up
    - Loose or faulty condenser (If loose, as temporary expedient switch on lights)
  - Water in fuel
    - Dirt in carburettor
    - Partially obstructed air vent in filler cap
- LACK OF POWER
  - Exhaust system choked
    - Leaking cylinder head
    - Faulty piston rings
    - Worn cylinder bore
  - Incorrect ignition timing
    - Obstruction in fuel supply
    - Brakes binding
    - Chain too tight
    - Faulty lubrication
- KNOCKS
  - Heavy carbon deposit
  - Unsuitable plug
  - Ignition timing too advanced
  - Roughness in cylinder head
  - Fuel supply or jet obstructed
  - Carburettor set too weak
  - Fuel of low anti-knock value
  - Faulty cylinder head joint
  - Faulty lubrication

there is a spark at the appointed place—the plug points. All we have to do is to remove the plug and place it on top of the cylinder so that only the body of the plug touches the cylinder, and the terminal, to which the high-tension cable is attached, is well clear of the cylinder or any other metal part. Now rotate the engine either by pushing the machine with the clutch home or, preferably, by use of the pedals with the machine on its stand. A regular spark should occur at the plug points. Bear in mind that the fact that a spark occurs at the points in the open air is not absolute proof that a spark occurs under compression. Owing to oil and carbon the spark may, under compression, occur inside the plug instead of at the points.

If a plug fails to spark, look very closely at the gap between the central electrode and the side point or points. Sometimes a very thin slither of metal will be found bridging the gap and preventing a spark occurring. Removal is merely a matter of running a penknife blade, or even a pin, between the points, thus knocking it off.

Remember that, when an engine is comparatively new, there is the possibility of the fibre heel on the contact-breaker bedding down a little—perhaps to the extent that the contact-breaker points do not separate, as they must do if the circuit is to be broken and a spark occur. Adjustment is discussed in Chapter 13, so need not be touched on here.

If at any time the engine stops suddenly and locks the back wheel until the clutch lever is raised, there are two possibilities. One is that the sparking plug is of the wrong type and incapable of withstanding the heat. Or perhaps there is some obstruction in the fuel system which is causing a weak mixture; lean mixtures mean more heat and can result in this pre-ignition even with a plug which is of the correct type. Another possible cause of this locking up is partial seizure of the piston. This is unlikely —very—but can occur with a new piston or if the owner has failed to mix the proper quantity of suitable oil with the petrol. A weak petroil-air mixture can also be at the root of the trouble. Where the trouble is pre-ignition





the plug points will have that hard, whitish appearance mentioned earlier. Also, the engine will rotate freely once the throttle is closed. In the case of partial piston seizure—drying-up, it is often called—it will be a moment or two before the engine is free. While these possible troubles are mentioned, the chances of either in these days, except because of soot (*vide* the last chapter), are at least 1,000 to 1—maybe, 10,000 to 1.

This guide to good ownership is coming to an end; may one bit of rather obvious advice be given? It is just this: it pays to adopt the old adage " a stitch in time ". While it is foolish to disturb the cylinder and piston when the engine is running well, it is even greater folly not to top up that primary chain case, adjust the final driving chain when it needs it, occasionally see that the plug and contact-breaker gaps are approximately correct—indeed, attend to any of the little maintenance tasks; there are not many.

Finally, please remember that *The Motor Cycle* is always available for friendly helpful advice, so if you are in doubt on any point in connection with your autocycle, drop a line to *The Motor Cycle*, Dorset House, Stamford Street, London, S.E.1., enclosing a stamped, addressed envelope for the reply.

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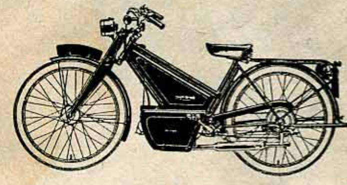

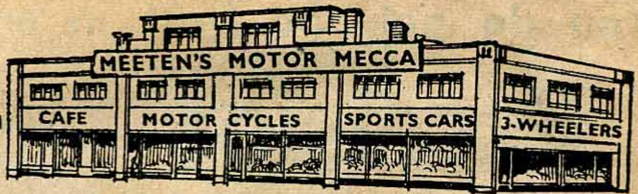


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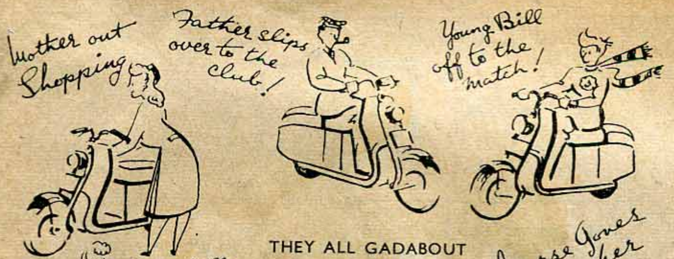



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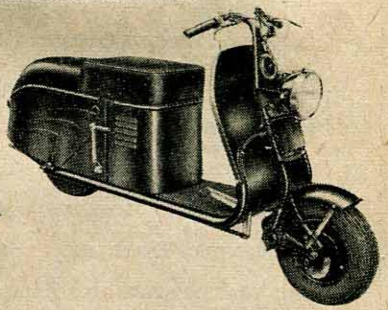


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