Autocycles and Cyclemotors

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"THE MOTOR CYCLE" DIARY

AUTOCYCLES AND CYCLEMOTORS

How to Get the Best from Them

By
THE STAFF OF
THE MOTOR CYCLE

With 80 *illustrations*

SECOND EDITION

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Foreword

ANYONE who can ride a pedal cycle will feel at home on an autocycle or a bicycle fitted with a cyclemotor in a matter of minutes. Tending these machines is also simple. There are, however, various little hints and tips on riding and maintenance which come with experience, and the aim of this handbook is to pass on the accumulated knowledge which members of *The Motor Cycle* Staff have gained over the years.

The title, "Autocycles and Cyclemotors: How to Get the Best from Them", gives a good general indication of the contents, but, as will be found from the chapter headings on page 5, every facet of ownership is embraced, from 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 their most economical, ever growing more popular, little vehicles.

H. W. LOUIS,
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Abbreviations Used in This Book

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

What they are

WHAT is an autocycle? What is a cyclemotor? The generally accepted answer to the former question 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.

Note the word " machine "—an autocycle is a complete machine, usually of 98 c.c. A cyclemotor, on the other hand, is an engine unit designed for attachment to an existing bicycle. As a rule, the engine is half or, perhaps, only a quarter the size of that of an autocycle. Sometimes these engines are called " motor attachments ", " micro-motors " or just " clip-ons ", or the machine as a whole may be termed a " motor-assisted bicycle ". The meaning in each case is clear—more or less—but there is at least one now-famous model which, although of only 45 c.c. and essentially cyclemotor in performance, is sold as a complete machine. In general, however, the definitions hold good.

Obviously, in view of its engine size, the autocycle has greater power and is capable of higher speeds than the bicycle fitted with a cyclemotor. The small yet powerful 98 c.c. engine of the standard British autocycle does far more than assist the machine and rider along. Once started, the engine takes care of the work and the pedals become rests for the feet, plus, in some instances, the means of applying the rear brake.

Such machines will tour along at 15, 20 or something close to 30 m.p.h. The owner can travel at approximately cycling speed admiring the countryside, the engine providing the propulsion and thus making the journey joyous relaxation, or forge ahead at a rate which, over give-and-take roads, will result in an all-in average of 20–25 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.

So much for autocycles: what about the capabilities of cyclemotors? With these the aim is also to provide cycling without effort, but—and this is important—at no more, or little more, than bicycle speeds. As opposed to a machine weighing 100 or 120 lb, there is a pedal cycle of normal weight plus an engine unit which comes out at no more than 20 lb. The theme is " bicycle " and, since one is using an ordinary pedal cycle designed for human propulsion, wisdom dictates that the power output of the engine, and the speeds used, be appropriate. Otherwise, frames, wheels, tyres—everything—must be strengthened to cope, and the machine becomes akin, in weight and cost, to its larger brother, the autocycle.

On normal roads and with no opposing gale of wind, it is a case of free-wheeling all the way. Against a powerful head-wind or up a steepish hill, the engine renders easy a task which would be burdensome. Gentle twirling of the pedals is usually all that is required—so gentle that frequently it comes as a surprise to see cyclists struggling.

In the main, the method of control is the same irrespective of whether the machine is an autocycle or a bicycle fitted with a cyclemotor. Usually, once the machine is under way, it is merely a matter of operating a lever on the right of the 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 slow down and, finally, stop. With an autocycle and with the majority of cyclemotors there is also a means of disconnecting the drive from the engine to the wheel—either by what is known as a clutch or, with some cyclemotor designs which employ roller drive to the tyre, moving the roller relative to the wheel. In either case there is an accessible, easily operated lever. Where there is a " clutch " the engine can be kept running while the

machine is stationary at, say, traffic lights and then used to assist the getaway when the lights change to green.

Control, with either an autocycle or a bicycle fitted with a cyclemotor, is so simple that, in a matter of minutes, anyone who has ridden a bicycle feels confidence. On many occasions we of *The Motor Cycle* 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 and to cyclemotors—but the cycling without effort, which is the natural prerogative of ownership, spells a fresh and frequently 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, exept 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 more distant parts of the country, the Mancunian visiting Land's End and the Londoner, the Lake District.

This is where the autocycle and the bicycle with a cyclemotor score so heavily; they constitute a key to the beauty of this country of ours at a cost comparable with that of shoe leather.

Although the elderly have been mentioned, it is not only those no longer in their first youth to whom the almost continuous free-wheeling can be a boon. The youngster will frequently find that the machine spells fresh freedom and, incidentally, there is no cheaper form of personal motor transport and no better stepping-stone from a bicycle to a motor cycle.

Thousands of autocycles and motor-assisted bicycles are used as a healthy, carefree method of getting to and from office or factory. And it is a fact that the riders of such machines remain singularly free from ailments like colds and influenza. It is also a fact that use of an autocycle or a bicycle with a cyclemotor is, generally, 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 or a cyclemotor 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 frequently 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 or a cyclemotor can mean much.

CHAPTER 2

What they cost

AT the time this book goes to press, the prices of cyclemotors vary from £21 to £40 for an out-of-the-ordinary design incorporating a two-speed gear. The general run of prices is between £21 and £27 10s. Autocycles, being complete machines, are naturally more expensive and, unlike cyclemotors, are subject in Great Britain to purchase tax. The cheapest comes out at £63 17s 10d, inclusive of tax, and the dearest, £81 15s 7d. The latter machine has a two-speed gear, whereas the majority are single-gear mounts.. Since the average price, with tax, is £71 3s 0d, it will be realized that there is a measure of standardization in the specifications of the machines. The majority have the same type and size of engine, the excellent 98 c.c. Villiers engine-and-clutch unit.

By the way, purchase tax on motor cycles and autocycles comes out at $16\frac{2}{3}$ per cent of the total price.

Where a cyclemotor is purchased it is, of course, usual to fit it or have it fitted to a pedal cycle which one owns already. It is free from purchase tax on the basis that it is a fitting or attachment. A complete machine, as in the case of one very excellent model which has a special frame, automatically carries the tax. It cannot be over-emphasized that the pedal cycle to which a cyclemotor is to be attached must be in thoroughly sound order. To fit a motor to an elderly and somewhat decrepit bicycle is not only to risk trouble, but also, possibly, to run into danger. There will be more on this aspect later, but it is desirable that this point should be realized straightaway and allowance made for the purchase of a sturdy roadster bicycle if the machine on hand is a doubtful proposition or cannot be rendered suitable by, say, an overhaul.

Normally a brand-new cyclemotor will be purchased and not one which is second-hand, though, of course, it is not unknown for people to buy pedal cycles which have already been equipped with cyclemotors. Obviously, whether one is buying a cyclemotor or an autocycle, it is more pleasurable to have one which is brand-new. And there is the point that even the man or woman who has no mechanical bent can purchase either without any fear that harm will arise owing to mishandling.

In normal times it is the initial depreciation in cost that is the heaviest. Frequently, where an autocycle is concerned, a useful saving can be effected by buying second-hand. Quite likely the machine has belonged to someone who, having once become accustomed to the machine and particularly to having 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 available at a figure pleasantly below the original list price.

Where a second-hand autocycle is concerned, anyone with a knowledge of pedal cycles should gain a fair idea of the machine's condition—the state of the cycle parts alone is likely to afford more than 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 frequently unasked, will issue, say, a three-months' guarantee on any second-hand autocycle they have for sale. This covers the provision of free parts to replace any which prove faulty during the guarantee period.

Taxation on an autocycle or a machine fitted with a cyclemotor 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 if one has passed the driving test or held a driving licence previous to 1 April, 1934. Otherwise, a provisional driving licence costing 5s for three months must be obtained. The intention of the authorities is that the holder of a provisional licence shall go for his or her driving test within the three months, though actually the regulation is so framed that anyone can obtain a succession of such licences and continue indefinitely as an " L "-plate rider or driver. There is nothing frightening about the driving test, except perhaps the fee, which is 10s. The driving-test examiners are human and, almost invariably, helpful, but they have to make certain that the rider is competent in handling his or her machine *and* knows the Highway Code inside out. During the rider's " L "-plate or learner period, any pillion passenger must hold a licence to drive motor cycles and have passed the driving test or have held the " full " driving licence for at least two years, *except* in the case of tandem bicycles fitted with cyclemotors; with these latter a passenger need not hold or have held a driving licence.

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 a cyclemotor machine or an autocycle. Some manufacturers offer special insurance policies which they have negotiated with underwriters. The catalogue issued with any given make will invariably quote details. Examples are 12s 6d a year for a third-party policy in the case of one make of cyclemotor and a £1 17s 6d " family " policy on another which covers everyone who has a licence to drive and includes, in addition to third-party risks, fire, theft and accidental damage to the machine and motor.

The so-called " tariff " insurance companies quote 21s 9d for a third-party policy on an autocycle of single-geared type, 32s 6d for third-party, fire and theft and 76s 6d 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 machines which are constructed or adapted for the carriage of goods. Such models 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 for autocycles are: 20s, third-party; £1 12s, third-party, fire and theft; £2 17s 6d, comprehensive. Like the makers of cyclemotors, some autocycle manufacturers have their own special insurance policies. For cyclemotors the D.U. rates are: 15s, third-party; £1 2s 6d, third-party, fire and theft; and £2, comprehensive. Comparable " tariff " rates for single-gear cyclemotors are 13s 6d, 19s 6d and £2 5s respectively.

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 or a machine fitted with a cyclemotor 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 and is issued by insurance companies pending the machine's 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 or cyclemotor machine has not

previously been registered, 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, as is generally easier (there may be a queue at the licensing authority), do the whole thing by post. With a new or other unregistered 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 for the machine (or cyclemotor).

If the machine has already been 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.

Incidentally, some of those who fit cyclemotors to existing pedal cycles may overlook the fact that a bell is no longer legal as the " warning instrument." A horn must be fitted 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 30 September, 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. 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.

It is interesting, too, 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.

As would be expected, the cyclemotor uses even less petrol and oil than an autocycle. A gallon of petrol enables the owner to cover a minimum of 200 miles, and it is quite usual for the m.p.g.—the miles per gallon—to be 250–300. Tests carried out by *The Motor Cycle* reveal that, phenomenal though such figures may appear to be, running costs may rightly be based on them. What other expenses there are—additional to the cost of licences and insurance—depends on the condition of the bicycle to which the cyclemotor is attached and whether the machine is driven at pedal-cycle speeds or harder. As has been suggested earlier, the power of the engine should be used to provide cycling without effort rather than cycling " plus ". In the latter case greater loads are being imposed than those for which the bicycle was designed, and wear and tear will be more rapid, with consequent greater running cost.

Then there are the maintenance costs in connection with the motor and its drive. The periodical decarbonization and check-over of the engine costs 10s–15s and is required, on average, every 1,000 to 2,000 miles. As will be gathered from the chapter on the subject, decarbonizing these simple little engines is quite straightforward and consequently many owners carry it out themselves as a matter of course. Over the drive, where this is by roller to the front or rear wheel, the tyre with which the roller engages naturally wears more rapidly than that of a normal bicycle.

These rollers function best in conjunction with a continuous tread, such as that of a ribbed-type tyre, rather than a studded or knobbly tread which " catches " on the surface of the roller. A point to bear in mind in this connection is that if the inner tube of the tyre with which the roller mates is repaired with a thick patch, there will inevitably be a hump in the tyre at this particular point and the tread in the vicinity will wear more rapidly than the rest of the tyre. The rule with roller drives, therefore, is that any patching rubber shall be thin and preferably have bevelled edges.

Experience shows that tandem-type tyres used with roller drive generally last for about 2,000 miles and that the tyres developed specially for roller-drive machines give an even greater mileage.

With cyclemotor machines growing in popularity at the rate of thousands a week, no doubt an increasing number of logs of expenditure will be reaching *The Motor Cycle* Offices annually. Discussions with owners, however, suggest that only a tiny percentage will ever bother to keep careful figures. The general reaction is one of amazement that the running cost should be so low, and the average owner appears to be content to leave matters at that!

CHAPTER 3

How the Engine Works

OF all internal-combustion engines, the three-port two-stroke type is by 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 two-stroke 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 cylinder. Fig. 1, on the next page, shows the bicycling and Fig. 2 the elements of an autocycle engine or cyclemotor. 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 (or roller) 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 detail, but still in a diagrammatic form. Solely for clarity, the engine is shown with the cylinder arranged vertically

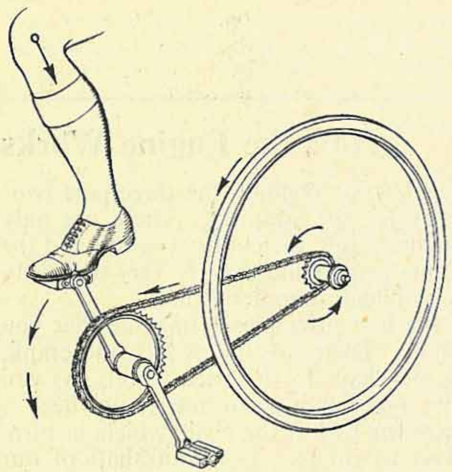


Fig. 1—Pedalling—an action which is familiar to all !

instead of horizontally, which is the disposition in autocycles and a few cyclemotors. 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 a—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 seen in a minute or two, is to deflect the fresh petrol-air gas upward and away from the gas which

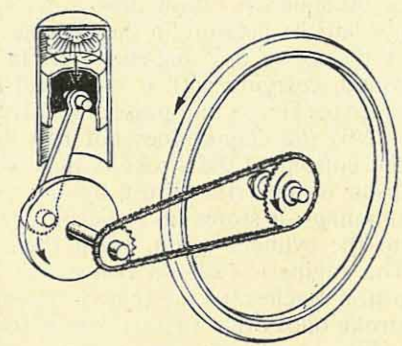


Fig. 2—No difficulty will be experienced in understanding how the engine drives the back wheel, particularly if this drawing is compared with Fig. 1

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 one or more passages. The former are the means of entry and exit for the gases and are called " ports".

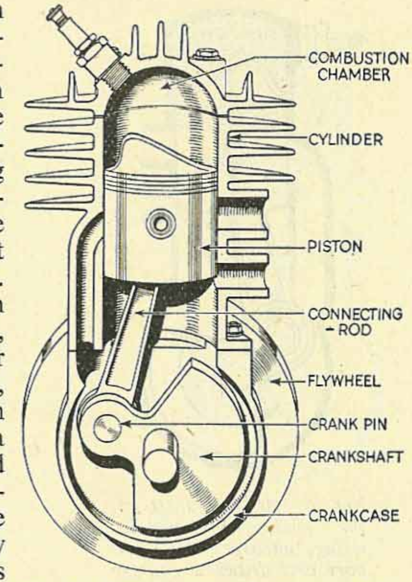


Fig. 3—Components of a two-stroke engine such as is fitted to autocycles and cyclemotors

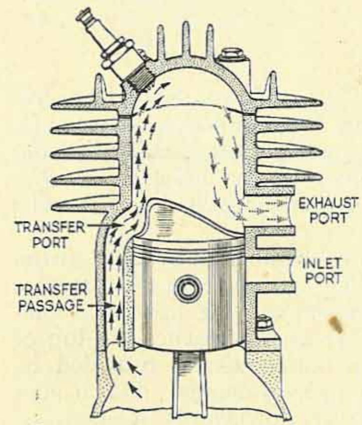


Fig. 4 shows the various ports in the cylinder.

Next look at Fig. 5. The piston in this diagram is shown moving upwards. As it does so, the bottom of the piston uncovers the inlet port. The crankcase, as we know, is a

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

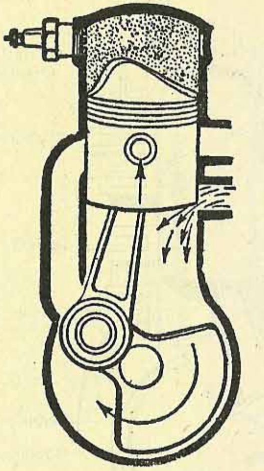


Fig. 5—At the start of the cycle, the piston, rising, uncovers the inlet port and draws a charge of gas into the crankcase. At the same time the upper side of the piston compresses the charge from the previous cycle

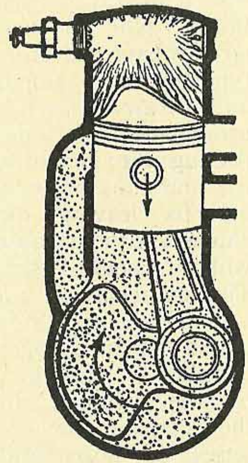


Fig. 6—The compressed charge is ignited; the piston, descending, now compresses the charge waiting in the crankcase

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 the magneto, ignites the compressed charge. Down goes the piston (Fig. 6). As it travels downwards, it uncovers,

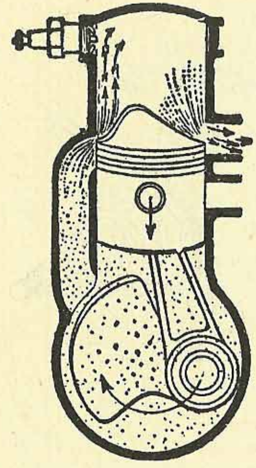


Fig. 7—Continuing downwards, the piston first uncovers the exhaust port, so releasing the burnt gas. Then the transfer is opened and the new charge rushes up from the crankcase to the combustion chamber

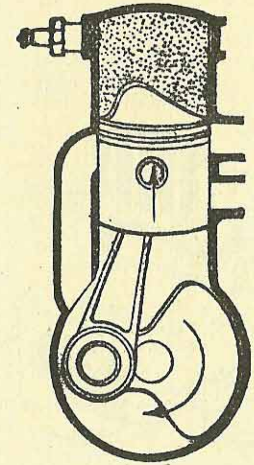


Fig. 8—The piston, rising again, starts a further cycle of operations

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

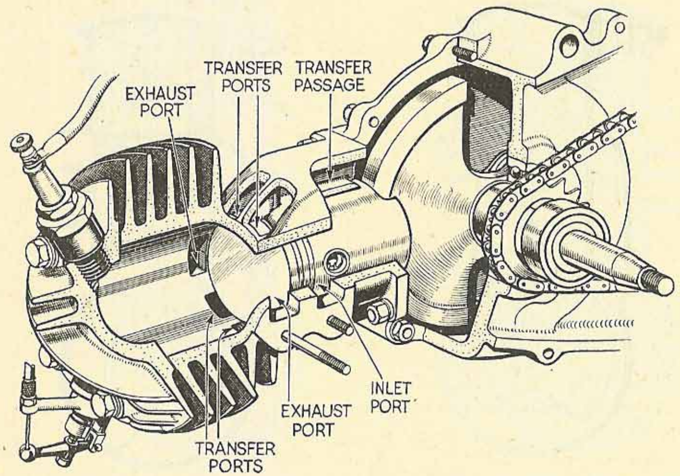


Fig. 9—In this drawing is shown the construction of the Villiers Junior-de-luxe engine, which is fitted to thousands of autocycles

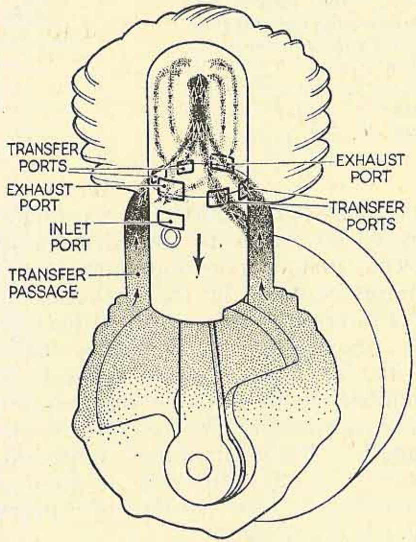


Fig. 10—Gas flow in the Villiers Junior-de-luxe engine, which has a flat-topped, as opposed to a humped, or deflector, piston

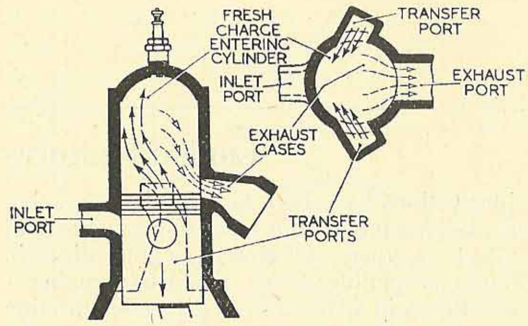


Fig. 11—Port arrangement and gas flow in the latest Villiers autocycle engine, the Mark 2F

All standard two-stroke engines of cyclemotor, 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 127. The earlier Villiers autocycle engines had deflector-type pistons, which, as will be seen from the drawings on pages 37–46, are usually employed in cyclemotors.

CHAPTER 4

Engine Features

SO far, the illustrations have been largely diagrammatic. Now let us examine the various parts of an engine and see how they all go together. Of course, engines differ in detail, but if the construction of one two-stroke engine is fully understood, there will be no difficulty in understanding the design of any of the others.

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. 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. In some engines the same object is achieved by brass end-pads fitted in the gudgeon-pin.

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

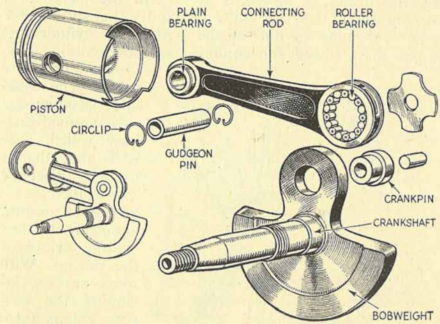


Fig. 12—Crankshaft, piston and connecting-rod of the Villiers Junior-de-luxe engine. In the small drawing on the left the parts are shown fitted together

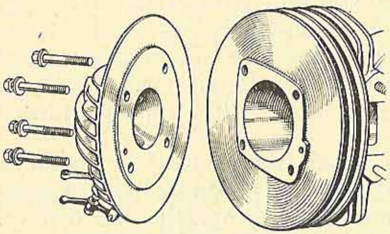


Fig. 13—Detachable aluminium cylinder head of the Junior-de-luxe engine. The cylinder head fits straight on the cylinder barrel without any jointing medium. The fifth hole, the small one, is a passage leading from the compression-release valve to an exhaust port

cylinder bore—might, in fact, become too large for the cylinder and seize. With an aluminium-alloy cyclemotor, autocycle or motor cycle piston the expansion under heat is considerable and piston rings are, therefore, a necessity.

Aluminium 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. The cylinder, as we know, is ribbed for cooling purposes: cooling fins, these ribs are called. The usual 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

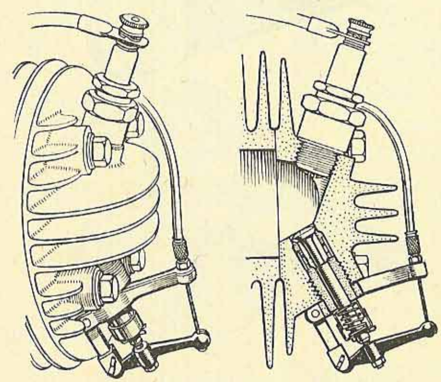


Fig. 14—Construction and general arrangement of a compression-release valve

the cylinder. The Junior - de - luxe engine under review has a detachable aluminium-alloy cylinder head (Fig. 13). The reason for the aluminium 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 ". Aluminium is also used for the cylinders of some engines; in such cases there is an internal tube or " liner ", of special iron, which acts as the bore of the cylinder.

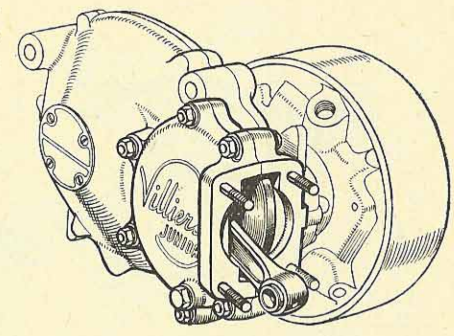


Fig. 15—Crankcase assembly

Screwed at an angle in the Villiers 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.

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, 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

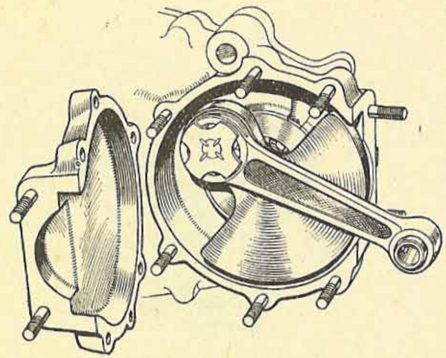


Fig. 16—How the crankshaft assembly is mounted in the crankcase

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 (page 26). 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—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

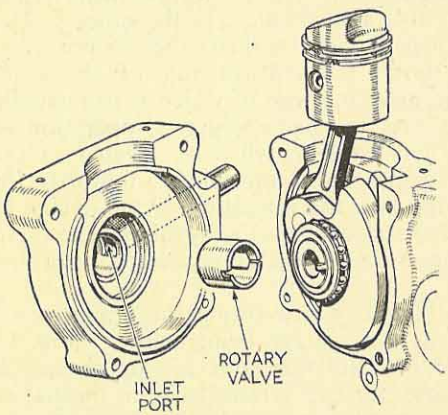


Fig. 17—On the Bantamoto a crankshaft-driven, cylindrical, rotary inlet valve is employed in the crankcase instead of a piston-controlled inlet port in the cylinder

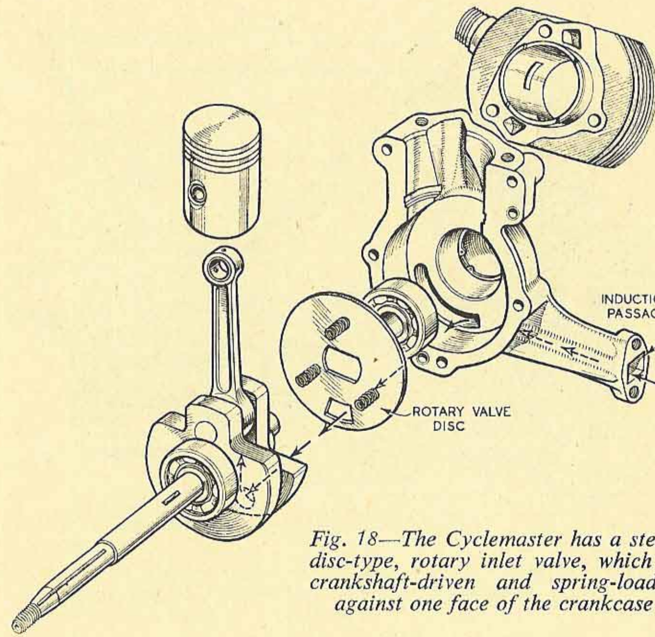


Fig. 18—The Cyclemaster has a steel, disc-type, rotary inlet valve, which is crankshaft-driven and spring-loaded against one face of the crankcase

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 should be readily understood. For example, examine the special drawings of cyclemotors and other engines on the following pages. An exception to the two-stroke principle is the Cucciolo, a four-stroke, shown on page 39.

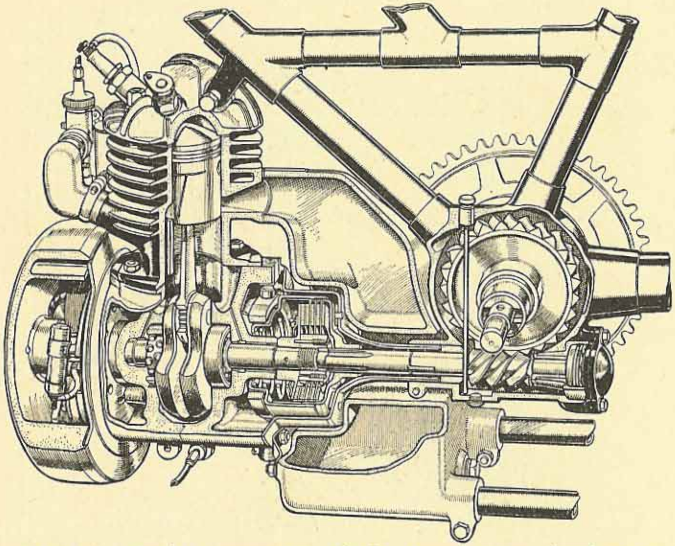


Fig. 19—Detail construction of the Scott engine fitted to a Cyc-Auto. This machine has a worm gear as the primary drive

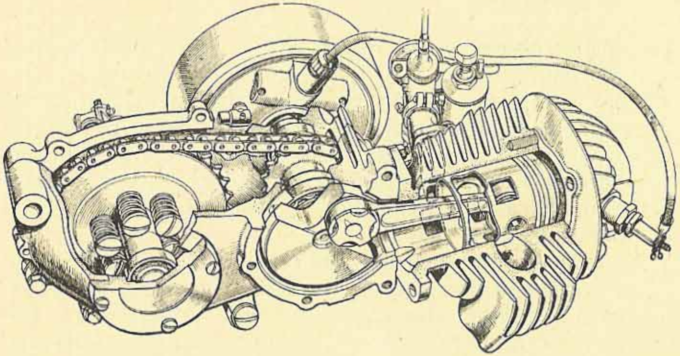


Fig. 20—In the Brockhouse-Excelsior Spryt engine there are special plugs at the transfer ports which are carefully machined to deflect the gas, thus obviating the need for a humped, or deflector, piston

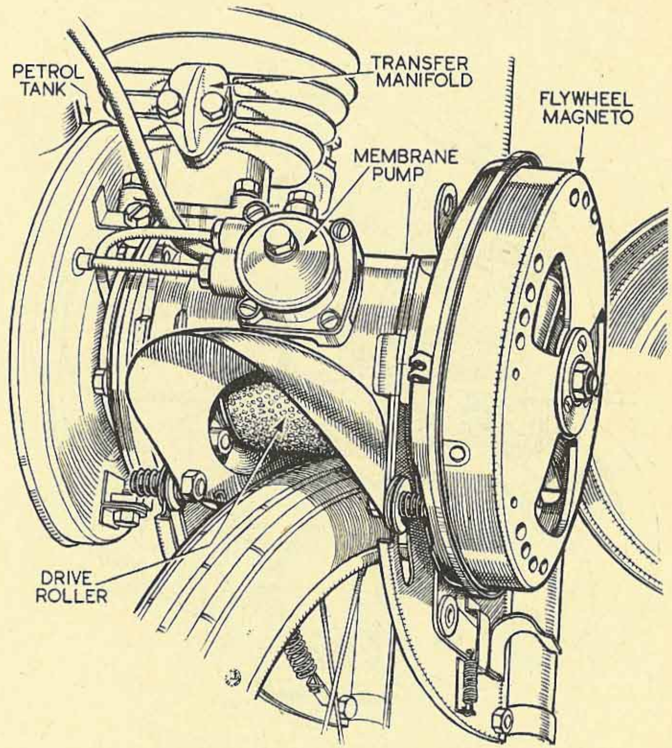


Fig. 21—Although the engine is only of 45 c.c. and drives the front wheel by an emery-faced roller, the VeloSolex is not a cyclemotor for attachment to bicycles but is sold as a complete machine. The frame is of open-type and specially constructed. Unusual features of the engine unit are a membrane pump for lifting the petroil from the 1¾-pint tank mounted on the right of the crankcase (see page 50) and a float-less carburettor, which is illustrated on page 51. The cylinder head is a die-casting in aluminium alloy

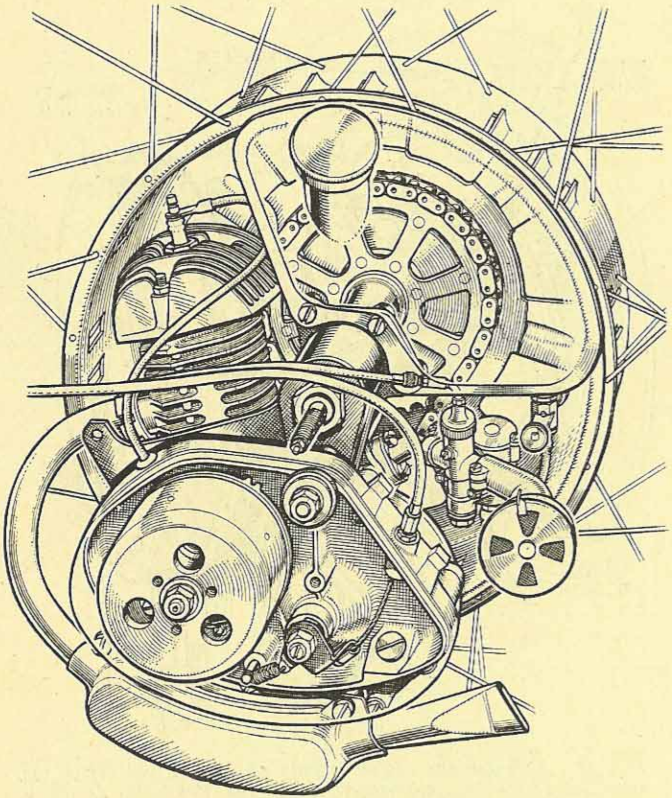


Fig. 22—Of 25·7 c.c. engine capacity, the Cyclemaster is sold as a complete rear wheel. The engine is contained within an open-sided drum, which forms the wheel hub and is provided with louvres designed to assist cooling by directing air on to the engine. In unit with the engine is a single-plate, cork-insert clutch running in oil. Primary and final drives are by chain. A notable feature of the engine is that the inlet port is controlled, not by the piston, but by a crankshaft-driven rotary valve—illustrated on page 33

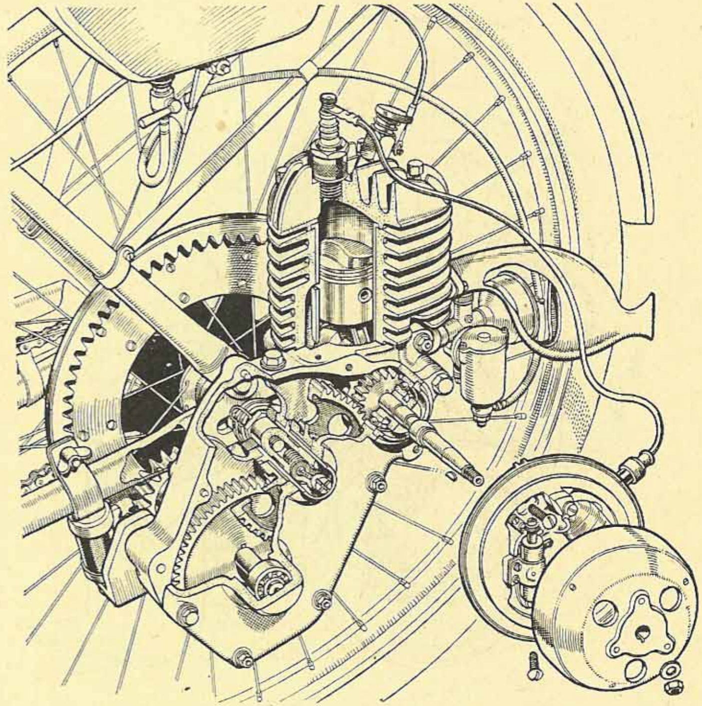


Fig. 23—A train of gears is employed for the drive of the 40 c.c. Bantamoto, which is attached to an extension of the rear-wheel spindle. The engine unit pivots about this spindle within the range permitted by a rubber block attached to the chainstay of the machine; thus there is a rubber-cushioned drive. Like the engine illustrated on the opposite page, the Bantamoto has a rotary inlet valve. This consists of a ported steel cylinder which floats within a phosphor-bronze bush in the right-hand crankcase half and is driven by the crankshaft—see page 32

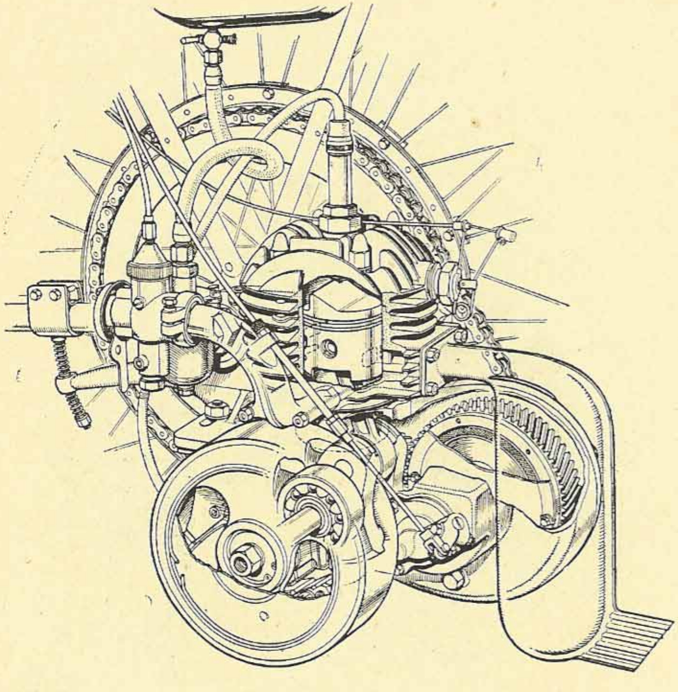


Fig. 24—Of French design and manufacture, the 20 lb, 48 c.c. V.A.P. cyclemotor is mounted on an extension screwed to the rear-wheel spindle and drives through a cone-type clutch and a roller chain. The chainwheel, it will be noted, is clipped to the wheel spokes. Helical pinions between the crankshaft and the chain drive provide a primary gear reduction. The springs just in front of the carburettor's air intake control the pivotal movement of the unit about the rear-wheel spindle and thus act as a transmission shock absorber

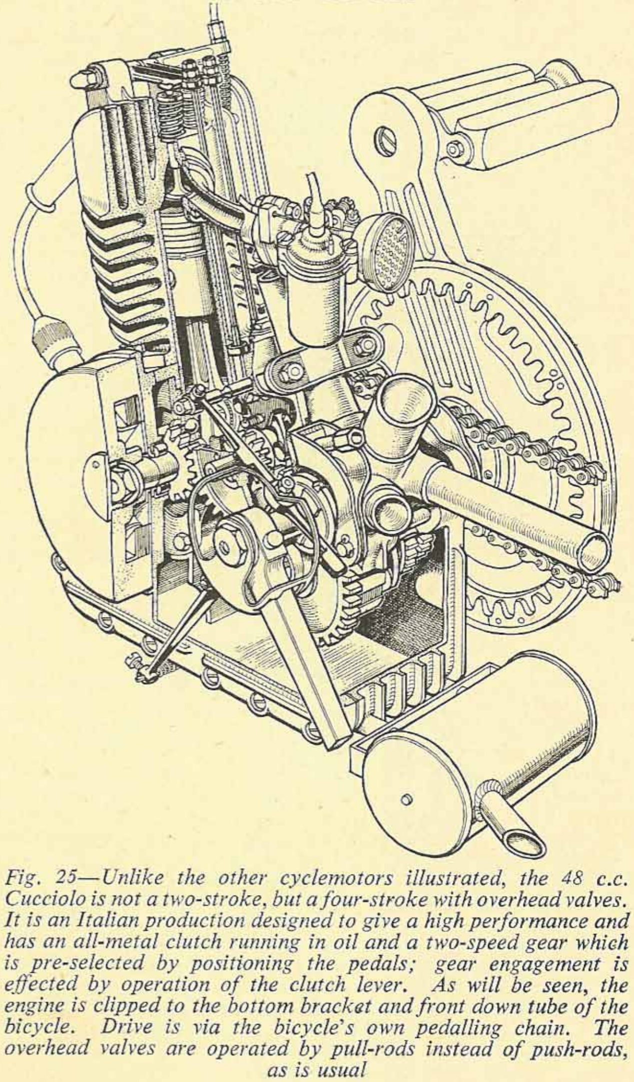


Fig. 25—Unlike the other cyclemotors illustrated, the 48 c.c. Cucciolo is not a two-stroke, but a four-stroke with overhead valves. It is an Italian production designed to give a high performance and has an all-metal clutch running in oil and a two-speed gear which is pre-selected by positioning the pedals; gear engagement is effected by operation of the clutch lever. As will be seen, the engine is clipped to the bottom bracket and front down tube of the bicycle. Drive is via the bicycle's own pedalling chain. The overhead valves are operated by pull-rods instead of push-rods, as is usual

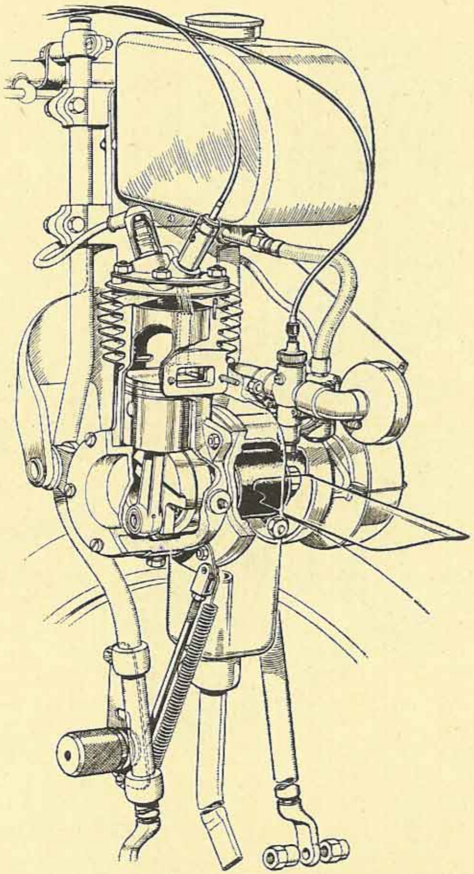


Fig. 26—Mounted over the front wheel on a shock-absorbing sub-frame, the Mocyc drives the front tyre by roller. The sub-frame is attached to the handlebar at the top and the wheel spindle at the bottom, thus reducing the loading on the front fork. The engine is a two-stroke of the flat-topped-piston type with a capacity of 49 c.c.

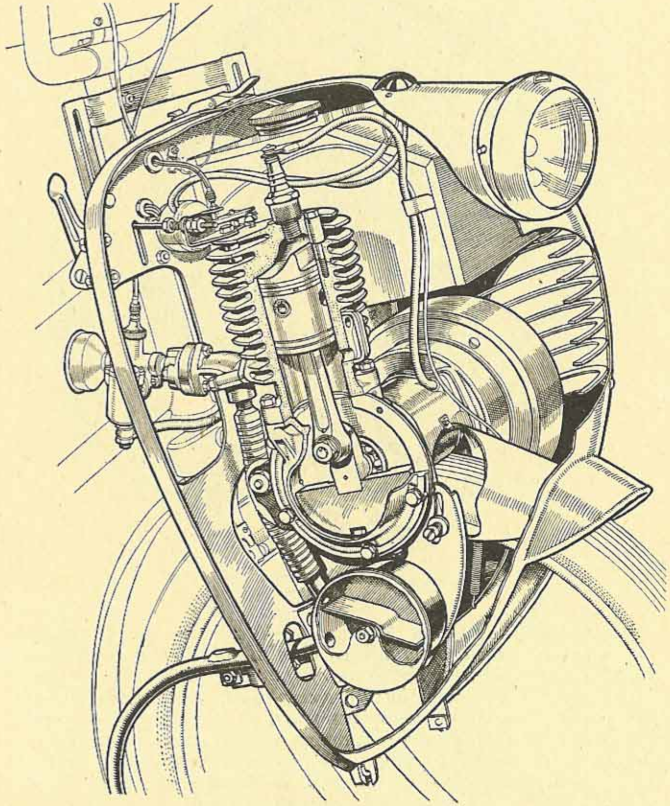


Fig. 27—Another roller-drive design, the 45 c.c. Cymota two-stroke is also mounted over the front wheel. Rubber grommets are employed between the engine unit and the side plates which clamp on the front-fork blades. Weight of the complete, neatly cowled unit is 22 lb. Current for the electric lighting is provided automatically by means of lighting coils in the Miller flywheel magneto. Depression of a conveniently mounted lever brings the roller into contact with the tyre

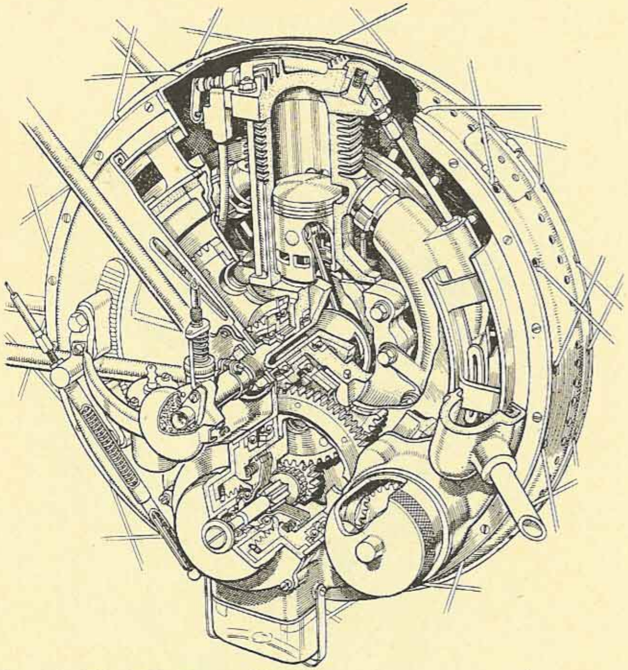


Fig. 28—The T.I. Power Wheel is a 40 c.c., two-stroke rotary engine which spins around a fixed crankshaft (the wheel spindle) and is contained within the drum of the wheel hub. Gear transmission and a five-plate clutch are employed. The design incorporates, among many ingenious features, a rotary inlet valve actuated by the connecting-rod, magneto ignition, a separate gear-driven alternator for lighting, and an internal-expanding brake. Cooling is automatic—the rotating engine acts virtually as the impeller of a centrifugal pump

Fig. 29 (Top)—A vee-belt is employed for the drive between the 31 c.c., two-stroke Cyclaid and the rear wheel. At the front, the engine unit is attached to the saddle pillar by a specially strong pinch-bolt via Silentbloc rubber bushes. A U-shape member attached to special nuts on the wheel spindle supports the rear of the unit. Weight of the unit is 15 lb

(Bottom)—Of 32 c.c. and weighing 15 lb, the Berini two-stroke drives the front wheel through an emery-faced roller. Brackets clamp the unit to the front fork. Roller contact with the tyre is maintained by coil springs, and the drive is disconnected by means of a lever on the left side of the handlebar

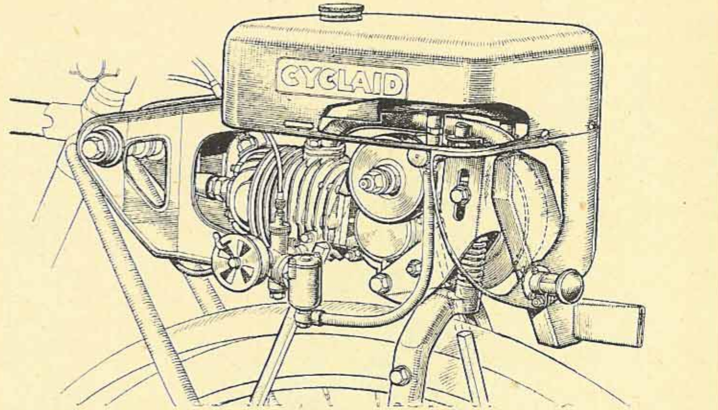
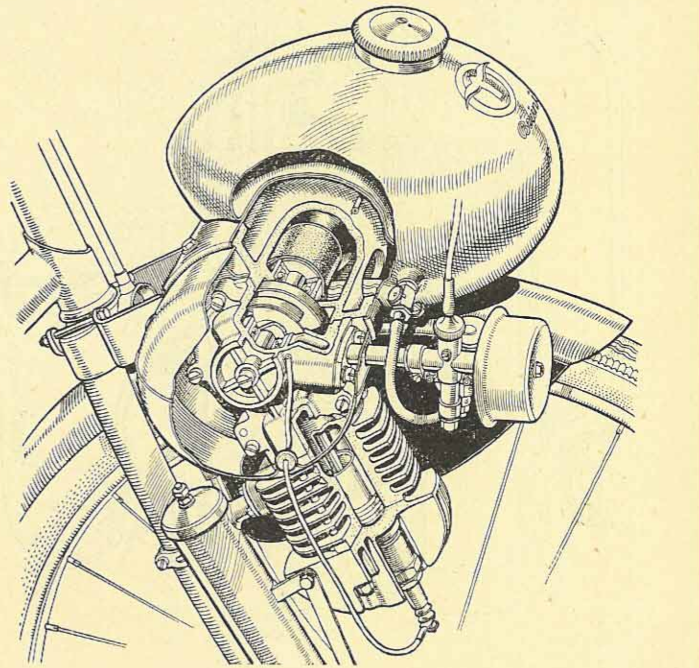


Fig. 29



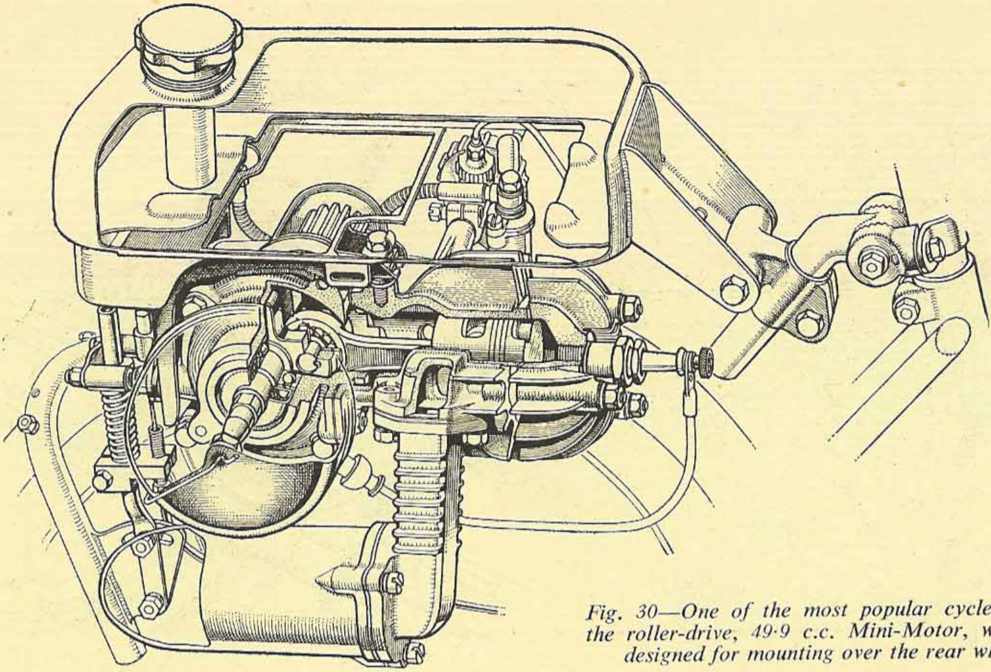


Fig. 30—One of the most popular cyclemotors, the roller-drive, 49·9 c.c. Mini-Motor, which is designed for mounting over the rear wheel

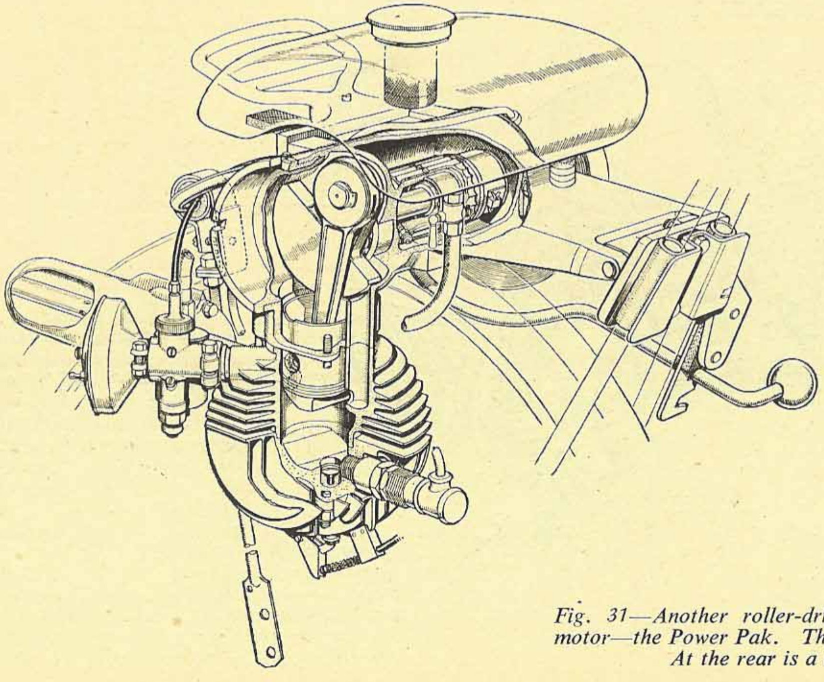


Fig. 31—Another roller-drive, rear-mounted cyclemotor—the Power Pak. The engine unit is of 49 c.c. At the rear is a lifting handle

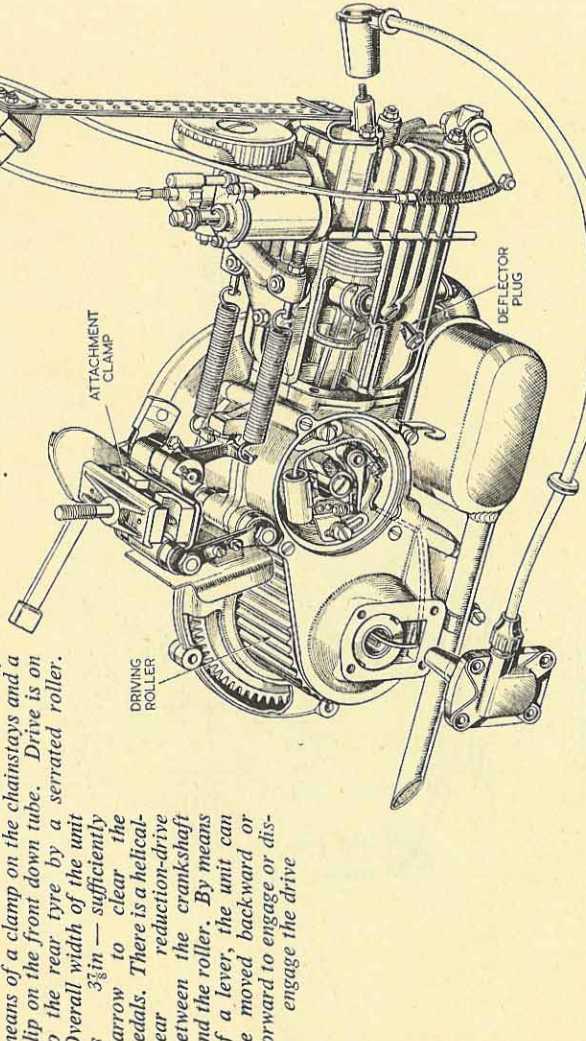


Fig. 32—Designed by the Italian Garelli concern, the 38 c.c. Mosquito two-stroke is mounted beneath the bottom bracket by means of a clamp on the chainstays and a clip on the front down tube. Drive is on to the rear tyre by a serrated roller. Overall width of the unit is $3\frac{7}{8}$in — sufficiently narrow to clear the pedals. There is a helical-gear reduction-drive between the crankshaft and the roller. By means of a lever, the unit can be moved backward or forward to engage or dis-engage the drive

CHAPTER 5

Carburettors 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. 33 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

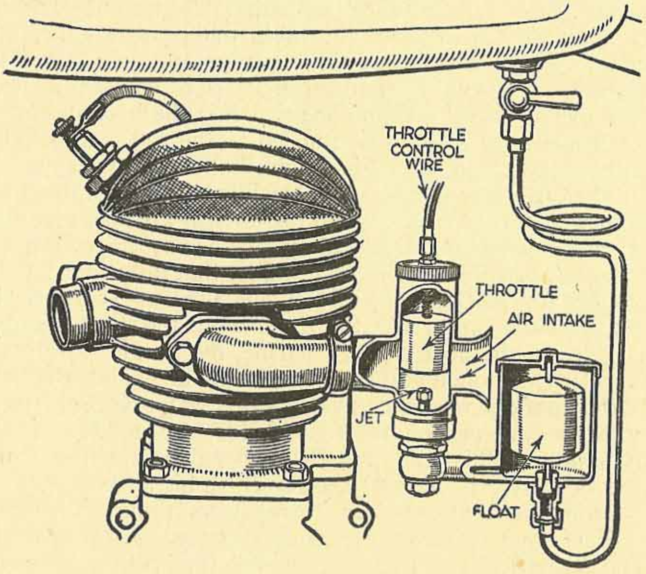


Fig. 33—A diagram revealing how the petrol is fed from the tank to the carburettor and thence to the engine

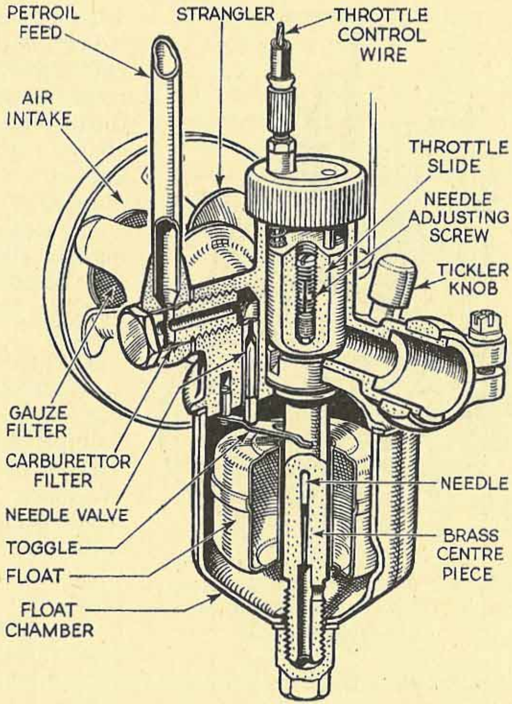


Fig. 34—Detail construction of the Villiers carburettor fitted to nearly all autocycle engines

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 handlebar 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.

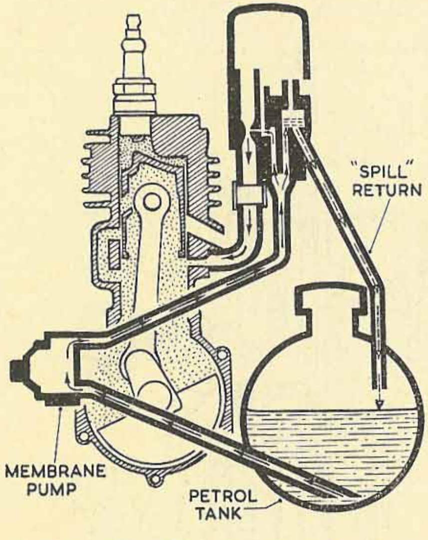


Fig. 35—Principle of operation of the floatless carburettor employed on the VeloSolex. Changes in crankcase pressure operate a membrane pump

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.

Though the carburettor shown in Fig. 33 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 and cyclemotors are not very different. Fig. 34 shows the Villiers instrument, such as is fitted to thousands 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.

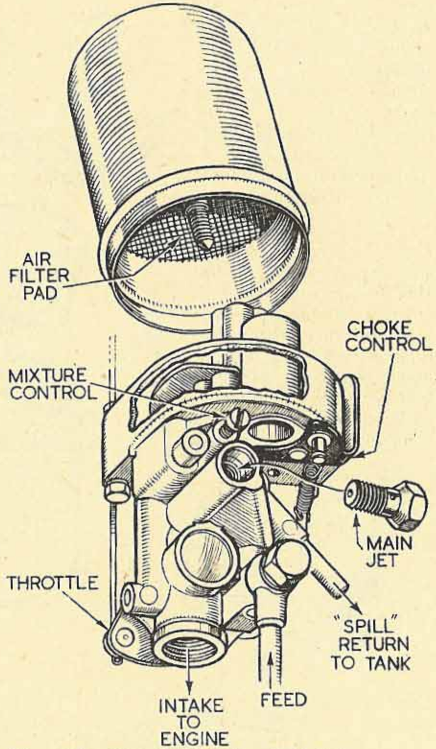


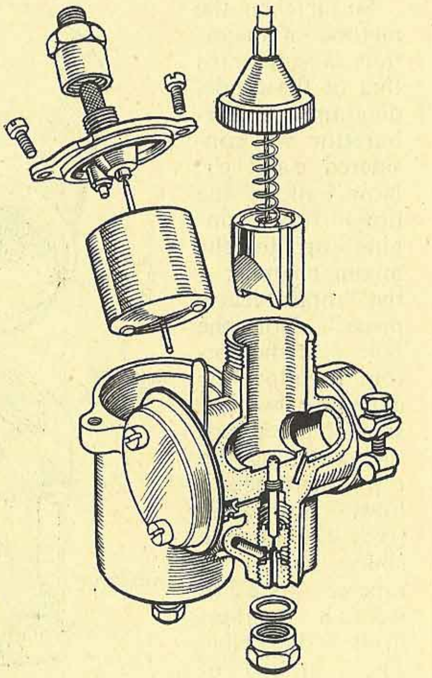
Fig. 36—Details of the VeloSolex carburettor. Fuel is drawn from the tank and fed to the carburettor by the pulsations of the membrane pump

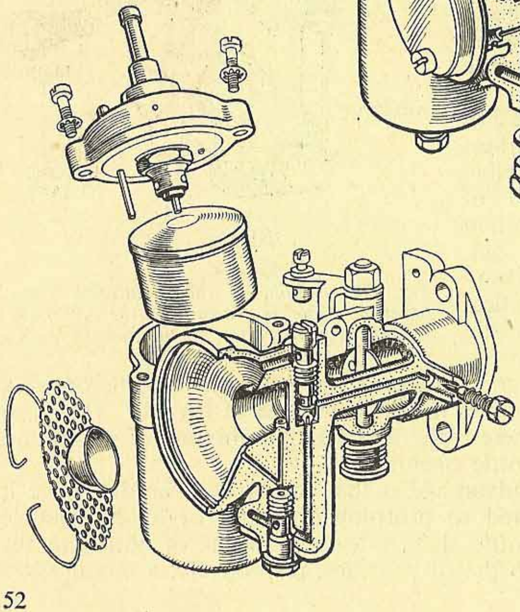
So far, then, the method of operation is similar to that of the crude, diagrammatic carburettor we considered earlier. Now look at the brass tube running up to the mixing chamber—the " brass centre piece ". Note the hole near the bottom to allow the entry of petrol, the small diameter of the outlet at 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

Fig. 37—Simplicity is the keynote of the Zenith carburettor on the V.A.P. cyclemotor. Fuel passes through a single jet and, apart from an air-strangler for cold-starting, mixture strength is controlled automatically by the throttle position

Fig. 38—Main and pilot jets are provided in the Weber-Cucciolo carburettor. For the slow-running mixture there are separate metering adjustments on both air and fuel supplies. This carburettor has a car-type butterfly throttle valve





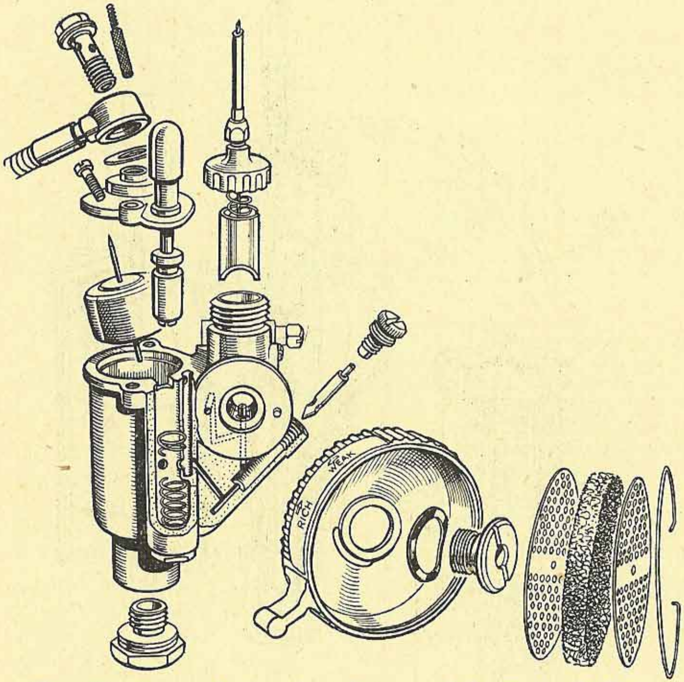


Fig. 39—Among the ingenious features of the Trojan-Dellorto carburettor on the Mini-Motor are a plunger pump to provide cold-starting mixture, a running mixture control operated by rotating the air-cleaner, and a readily detachable main jet

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 pages 93 and 94 (Fig. 58).

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. 34), we see a knob on top of the float

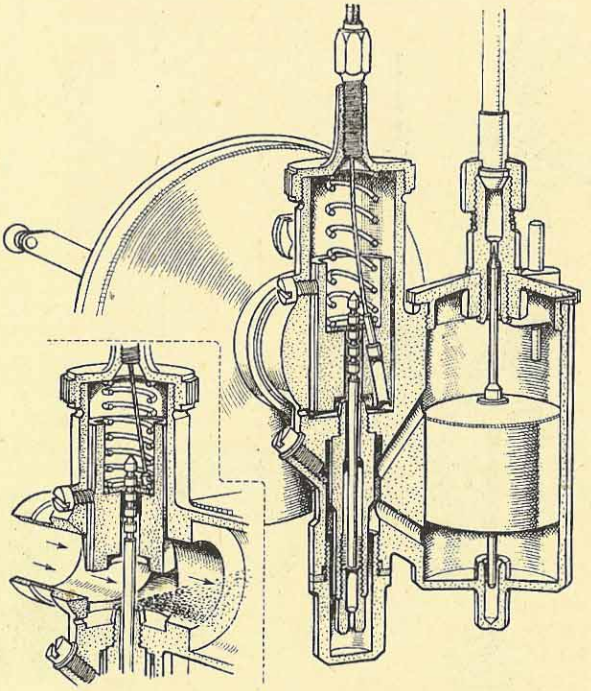


Fig. 40—A sectional view of an Amal carburettor such as is employed on large numbers of cyclemotors

chamber; protruding downwards from it, there is 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.

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.

Nearly all autocycles have a Villiers carburettor such as has just been described. Cyclemotors usually have an Amal carburettor, the general design of which is shown in Fig. 40. In this case, as in the diagrammatic carburettor on page 48, the float chamber is at the side of the mixing chamber. The carburettor may have the petrol entering at the top of the float, or at the bottom as on page 48. This makes no difference to general functioning of the instrument. The petrol, it will be seen, 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, which is of such a size that, when the throttle is fully open, just sufficient petrol is passed to give a proper petrol-air mixture for maximum power.

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 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

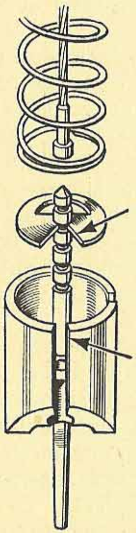


Fig. 41 — How the jet needle of the Amal carburettor is adjusted

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. 41, 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 and cyclemotors. The maintenance these instruments require is just about nil—merely occasional cleaning out of any filter (page 91) and removing any sediment in the float chamber (page 100). It is just possible that once in a while 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 101.

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 $\frac{1}{8}$ or $\frac{3}{16}$in.

On autocycles and cyclemotors—indeed, on the vast majority of two-strokes—the magneto is combined with the flywheel of the engine (Fig. 42). 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 may also be 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. 42 shows (among other things) the contact-breaker of a Villiers flywheel magneto and Figs. 43 and 45 those of the Miller and the Wipac "Bantamag". Since, like water in

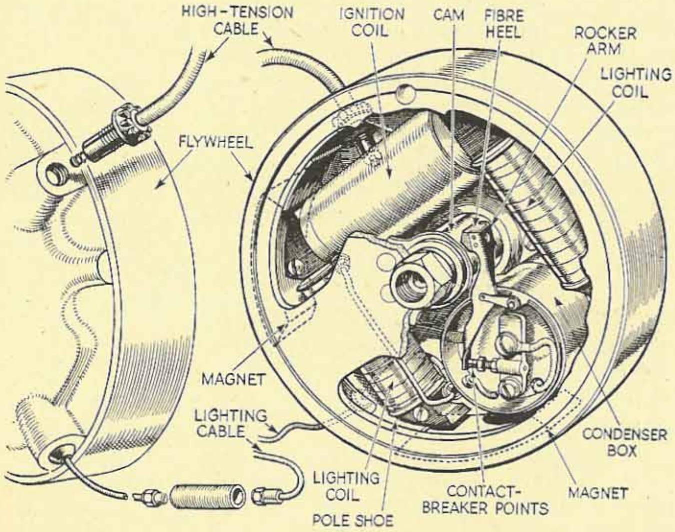


Fig. 42—A cut-away view of the Villiers Junior-de-luxe's flywheel magneto

a pipe, electricity has momentum and 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 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.

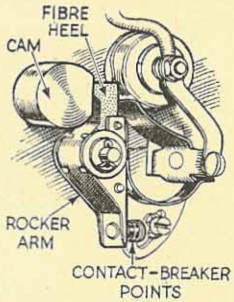


Fig. 43—General layout of the type of contact-breaker fitted to the Miller flywheel magneto

Now let us glance at a fairly typical sparking plug (Fig. 44). 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

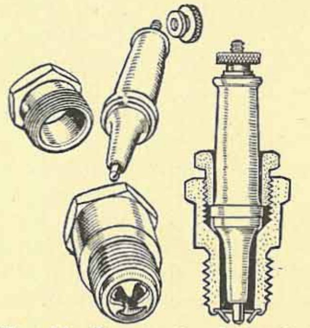


Fig. 44—Part-sectional drawing of the Lodge sparking plug fitted to Villiers autocycle units

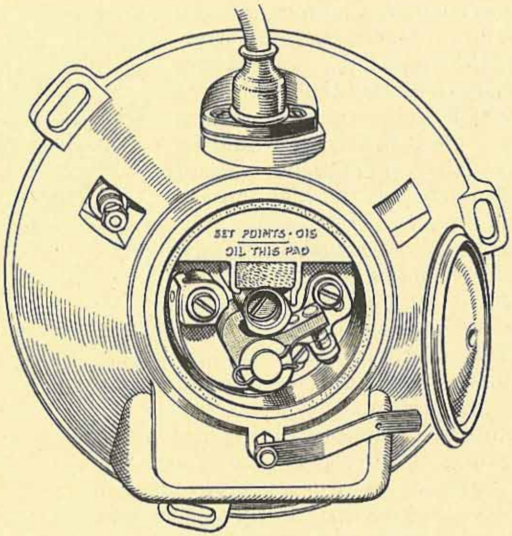


Fig. 45—Arrangement of the contact-breaker on the Wico-Pacy flywheel magneto

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. A difference of, say, a couple of thousandths of an inch, whether larger or smaller, does not matter.

The lighting side of the flywheel magneto on autocycles 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. 42, page 58). 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 head lamp is employed for parking at night and the horn one fits is of either the bulb type or one with a special battery.

CHAPTER 7

Lubrication

BECAUSE of its extraordinary simplicity, the lubrication of a two-stroke engine such as a cyclemotor or an autocycle unit, with some owners, brings trouble in its train. No lubrication system could be more simple. All the rider has to do is mix oil with the petrol—the correct oil 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-engined vehicles. 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 point 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. Frequently 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. Where people go wrong—and this cannot be over-emphasized—is, first, some fail to use the grade of oil recommended and, secondly, they do not take care to see that the quantity of oil is correct; they *will*, most unwisely, add a "little for luck".

Usually the best practice is to have the petrol and the correct quantity of oil poured into a 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 more than a minute or two, the petroil tap should be turned off some three hundred yards previous to the end of the run. 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 into 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 generally give 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 or cyclemotor 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 or quart, as is desired—add petrol 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 poured in on top. With this plan there is little or no chance of the petroil tap or pipe becoming choked. In passing, may it be emphasized, especially over cyclemotors, that a lighter-fuel tin of *petroil* enables one to cover many miles?

Another, though not nearly so good, method of replenishing without prior mixing 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 best to take care over the mixing!

Let us repeat: use the lubricant the makers of the engine recommend or, if this is not available, the equivalent grade of another well-known brand and use the correct quantity.

CHAPTER 8

Transmission and Cycle Parts

ONE of the many features common to autocycles and cyclemotors is that, from the machine angle, they are both essentially pedal cycles. The former may have " grown up " somewhat with its larger tyres and saddle, more robust frame and, with many models, sprung front fork, but the construction is based on the bicycle—understandably so in view of the bicycle's well-proven design.

In this chapter it is not intended to discuss ordinary bicycle features, such as pedals, pedalling gear and the standard chain from the chainwheel to the back wheel, nor wheel and steering-head bearings, but to touch on some of the items, on both autocycles and cyclemotor machines, which may be fresh to the eyes of the pedal cyclist.

An exception should perhaps be made in regard to one component, namely, the free-wheel. It will be appreciated that with an autocycle the free-wheel is in operation almost the whole time and that, even with a cyclemotor machine, there is so little pedalling that the free-wheel has to cope with many, many times its normal work. Where autocycles are concerned this point is covered by the provision of a special, extremely durable free-wheel—in other words, one designed specifically for the arduous life it will have to lead. *Per contra*, and very obviously, the free-wheel of a bicycle to which a cyclemotor is attached has to undertake a job for which it was never designed. Some free-wheels seem to take no exception to the additional use, but all must receive frequent and adequate lubrication. This is most important. Every 100 miles is not too frequently. May we urge that the point be borne in mind?

A matter which applies specifically to cyclemotors of the type which drive the rear or front wheel by a friction roller is that the wheel, whichever is to take the drive, must run true. Usually the cyclemotor will be fitted by a competent mechanic who will check this point and either make any necessary rectification or advise that the wheel be replaced with a new one. And the wheel, of course, must continue to run true. Further, the wise owner will make a periodic check of the wheel spokes—those of both wheels, particularly if the machine is driven at more than bicycle speeds.

The majority of autocycles and a few cyclemotor machines—those specially equipped—have spring front forks. Figs. 46 and 47 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.

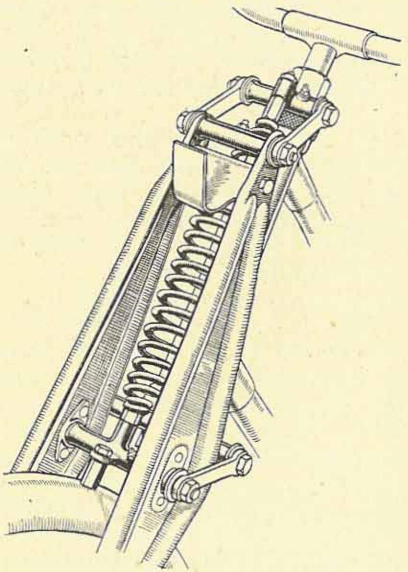


Fig. 46—A neat, effective type of central-spring front fork with a link action

Usually the bicycles which are fitted with cyclemotors have, of course, rim brakes. As mentioned earlier, the motor unit adds about 20 lb. This compared with the total weight of machine and rider, is so small an addition that, assuming they were effective previous to the motor

being attached, the brakes should continue to be adequate—always provided that the rider does not indulge in more than normal cycling speeds. Many riders do travel faster and obviously they must take care to see that their brakes are, and remain, really efficient.

Some bicycles and nearly all autocycles are fitted with internal-expanding brakes. Construction of a typical internal-expanding brake is shown in Fig. 48. 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.

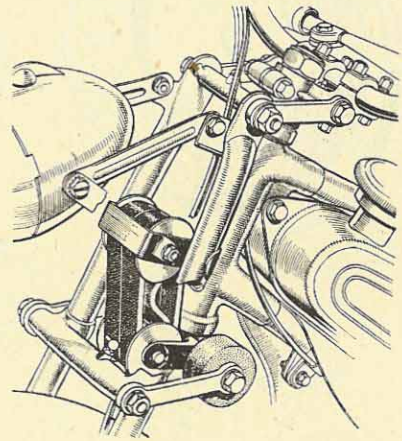


Fig. 47—Rubber bands form a simple but most effective suspension medium for front forks. This is an Excelsior design

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,

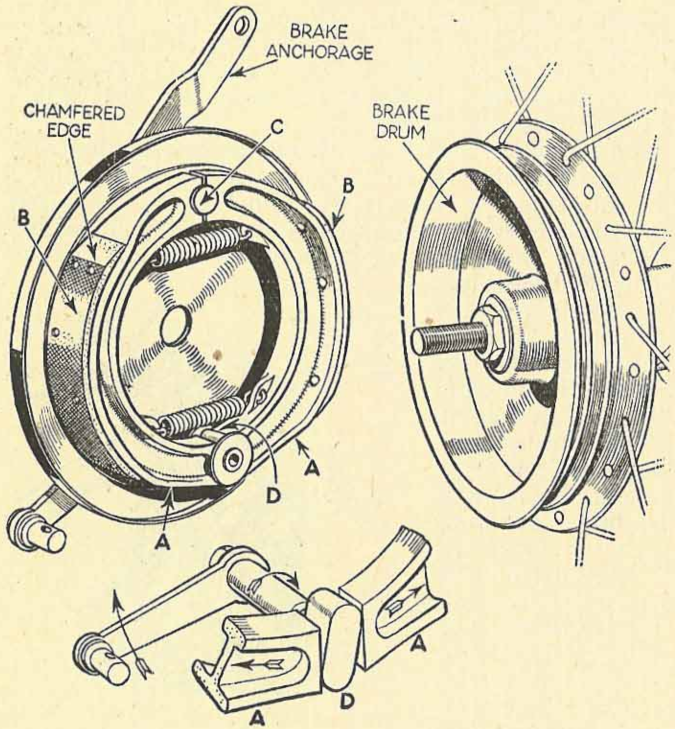


Fig. 48—How an internal-expanding brake functions

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, it should also 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.

While the transmission from the engine to the driving wheel is invariably by means of two chains and a clutch in the case of an autocycle, there are several different types of transmission employed with cyclemotors. First, there is the friction roller, bearing on front or rear tyre—this has been touched on previously, and seven engine units with this form of drive are illustrated in Chapter 4. With the majority of designs, the roller is mounted on the end of the crankshaft of the engine and thus rotates at the same speed as the engine. One famous model, however, is so arranged that the roller runs more slowly than the engine; this is achieved by a train of enclosed gears between the crankshaft and the driving roller. This particular design is shown on page 46. With all these cyclemotors there is a control which permits the roller to engage with the tyre or to be clear of the tyre to the extent of about $\frac{1}{8}$ in. In the latter, disengaged position, the machine can be pedalled along as if it were a normal bicycle. A great point this: if the user of a cyclemotor machine runs out of fuel or encounters trouble with the engine, he or she can always pedal home and with hardly any greater expenditure of energy than is involved in normal cycling.

The means of disengaging the roller is not equivalent to the clutch of an autocycle or car, and should not be treated as such. In other words, it should not be employed to keep the engine running ready for restarting at, say, traffic lights. In such circumstances the engine should be stopped and restarted by pedalling the machine and, when a normal cycling speed has been attained, engaging the drive.

Some makes, such as those illustrated on pages 36 and 38, are fitted with clutches. One it will be noted, a motor wheel, has two driving chains—a " primary " and a " secondary " chain—in the manner of an autocycle. Vee-belt drive is used in the design illustrated on page 43 and a gear drive for the unit shown on page 37. Then there is the unusual two-speed, overhead-valve four-stroke engine on page 39 which drives through a clutch and the bicycle's own pedalling chain. The rotary engine design on page 42 is also extraordinarily interesting.

In the case of an autocycle the primary chain which runs from the crankshaft of the engine to the clutch 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. 19, page 34).

Fig. 49 shows a very simple form of clutch, such as is fitted to autocycles and some cyclemotors. 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 rotates. B is one of a series of studs screwed into the back

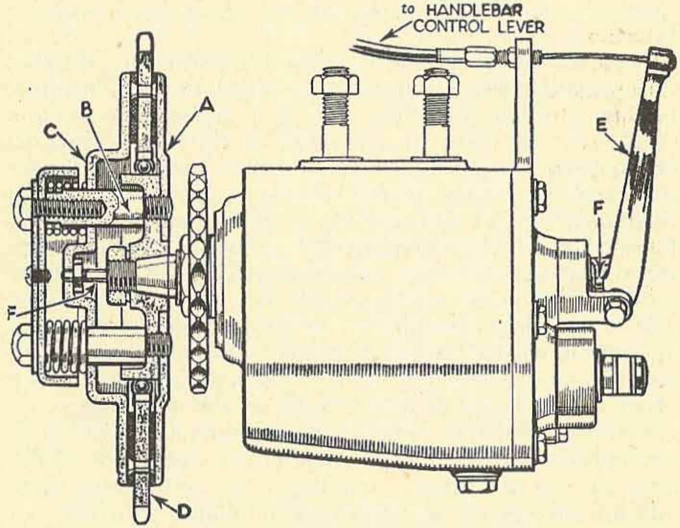


Fig. 49—A simple form of clutch such as is fitted to autocycles and some cyclemotors

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 or cyclemotor 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. 49, page 71). 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.

Cyclemotors seldom have stands, though a good central stand can be a boon; autocycles, usually, 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. Place yourself at the side of the machine, with the latter leaning slightly towards you, and lower the stand. Then put 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 merely entails 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, especially with higher-than-cycling speeds, 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, and—may we repeat?—lubricating the free-wheel *frequently*.

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. 50 shows how the handlebar controls are arranged on a typical autocycle and on some cyclemotor machines. As has been mentioned, only one or two cyclemotors have a clutch, but several of the roller-drive models have a control similar to the clutch lever depicted. In their case, the lever is provided as a ready means of engaging and disengaging the roller, i.e., so that the latter is in contact with the tyre or lifted clear of it.

Let us discuss riding a machine, whether an autocycle or cyclemotor mount, which is fitted with a clutch, but, in passing, touch on some of the differences between the various models. On the left of the handlebar, as in the illustration, there is the clutch control with its little trigger, also a brake lever. The latter, in the drawing, is for the front brake, while its opposite number on the right of the handlebar is for the rear brake. Equally, of course, the front brake control could have been on the left, and that for the rear brake on the right; 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. The latter is fitted to nearly all autocycles ; some cyclemotors also have a compression release, but in their case it is frequently linked with the throttle, that is, moving the throttle lever, from the open to closed position, first shuts the throttle, and therefore stops the engine firing, and then, pushed farther back, operates the compression release.

Alongside the petroil tank on an autocycle, as may be recalled from the chapter on carburettors and carburation,

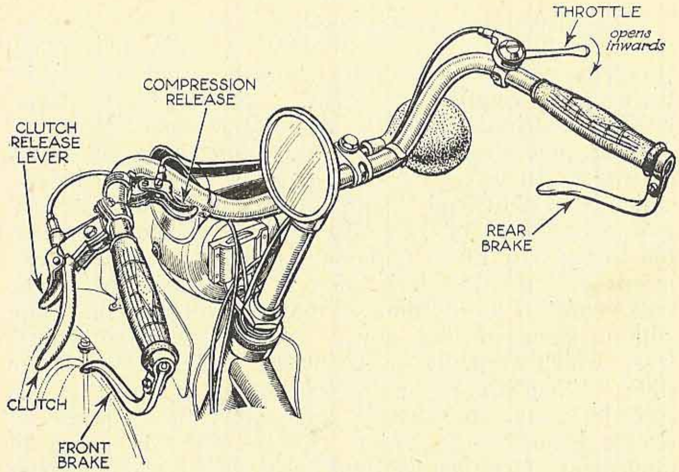


Fig. 50—How the handlebar controls are arranged on many autocycles and some cyclemotor machines. The front-brake control may be on the right and that for the rear brake on the left

there is usually a rod linked to a strangler on the carburettor. With cyclemotors and one or two autocycles, there is, instead, a little thumbpiece on the air intake of the carburettor itself. The only difference is that the strangler, in one case, is operated via a rod and, in the other, operation is direct.

Let us familiarize ourselves with the controls of our particular machine, preferably with the maker's handbook beside us. Then, legs astride the machine, we will try operating the clutch lever—if there is a clutch: similarly, with roller drive, if there is a clutch-type lever that engages and disengages the roller. Grasping the main portion of the lever we pull the lever towards the handlebar. Suddenly the spring-loaded trigger clicks home. Next release the lever—the trigger holds the lever in the " out " position and we find that the machine can be wheeled along effortlessly because the clutch or roller drive, as the case may be, is disengaged and the engine is no longer connected to the driving wheel of the machine.

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

After practising letting in and disengaging the clutch (or roller), let us try the other controls. Where a bicycle which is an old friend has just been equipped with a cyclemotor, operation of the brake controls will be automatic, but in the case of an unfamiliar machine, whether cyclemotor or autocycle, it is wise, at this stage, to try the brake controls several times so that we are sure to find them without having to look down. Next, there is the throttle lever, which normally opens inward, that is, towards the rider. When it is pushed forward as far as it will go, the throttle is shut and also, in some cases, the compression release brought into action. Let us note the range of movement, since then we shall know what is " one-quarter throttle ", " half-throttle ", and so on.

Now, having accustomed ourselves to the controls, the next thing is to get the feel of the machine on the road. Disengage the drive, by operating the click-type lever or whatever other control is provided, and then pedal the machine along the road and round a corner or two. This should be done even in the case of an old, familiar bicycle to which an engine has been attached, because the weight distribution of the machine, and thus the handling, will now be different.

Only a very few hundred yards need be covered for the rider to become accustomed to the general feel of the machine and, in the case of a strange mount, to try the brakes. Even with an autocycle, the weight of which is thrice that of a pedal cycle, there is a remarkable feeling of confidence, thanks to the low-set engine.

We have arrived at the great moment when we 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

(one-half with some cyclemotors; the instruction book will cover the point).

The exact method of starting varies according to the design of the power unit. We will consider autocycles and cyclemotors which have clutches or roller drives engaged by a clutch-type control lever. Even with an autocycle and its comparatively large engine, for the first " go " we will start the engine by pedalling. This is still the most widely adopted method of starting an autocycle, although with a 98 c.c. engine there is a less-energetic means; it is also the standard method with cyclemotors, irrespective of their method of drive.

Raise the " clutch " lever 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, gently—very gently—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 if the weather is cold—open the strangler fully or, where the strangler is marked " Rich " and " Weak ", move it towards " Weak " to the point at which the engine feels to be running best. The strangler is used only for starting with a cold engine; for all normal running it is left fully open or, with the " Weak–Rich " type, in the position which is found to be best. Now we come to a very important point:—When starting a hot engine, do not flood the carburettor or use the strangler. If you do either of these things you may make the mixture of petroil and air too strong to fire. Should the engine be merely off-cold, slight flooding can be desirable.

Control of the machine is by the throttle. Where a clutch is fitted, this should be used only if it is desired to stop with the engine still running or for, say, turning slowly in the road. Where there is a clutch-type lever controlling a roller drive, the rule is that it must be " in " or " out "; there must be no half-and-half and thus using the roller *as* a clutch. When the roller is disengaged, the engine should be stopped by closing the throttle and restarted in the manner described in the previous paragraph; this is important, because otherwise the tyre will be damaged.

With a machine fitted with a clutch-type lever, ride along with your hand away from the lever or, at least, not pressing on it even with the weight of a feather. There must be no question of " partly out " or, in the case of a true clutch, continuous loading of the clutch mechanism.

To stop the machine, close the throttle and apply the brakes as necessary. When the speed of the machine has dropped to about six miles an hour, raise the " clutch ". Where a machine is fitted with a clutch, as opposed to an engageable roller, the engine can be kept running during traffic stops and used as a means of assisting the getaway from a standstill. In this case, as you come to a halt, open the throttle a fraction at the same time that you declutch. With such a machine, practise the following:—Pause a moment with the clutch out and the engine throttled down to the point that it fires slowly yet does not stop. Then try getting on the move again, just as you would do if you had been held up momentarily at traffic lights or a pedestrian crossing. 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. As a rule, the initial fault is that the clutch is let in jerkily.

While, as suggested at the outset, the controls, especially those of cyclemotors, differ from one make to another, the preceding paragraphs, read in conjunction with the instruction book applicable to the particular design, should give a good understanding of the proper method of control. Of course, you will use a quiet stretch of road for your first ride. 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 any braking force 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 the 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 upright, on an even keel.

The object of a compression release, such as is fitted to a number of cyclemotors, as well as to autocycles, is mainly to enable the engine to be rotated with less effort than is involved when the piston has to compress the incoming charge. With some cyclemotors, especially those not fitted with a clutch, the idea behind the fitting of the compression release is that one will pedal along with the drive engaged and the compression release in operation and then, by means of its control—frequently the same lever as that for the throttle—lower the release valve on its seat, whereupon, if the throttle is open, the engine will start.

Where we have the larger engine of an autocycle, the easiest method of starting is the following:—Let in the clutch and push the machine with the compression release raised. After a couple of yards, drop the compression release and, immediately the engine fires, declutch. Then, with the engine running, get aboard and start off in the usual manner, that is, give a twirl or two of the pedals and gently let in the clutch, at the same time opening the throttle slightly. This may sound rather complicated, but it is quite simple in practice and calls for next-to-no effort. Try it if you have an autocycle.

The same method can be employed with a cyclemotor machine fitted with a clutch, but the smaller engine calls for so small an effort to start it that probably few will consider this push-starting worth while. Another practice with autocycles is to pedal off with the left thumb operating the compression release and the remainder of the hand holding out the clutch; then release, first, the clutch and, secondly, the compression release.

What about the pedals when the machine is on the move? Where autocycles are concerned, such is the power of the 98 c.c. engine normally employed that the pedalling gear is seldom used except for starting, and then only by those who adopt the pedal methods of starting, and to help the clutch when a restart is made. On hills the pedalling gear is required only infrequently, since, as has been mentioned, an autocycle will usually 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 traffic or a sharp corner at the bottom, has to be approached extremely slowly, some pedalling may be necessary.

Irrespective of whether the machine is a cyclemotor mount or an autocycle, the important thing is to pedal before the engine starts to flag. For a given throttle opening the power an engine develops depends upon the speed at which it is running. Let the engine revs become 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.

With a cyclemotor one has a bicycle with normal bicycle gearing and this is close to ideal for helping the engine when the conditions, whether of road or wind, are adverse. Very gentle rotation of the pedals can make all the difference. One soon finds from experience how one can aid and abet the engine without putting forth any appreciable effort—far less, as a rule, than that involved in normal, on-the-level pedalling of a bicycle without an engine. In the case of autocycles, however, the pedal gear ratio is necessarily a compromise between that which will render engine starting reasonably easy and that which will assist a flagging engine. For the latter purpose a higher gear would be desirable. However, the same general rule applies, namely, pedal early rather than late and use the pedals to maintain the revs of the engine and thus its power output.

So much for the initial stages; in the next chapter will be discussed the finer points in handling the machine and—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 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. Indeed, with a cyclemotor, it should be no more than that which gives a normal bicycle speed, especially if the bicycle is one of the lighter models.

When a machine fitted with a clutch is driven 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. The good rider will open his throttle gradually as the clutch begins to bite and will almost literally glide away.

It need hardly be emphasized afresh that a roller drive must not be employed as a clutch—that to use it as such is liable to result in lumps being cut out of the tyre. Hence the one point in the foregoing which applies to the owner of a clutch-less cyclemotor is that he or she should use the throttle gently. Where it is necessary to accelerate from a low speed after, say, rounding a sharp corner, the engine, instead of being given large gulps of mixture and snatching at the transmission, will be coaxed up to the higher speed. The aim, at all times, is to have the machine running smoothly and comfortably. This ensures that both the machine and engine can give of their best and is the way to secure long, troublefree service.

A point which the majority of cyclists will know already is that a two-wheeler has greater stability when it is being propelled than when free-wheeling. Hence it is a good practice to enter bends on the slow side and accelerate round them.

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 a clutch should not be used as if it were a gear has been given already. This, as pointed out, 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 if, for some 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 (assuming that there is a 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, with the clutch disengaged, use the pedals. A similar practice can usefully be adopted with a cyclemotor model.

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. With a cyclemotor he will start to pedal while the speed of the machine is still high, knowing that, within limits, the higher the speed at which the engine is maintained the higher the power output and, therefore, the less total work he will have to undertake. By starting to pedal early he saves himself unnecessary effort, a point which can hardly be over-stressed. He will take really steep hills in his stride—merely gentle pedalling—solely because, in his wisdom, he began pedalling early.

While the owner of an autocycle has a larger, more

powerful engine, and therefore can climb nearly all hills without pedalling, he can be less fortunate than the cyclemotor owner when, eventually, he does encounter a hill that demands pedalling, because he has to allow the engine revs to drop before the pedals, with their low gearing, can do much to help. He should start to pedal just as soon as, even with something approaching a flurry of legs, he can aid the engine. In the case of either type of machine, if the pedalling is left until the engine nearly conks out the effort required from the rider 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.

With a cyclemotor machine there is only about 20 lb extra weight as compared with the equivalent pedal cycle, so the method is to disengage the engine drive and push the machine up just as if it were a bicycle. In the case of the much heavier machine, the autocycle, start the engine—if necessary on the stand—and then walk beside the machine, using the engine to pull it, though not you, up the hill. Keep the throttle opening as small as you can, because, unless you are going to run, this method involves use of the clutch. 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 use of the throttle, 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 a clutch, the brakes, if used for any great length of time, will heat up. Where a machine is fitted with a compression release, frequently it will pay to raise it on long descents—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 throttle should be opened momentarily (compression release closed). The reason, it will be recalled, is that otherwise the engine will receive no lubricant. If there is a clutch, 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 machine; a bell is not legal. Secondly, remember 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, machines are used for carrying a child. This, from the legal angle, is permissible, but the child (one only) must sit astride on a proper seat securely fixed to the machine *behind* the driver's seat. 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 or cyclemotor machine 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 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 opposite page. It will be noticed that the rider can use either his left or right hand for indicating that he wishes to turn left. Please

OFFICIAL TRAFFIC SIGNALS

Signals to the Traffic Pointsman

Fig. 51—I want to TURN to my LEFT

Fig. 52—I want to go STRAIGHT AHEAD

Signals to Traffic Behind You

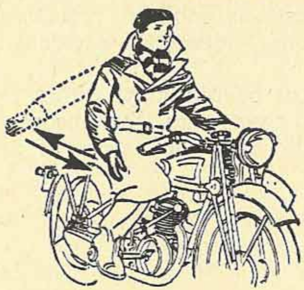


Fig. 53—I am READY to be OVERTAKEN (the overtaking rider must satisfy himself that he can overtake with safety)

Fig. 54—I am going to TURN to my LEFT (alternatively as Fig. 51 which is usually preferable)

Fig. 55—I am going to TURN to my RIGHT

Fig. 56—I am going to SLOW DOWN or STOP

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 Machine

HUNDREDS of miles have to be covered before a new engine gives of its best. How good that best is depends, in large measure, on the manner in which the engine is driven during its early life. No special skill is required; it is simply a matter of knowing what is needed and acting accordingly.

The aim in running-in is to give the various bearing surfaces—those of the piston, cylinder, big-end, little-end, etc.—their opportunity of bedding down, taking on a high degree of polish and becoming close to frictionless. This they will do automatically if there is correct lubrication, a proper mixture of petroil and air via the carburettor and thoughtful handling of the controls, especially the throttle control.

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. With a cyclemotor the same usually applies, because of the desirability of an expert fitting the attachment and checking over the whole machine. Consequently, the fuel tank, in most cases, 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 there is the correct grade of oil, the precise quantity that the makers of the engine recommend and that the oil and petrol are properly mixed. An incorrect grade of oil or the wrong quantity will affect the strength of mixture provided by the carburettor; it may also result in sooting up of a type that can lead to a certain amount of bother.

To aid the owner of an autocycle or cyclemotor in this matter of ensuring that the quantity of oil is correct, there is generally a special measure incorporated in the underside of the tank filler cap. Unscrew the filler cap or, as the case may be, press it down and turn it through a few degrees to release the bayonet catches, and on withdrawal of the cap the little cylindrically shaped measure is ready for use. Information as to the number of measuresful that should be used for a quart, half-gallon or gallon of petrol will be found either stamped on the filler cap or in the maker's instruction book. In some books there is a recommendation that the quantity of oil be increased just for the running-in period. Please check this point and be meticulous that the quantity you use is correct. Quite a lot of unnecessary trouble is caused by people employing the wrong grade or wrong quantity—sometimes they do both.

With a cyclemotor unit that has been sold or issued from the factory in a carton there is the possibility that some speck of dirt has settled in the air vent of the petroil filler cap—the tiny hole which enables air to enter the tank and, hence, fuel in adequate quantity to flow to the carburettor. Therefore, check, with, say, a pin, that any air-vent hole is clear. It is worth while doing so also in the case of an autocycle, since if there is not a free flow of fuel, the mixture provided by the carburettor may be weak and a weak mixture promotes hot running, which is something we do not want during the running-in period.

The rule over running-in is that the initial mileage is covered with the engine working lightly and that, as the distance increases, the engine is given progressively more to do until, at the end of the stipulated mileage, it is operating up to the full, desired capacity. Therefore, at first, keep to about a third or, at the most, half-throttle. With a cyclemotor, aid the engine with the pedals so that it does not have to labour. If, during the course of a run, the engine seems to run unduly hot and sluggishly, disconnect the drive and give the engine a minute or two to cool down. The chances are that nothing of the sort will occur, but it is as well to be clear on the point that the engine should, at first, have a really easy time.

Makers differ in their views on the distance that should be covered previous to the engine's being driven at full capacity. Four hundred miles is mentioned in the

instructions issued by one well-known manufacturer. With a 98 c.c. autocycle, 500 miles is the figure usually quoted. Your particular instruction book probably stipulates a distance; if not, the above figures will act as a useful guide.

As the miles tot up, give the engine more work to do. If, however, at any time it becomes fussy, ease off for a bit or, at least, let the engine cool off. We do not want to force it. Our aim is to get the best possible service from the engine and a little care and patience over this initial period can bring handsome dividends over years.

A new machine of the autocycle type *can* be driven too slowly. If, for mile after mile, its 98 c.c. engine merely propels the machine at about 15 m.p.h. in flat country, the power unit never has any real work to do and a certain amount of soot becomes deposited on the skirt of the piston. This soot, by taking up the clearance between the piston and the cylinder, may cause the engine to stop owing to piston seizure. Hence, in the case of such a machine, it can—in such circumstances—be wise to remove the cylinder after 350 miles or, at the most, 500 miles and wipe off any sooty deposit. Of course, the average purchaser will drive a 98 c.c. autocycle harder than this, in which case there will be no such trouble. Full instructions on decarbonization will be found in Chapter 14.

During the running-in period, many parts of a machine tend to bed down. Hence it can be wise to check the tightness of nuts and the correctness of adjustments. A clutch, if fitted, is almost certain to bed down to some extent in the first few hundred miles. If with a machine that has a clutch it is found that when the throttle is opened the engine starts to buzz hard yet the machine travels no faster, or very little faster, the reason is merely that the clutch is slipping. Provided that it is not a case of the rider grasping the clutch lever without realizing the fact, one simple alteration to the setting of the clutch-control adjuster is all that is needed.

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.

Where, as shown in Fig. 57, there is an external lever on the engine unit, it is a matter of a moment to check whether there is free movement in the cable, and no more than a couple of minutes is required to slacken the locknut, rotate the screw anti-clockwise to the required extent and re-tighten the nut.

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 many of the units have guarded against this by fitting special filters. In the case of the Villiers engine the filter, wisely, is of 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. 58). Clean

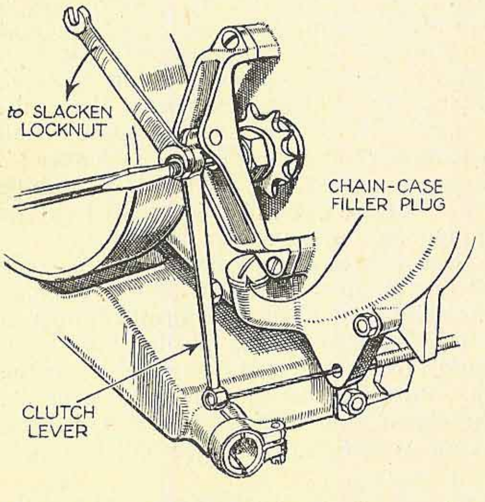


Fig. 57—Adjustment of the clutch control to provide the necessary one-eighth of an inch free movement at the end of the clutch lever

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.

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. 58 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.

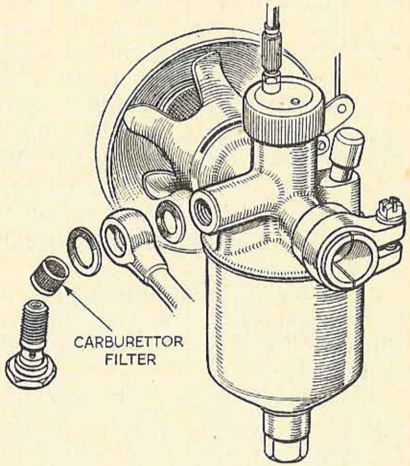


Fig. 58—How the filter on the Villiers carburettor is dismantled for cleaning purposes

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, with some designs, 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 and the drive engaged 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.

Three final points:—Running the engine for long periods with the machine stationary is undesirable. In such circumstances there is no cooling draught other than that of any breeze. Secondly, if at any time a new piston is fitted, treat the engine as if it were new. Thirdly, carburettor jets have very small holes and, if there is not an efficient filter and the petrol or oil comes from a dirty can or measure, they may become choked. One manufacturer of cyclemotors urges that users filter their petroil through a chamois leather and thus ensure that there cannot be any trouble in this regard.

CHAPTER 12

Maintenance Points

IN order to aid perfect running-in, some factories dispatch their engine units with the carburettors set a little on the rich side, this helping to promote cool running. Such practice is standard in the case of the Villiers engines fitted to the majority of autocycles. Therefore, with these machines, it is a good plan for an owner, after covering the first 500 miles, to take his mount along to the dealer from whom he bought it and have the carburettor reset. This is a simple task which will generally result in improved running and better fuel consumption. The improvement in running lies in the better two-stroking. Where a carburettor is set on the rich side, the engine has a greater tendency to four-stroke, that is, to fire on alternate revolutions instead of every revolution. If an engine is prone to four-stroke under all conditions, and there is no question of the quantity or grade of oil in the petroil being incorrect, it is almost certain to be worth while having the carburettor readjusted.

The method of resetting the taper needle in an Amal carburettor was described and illustrated on pages 55 and 56. Probably it will be desirable for the needle to protrude from the throttle slide to the extent of one extra notch. The greater the distance the needle protrudes the smaller the effective area of the jet through which the petroil passes and, therefore, the weaker the mixture.

With the Villiers carburettor there is a screw-type adjustment (Fig. 59). The little screw has to be rotated clockwise by about one full turn according to the needs of the particular engine. The dealer 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.

Removal of the throttle slide is quite simple. With both the Amal and the Villiers (Figs. 40 and 60), it is

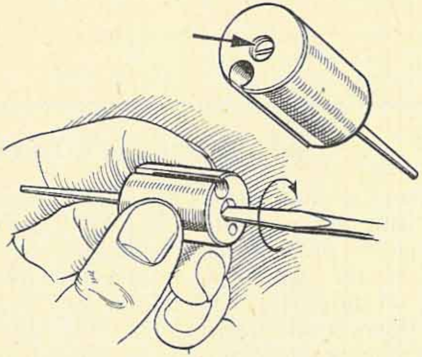


Fig. 59—Adjustment of the needle fitted to the Villiers throttle slide

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—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—straight towards the air intake with the Villiers and towards the protruding screw in the case of the Amal—and that the needle attached to the throttle slides

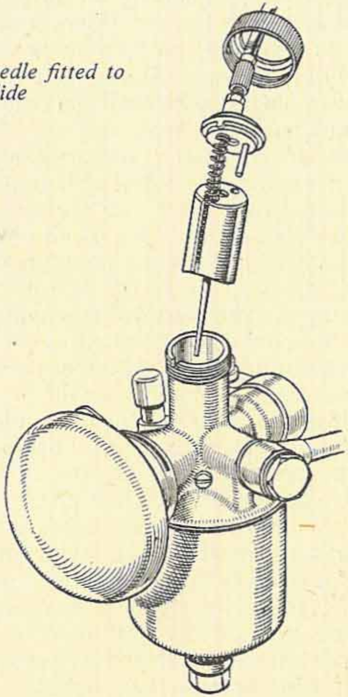


Fig. 60—Method of removing the throttle, complete with its needle

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.

Before we pass on, it is perhaps as well to emphasize that it is quite usual for a two-stroke engine to four-stroke when it is running lightly.

A point which the makers of autocycles and cyclemotors stress is that only the correct types of sparking plug should be used. The instruction book, it will be found, gives details of the make and type for the particular engine and the gap at which the points of the plug should be set. For the still widely used 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 fitted to the latest engine, the Mark 2F. The gap between the side or earthed electrodes and the central electrode should be approximately twenty-five 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. 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.

The wise owner of an autocycle or cyclemotor will always 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, but, where this is not so, give the spanner a tap with anything suitable that may be available, say, a stone. 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 for this Villiers engine is the Lodge H.L.I.P.

On the majority of carburettors fitted to autocycles and cyclemotors there is an air-intake filter. This may take the form of a simple gauze 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. Removal of the gauze is effected by unscrewing—by hand—the domed

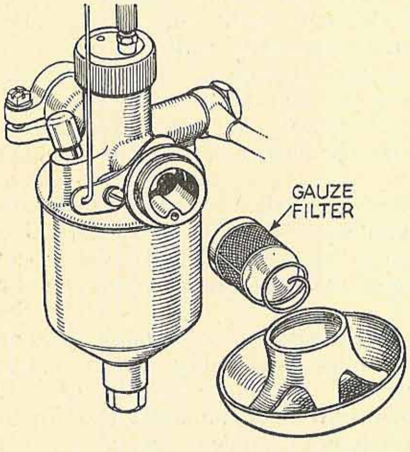


Fig. 61—Removal of the Villiers gauze-type air filter

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 a 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.

Reduced power output is frequently caused by the silencer becoming choked with soot and oil. *The Motor Cycle* has even received, for examination, two-stroke exhaust pipes which were so carboned up that there was only a hole of about $\frac{3}{16}$ in diameter through which the exhaust gas could pass. No wonder the engines were running badly.

How frequently the silencing system needs cleaning out depends on whether the rider has been careful to use the correct grade and quantity of oil in his petrol, the design of the silencing system and on the work for which the machine is used. Where the riding is mainly in traffic and there is much starting and stopping, it may be necessary to clean out the silencing system, and particularly any tail

pipe, once every 750 miles. With open-road riding, every 2,000 miles should be sufficient. Normally the way any given exhaust system should be dismantled for cleaning is obvious; if this is not the case, the instruction book issued with the engine or machine will proffer advice. A point that should be noted in connection with the Villiers Junior unit is that the tail pipe, or the pipe leading to any auxiliary silencer, is pushed into the rear of the cast-aluminium silencer and held there by a clip or by a flange with two nuts.

Tail pipes and the like can usually 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 end of a tail pipe is blanked off, the exhaust outlet will take the form of a slit or a series of holes. A slit, of course, can be scraped clean with a knife. A metal skewer will attend to any holes. Another method of cleaning out an exhaust pipe or a silencer—*provided* that it is not made of aluminium—is to use a solution of caustic soda in water. Three pounds of caustic soda to a gallon of water is satisfactory. Preferably the solution should be used hot, and in the case of an exhaust pipe the plan is to stop up one end, fill the pipe with hot solution and leave it for an hour or two, or even over-night; then drain the pipe and flush it with clean water. Avoid getting the solution on your hands; some skins are sensitive to it. Note that in no circumstances must this decarbonizing medium be employed for anything made of aluminium. Incidentally, the aluminium silencer fitted to the Villiers engine does not require cleaning out.

Assuming clean petrol and oil, and that the fuel tap is not left open when the machine is laid by in hot weather, it is very seldom that a carburettor will require cleaning out. This point about failure to shut the petroil tap is important. As will be readily understood, if the weather be hot the petrol in the petroil that is in the float chamber will tend to evaporate; as it evaporates, so more petroil flows in and the process may continue until the carburettor is almost full of neat, clogging oil, which will have to be removed before the engine will start.

It may help if cleaning a carburettor is discussed in some detail, because, although not the slightest difficulty will be encountered, there are various useful little hints and tips.

Let us start with the Villiers instrument and then pass on to the Amal design, noting that many of the points on cleaning the Villiers carburettor apply equally to the other carburettors. The Villiers, as pointed out on page 90, has a filter in the banjo feed union. This, provided that it is undamaged, traps all dirt other than minute particles.

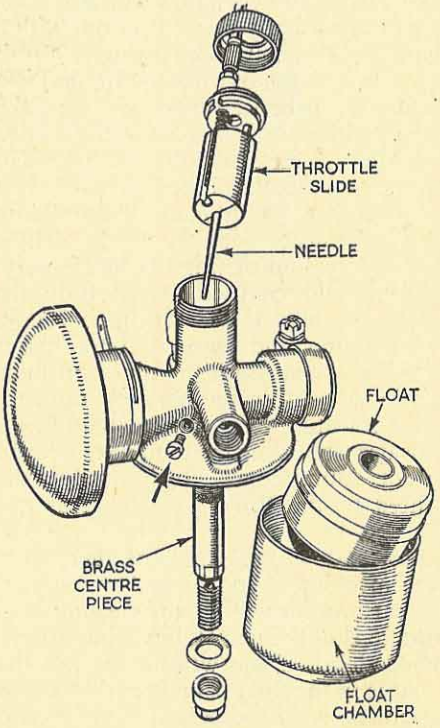


Fig. 62—How the Villiers carburettor is dismantled. The screw indicated by the arrow is only undone if it is wished to remove the brass centre piece

Normally, cleaning a 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. 62. 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 any strangler control rod 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. 63). 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. 62 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. 64, 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.

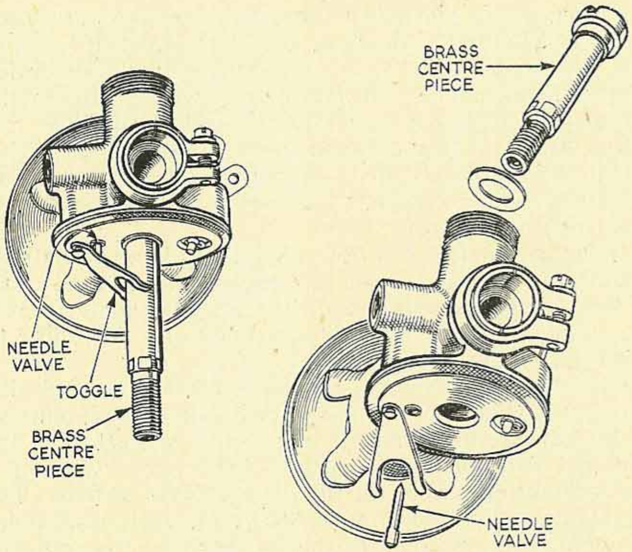


Fig. 63 (left)—In order to get at the needle valve which controls the flow of petroil into the carburettor, the brass centre piece is pressed upward after removal of the screw indicated in Fig. 62. In no circumstances must the toggle be bent or any endeavour made to remove the pin on which the toggle pivots
Fig. 64 (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

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 float 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.

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 (Figs. 40 and 65), the general methods being the same. Where the float chamber has a top feed (Fig. 40), 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. Should the jet be choked, clear it with a bristle—never a needle or pin—and blow through it. Fig. 65 reveals how the float is removed in the case of the bottom-feed type of Amal carburettor. 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

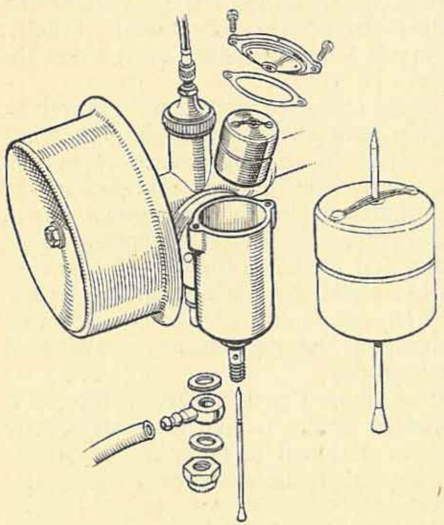


Fig. 65—Arrangement of the float and float needle in a bottom-feed type of Amal carburettor

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 or cyclemotor, 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.

Now for a few general points regarding the transmission and cycle parts. With a roller-drive cyclemotor it is important that the tyre with which the roller engages is kept hard. If the tyre has a Woods- or cycle-type valve there is no means of checking the actual pressure, so one must leave the subject with the remark that the operative word is " hard ". Should there be a Schrader-type valve, such as is shown in Fig. 66, a normal car or motor cycle tyre-pressure gauge should be used and the pressure of the tyre maintained at the figure given in the instruction book issued with the machine or cyclemotor—35 lb/sq in in the case of the Mini-Motor.

The primary-drive chain of an autocycle is of a non-adjustable, endless type, that is, no spring connecting-link,

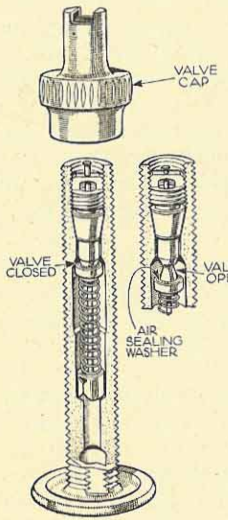


Fig. 66—Construction and method of operation of the modern type of tyre valve

such as is shown in Fig. 67, is fitted. It is also " pre-stretched ", and all it is necessary for the rider to do is to see that the chaincase contains its required quantity of the correct lubricant. The lubricant for the Villiers unit is Castrol D, which is a considerably thicker oil than Castrol 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 Castrol D. This is solely to overcome any tendency for the clutch to stick and, in normal circumstances, the grade to use is D. The oil-filler plug on the Junior-de-luxe engine is just underneath the clutch lever (Fig. 57, page 90). See that the machine is vertical and on level ground; then pour in oil up to the level of the filler hole—this is the correct level. Provided that the thicker oil, Castrol D, is employed, topping-up will only be required about once every 2,000 miles. With the thinner oil, more frequent topping-up may be needed owing to leakage. Incidentally, all Villiers chaincases are filled before the engines leave the factory.

With this type of primary drive, when, at long last, the 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 of an autocycle. Since this is not enclosed in an oil-bath case, the wear is more rapid, and the rear chain, of course, has a fairly hard life. Ideally, the latter should be removed at least once every 1,000 miles, washed in a tin containing

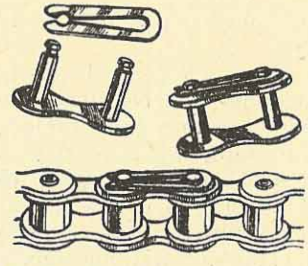


Fig. 67—How the spring connecting-link of a chain is removed. The closed end of the spring clip should point in the direction in which the chain travels

paraffin and, after draining, immersed in grease rendered 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 of an autocycle 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.

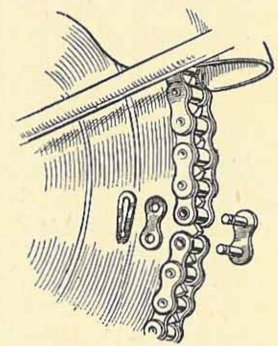


Fig. 68—Replacement of a rear chain is, as a rule, rendered easy if the two ends are pressed home in the rear chain-wheel, thus bringing them into the correct relative position for sliding home the connecting-link

Chain lubrication is obviously desirable irrespective of whether the chain is for pedalling or transmitting the power of the engine. Light oil dripped on a chain after it has been wiped over, while not so good as the cleaning-and-greasing outlined, is well worth while. May we, for the third time, mention the need to lubricate the free-wheel frequently?

Experience shows that, especially with cyclemotors, owners are liable to forget that Bowden cables, such as those for throttle, clutch and compression release, should be arranged in easy, sweeping curves; only then will there be lightness in operation.

Lastly, a general point or two regarding wheel and steering-head bearings. 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 fork, 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 handlebar forward. There should be no play, without any roughness or tightness being apparent when the handlebar is swung from one lock to the other.

CHAPTER 13

Care of the Flywheel Magneto

THE ignition systems employed on autocycles and cyclemotors are simple and troublefree. The same applies to the lighting side of the various sets standardized on autocycles. In all probability these flywheel magnetos will not require attention, other than lubrication of the contact-breaker bearings, 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 at 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.

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-

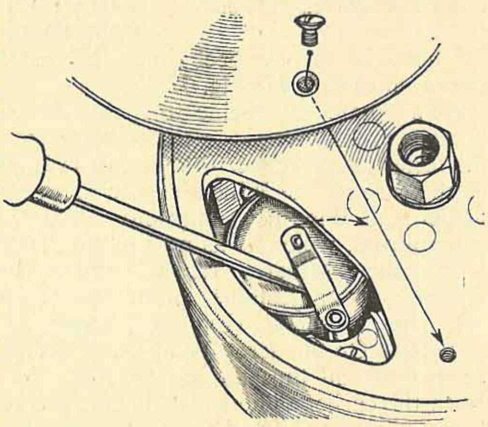


Fig. 69—Screws secure the magneto cover plate. The clip which holds the cover of the Villiers contact-breaker housing can easily be prised upwards with a screwdriver blade

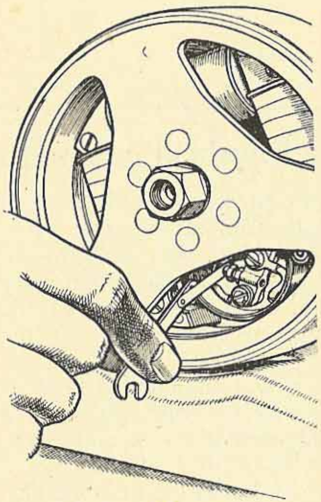


Fig. 70—Checking the gap at the contact-breaker points

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. 69).

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 (Fig. 45) or, in the case of the Bantamag, via one of the holes in the flywheel (once the dish-shape cover has been removed)—*vide* Fig. 72.

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. 70). 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. 43, page 59 and Fig. 45, page 60). On this screw being slackened, the 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

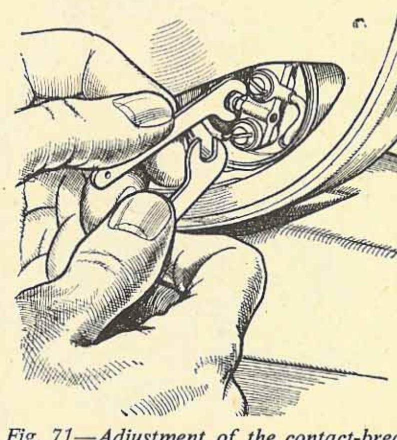


Fig. 71—Adjustment of the contact-breaker points on the Villiers Junior-de-luxe

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. 71 and Fig. 42, page 58), 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

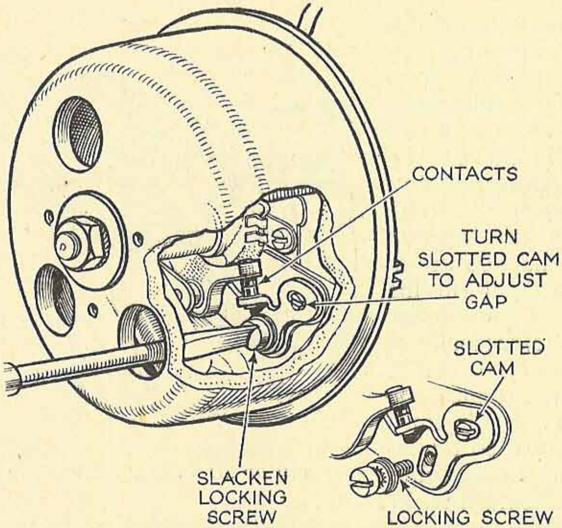


Fig. 72—How the contact-breaker gap is adjusted in the case of the Wico-Pacy Bantamag

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. A faulty condenser or a poor condenser contact can also prevent an engine from starting. Trouble with condensers, however, is rare.

It is a good thing, say, once a year to remove the rocker arm of the contact-breaker and, after wiping it clean,

smear the pivot with a mere trace of grease. Periodically the felt pad that lubricates the cam of the Wico-Pacy flywheel magneto should receive two or three drops of light oil. With other designs a smear of grease should be applied to the cam—the one which operates the rocker arm of the contact-breaker. Avoid over-lubrication; oil and grease are the enemies of electrical equipment and there must be no question of any reaching the contact points.

On the lighting side of the Villiers, Miller and Wipac sets fitted to autocycles 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. 73 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 negative (—ve) 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.

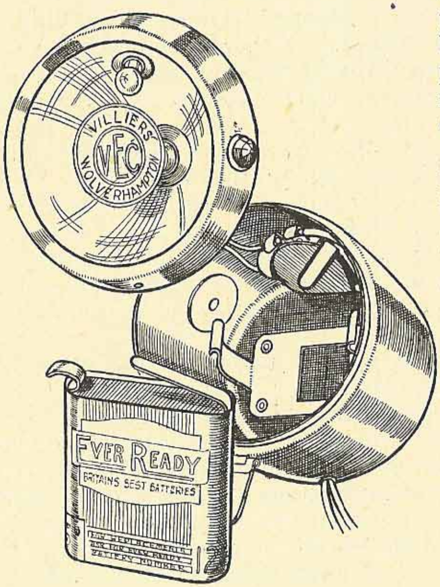


Fig. 73—When fitting a new dry battery in the Villiers head lamp, bend the short brass strip outwards so that it presses on the circular brass disc inside the lamp body. The longer strip of brass must make contact with the similar strip on the roof of the lamp shell

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 better driving light.

It is important that the correct bulbs are employed. 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.

CHAPTER 14

Decarbonizing the Engine

ANYONE with a grain of mechanical sense should have little difficulty in decarbonizing a cyclemotor or an autocycle engine. How quick and simple the task is can be gathered from the fact that usually the standard time at factories for removing the cylinder, cleaning out the combustion chamber and silencing system, and putting everything together again is, at the most, 30 minutes.

The frequency with which an engine should be decarbonized has been discussed rather briefly on page 89. Generally the distance covered in between "decokes" with a small two-stroke engine is 1,000–2,000 miles. Much depends on the work for which the machine is used, and quite a lot on the oil employed. One maker states that, assuming employment of the very light oil he recommends, even 10,000 miles may be covered before the engine's performance is seriously reduced owing to carbon deposit.

A point to bear in mind is that it is unwise to dismantle any engine needlessly. The cylinder and piston, which in a two-stroke act as a pump as well as the means of harnessing the force of the explosion, inevitably have to bed down again after being disturbed and it is some little time before they are working in true harmony. On the other hand, if the engine tends to knock, lacks flexibility and its power has fallen off, obviously it is wise to get ahead with the decarbonization.

While engines differ in their detail construction, if the step-by-step methods applicable to one two-stroke engine are fully understood, there is no difficulty over decarbonizing any other make of two-stroke. In this chapter the aim is to reveal the general methods and, here and there, to cover any minor points which otherwise might prove puzzling. Cleaning out silencing systems will not be discussed, since this subject was very fully covered on

page 98, but do bear in mind that decarbonizing the exhaust system can be more important, and required more frequently, than removing the carbon from the piston crown and combustion head.

The first job is to remove all dirt from the engine unit so that there shall be no grit which may become detached and fall into, say, the crankcase. For this one may use paraffin and a stiff brush, or apply one of the special degreasing agents which one brushes on and then washes off, dirt and all. Then, after the carburettor has been carefully removed and tied to a frame member to be out of harm's way, there is the question of detaching the cable from any compression-release valve that may be fitted. Where the release valve on the engine has two arms (Fig. 57, page 90, shows an example), operate the handlebar control so that they are pressed together and hold them in this position by means of a pair of pliers or the jaws of 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 undoing the cable fixing. With many designs the valve itself can be pressed down. Should there be a knurled screw to be undone and this be found to be tight, do not use pliers, which would damage the knurling, but wash away the grit which is almost certain to be causing the difficulty.

Where it is found that the nipple at the end of the control cable is jammed in its housing, there are two sound methods. One is to grasp any protruding outer portion of the nipple lightly with a pair of pliers and pull the nipple out; the other is to press the nipple out by means of a thin screwdriver blade inserted in the slot for the cable. Do not push hard on the cable itself, because it is important not to cause a permanent set or kink in it.

It is usually immaterial whether the silencing system or the sparking plug is removed next, but over the silencing system, make sure that all the necessary fixings are undone or removed. It is all too easy to undo the attachment at the cylinder and to overlook some, perhaps hidden, fixing. The little clip or strip underneath the Villiers Junior engine (Fig. 74) is a case in point.

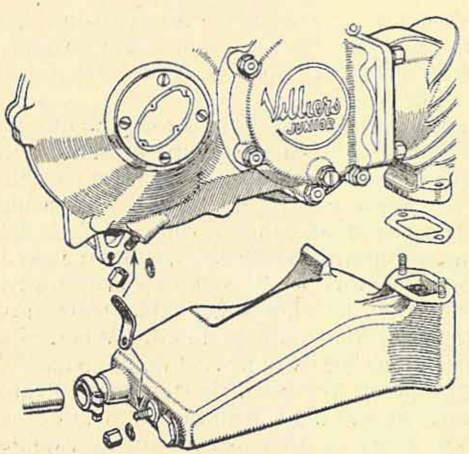


Fig. 74—Method of attaching the silencer to the Villiers Junior engine

Next comes removal of the cylinder complete with its head. With many autocycles it is helpful to turn the front wheel first one way and then the other, since this will facilitate reaching the left and right cylinder-base nuts, as the case may be. Use a good, correctly fitting spanner on these nuts which attach the cylinder to the crankcase—indeed, on all nuts and bolts on the machine—thus ensuring that the hexagons remain undamaged.

As a rule, 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 away without difficulty.

It will be noted that we are detaching the cylinder complete with head, and those who have engines with cylinder heads which are separate from, and merely bolted to, the cylinder, will ask why the head only should not be removed. The answer to this is:—Since the combustion chamber can readily be 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 and thereby breaking the joint between the head and the barrel. If a compression-release valve is fitted and this requires grinding-in, the position can be different. In that case, unless the whole valve assembly can be unscrewed from the head—

which should be done after the cable has been detached and before the cylinder-base screws are undone—the cylinder-head fixings should be unscrewed and the head removed previous to the cylinder. Generally a cylinder head is found to adhere to the cylinder even after the fixing screws have been undone. In no circumstances, endeavour to prise off the head with a screwdriver or other similar weapon; this is a sure way to damage the all-important cylinder head–cylinder barrel joint and may result in one or more of the cooling fins being broken. Quite likely, if you replace the sparking plug and rotate the engine, the compression will break the adhesions. For preference, the cylinder-head fixing screws should be in place, but, say, half-unscrewed, since then there will be no chance of the head falling and perhaps being damaged. Should this not do the trick, it may be necessary to tap the base of the cylinder head all the way round with a light brass hammer or other soft-metal hammer. Do this at right-angles to the axis of the cylinder and with commonsense care so that there can be no possible question of damage resulting.

Attention to the release valve will be discussed a little later; let us now carry on with the task of decarbonization. We have reached the point at which the cylinder and head are ready to be removed. It will be remembered from the description of the two-stroke engine's construction that the piston-ring grooves have stops or pegs in them to prevent the piston rings moving round and their ends becoming trapped in the ports in the cylinder. Hence when we remove the cylinder we must be careful not to twist it relative to the piston—a few degrees do not matter, of course.

Once the cylinder is an inch or so away from the crankcase mouth, 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 important because, if the piston and connecting-rod were allowed to crash sideways or downward, as the case may be, the piston would probably be damaged. Next wipe the bore of the cylinder and the walls of the piston with a piece of clean rag steeped in petrol. The object of this is to remove the oil and thus ensure that carbon and other grit does not stick.

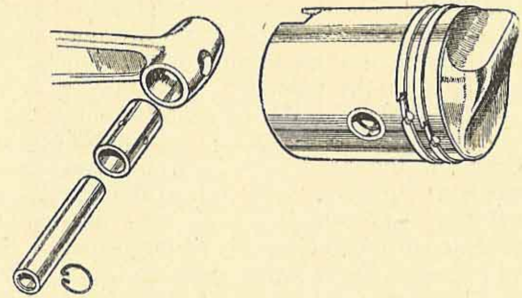


Fig. 75 (top)—How the piston is attached to the connecting-rod

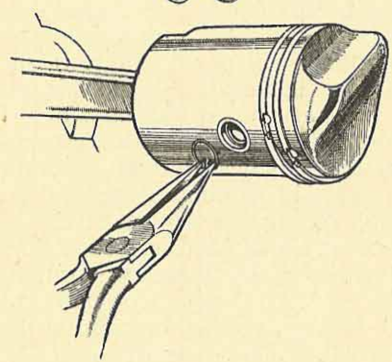


Fig. 76 (bottom)—A pair of pointed-nose pliers form the best tool for removing and refitting the circlip

Now the piston should be removed. If, as is usual, the gudgeon pin is prevented from moving endways in the piston by wire rings, or circlips, grasp the protruding ears of one of these circlips with a pair of pointed-nose pliers and, squeezing the two ears together, pull the circlip away. Figs. 75 and 76 make matters quite clear. Note that only one circlip need be removed. Then the gudgeon pin can be pushed out of the piston from the other end by means of a pencil or skewer.

If, by any chance, the gudgeon pin does not push out readily, do not use force, but apply a cloth steeped in boiling water to the piston; this will cause the piston to expand slightly, thus freeing the gudgeon pin. A flat-iron or a soldering iron can be used for heating purposes.

Provided that the circlip is not damaged in removal, and there is little likelihood of this if ordinary care is used, it may be employed again and again; experience shows that it is quite safe to do so.

With some engines the gudgeon pins have brass end-caps and not circlips. In this case the gudgeon pin is merely a push fit.

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 round or the correct way up, as the case may be.

Generally the little-end bush is a press fit in the connecting-rod, but with the Villiers engines the bush is free to turn in the little end of the rod. Because of oil on its outer surface it may stay in place, but if the machine is leant over it is possible 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. Better than a screwdriver is a length of solder with its end hammered to a chisel point, because this, being soft, cannot cause any damage, but it is only effective if the carbon is soft or flakes easily. Do the work in a good light and blow away the carbon flakes by means of the tyre pump.

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 solder or knife will soon remove the carbon from the piston crown. Where a knife is employed, gentle, careful scraping is necessary. 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 is a knife is used, but there need be no more than light scratches provided that a little care is taken.

Generally, 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. (Try the stick of solder, but the carbon may be too hard.) 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 and applies, normally, not to cyclemotors, but to the more powerful two-stroke engines fitted to autocycles. 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 98 c.c. 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.

Continuing with the subject of the two-stroke engines employed as cyclemotors and for autocycles: 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 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 which should bed down on the cylinder bore is discoloured; secondly, since the average engine is rotating at high revolutions, 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 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. 77 and 78 show the two methods.

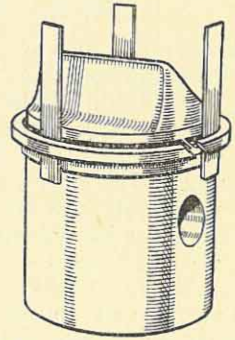


Fig. 77—Removal of piston rings by means of three strips of thin tin

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

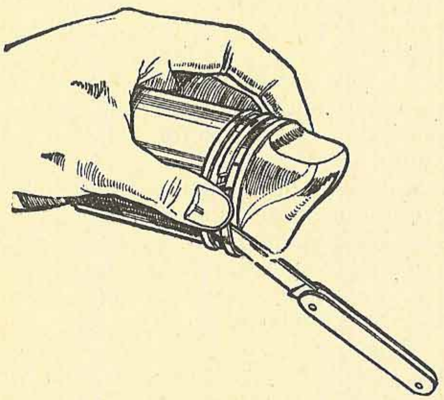


Fig. 78—If care is used, a piston ring can be peeled out of its groove very much in the style of peeling an apple

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.

The foregoing covers the decarbonization of two-stroke cyclemotors and autocycle engines except for attention to the compression-release valve. With many engines so fitted there is a hole running from the valve to the exhaust port. Any carbon in this hole should be removed with a metal skewer or the blade of a small screwdriver. Generally the valve itself calls for attention only at very infrequent intervals—perhaps not once in the life of the engine. However, the instruction book applicable to the particular unit will give information should any maintenance be necessary. The work involved is quite simple. All one does is to grind-in the face of the valve's mushroom-shaped head on its ring-like seating. Dismantle the valve, scrape any carbon off the valve itself and smear the valve seat very, very lightly with valve-grinding paste, which is specially mixed emery powder and oil and obtainable in small tins from accessory firms. Take a minute dab on a finger—if the paste is stiff, add a drop of light oil—smear this very thinly on the face of the valve and refit the valve; then, pressing the valve on its seat, turn the valve through about a third of a revolution, say, half a dozen times, lift it from its seating, redistribute the grinding paste and carry on with this sequence until it is found that

the face and the seat are bright over the whole of the area on which they are supposed to bear. This completes the job except for carefully washing away all traces of the paste with petrol or paraffin and reassembling the valve. Incidentally, the valves of a four-stroke engine, such as those of the Cucciolo illustrated on page 39, are attended to in the same manner. Further, the general methods of decarbonization are also applicable.

Now for the assembly of the engine. The cylinder, piston, gudgeon pin and the interior of the little-end bush (also the exterior if the bush 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.

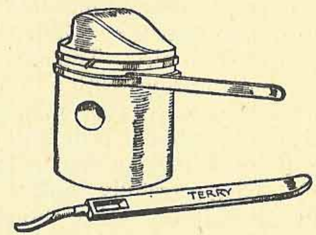


Fig. 79—If, by any chance, a piston ring is gummed solid in its groove, use of this special tool will probably free it. Before the ring is refitted, both it and the groove should be carefully cleaned by scraping

Now smear the little-end bush internally (and externally if it has been removed) with clean engine oil. Next the piston is refitted. As the illustrations on page 25 reveal, with an engine of the deflector-piston type the steep side of the hump or " deflector " on the piston should be towards the transfer port.

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. So long as the holes are in correct alignment the gudgeon pin will normally slip into place with the ease of a knife going through butter in a heat-wave. If, however, it was stiff to remove, it may be necessary to heat the piston, as was the case when the engine was dismantled. Next, the spring-retaining ring, the gudgeon-pin circlip, is replaced, using, as before, a pair of pointed-nose 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 dirt); 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 pointed-nose 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

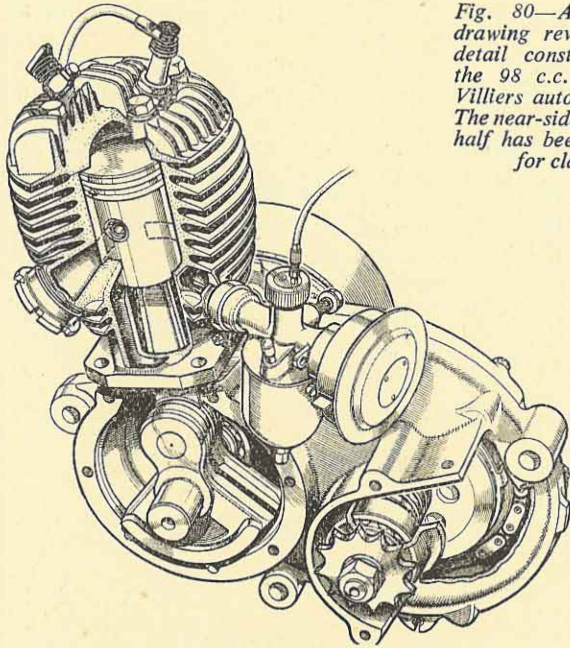


Fig. 80—A cut-away drawing revealing the detail construction of the 98 c.c. Mark 2F Villiers autocycle unit. The near-side crankcase half has been removed for clarity

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.

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 130 and 131 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 the trouble, whatever it is, 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!" 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).

AUTOCYCLE AND CYCLEMOTOR 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
  - 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, if fitted
- 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

FAULTY RUNNING OF ENGINE

- MISFIRES
  - Sticking compression-release valve (if fitted)
    - 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, assuming flywheel lighting)
  - Water in fuel
    - Dirt in carburettor
    - Partially obstructed air vent in filler cap
- Excess of oil in petrol
- 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

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 cyclemotors and contact with 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; twist the terminal end clockwise and not anti-clockwise, which might cause the high-tension pick-up to unscrew.

Now a more detailed explanation of how to check whether 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 drive engaged 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. If this trouble occurs frequently, it is probable that a weak carburettor mixture, a choked exhaust system or retarded ignition timing, are resulting in the engine operating at a higher-than-normal temperature. Therefore the frequency of the plug-point bridging may be reduced by (*a*) setting the carburettor to give a slightly richer mixture, (*b*) cleaning out the entire exhaust system, (*c*) ensuring that the contact-breaker gap and ignition timing are correct and (*d*) increasing the gap between the plug points as much as possible consistent with easy starting and good running.

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 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 nowadays, except because of soot (*vide* Chapter 14), 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 attend to any lubricators, 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 or cyclemotor, 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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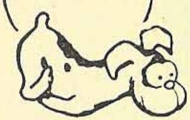

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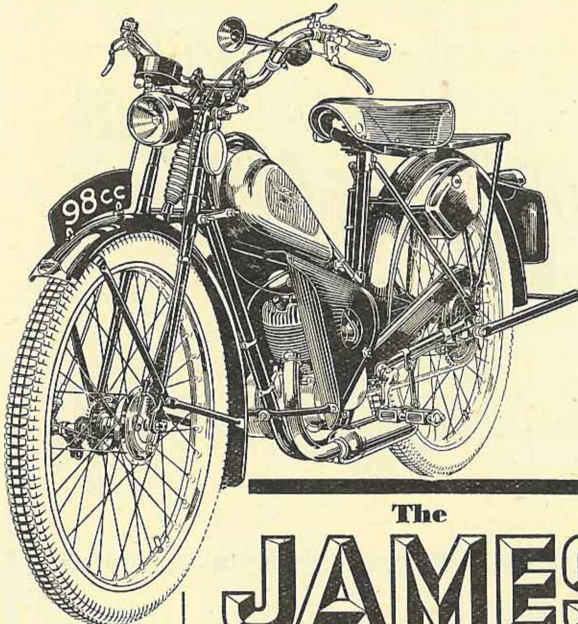

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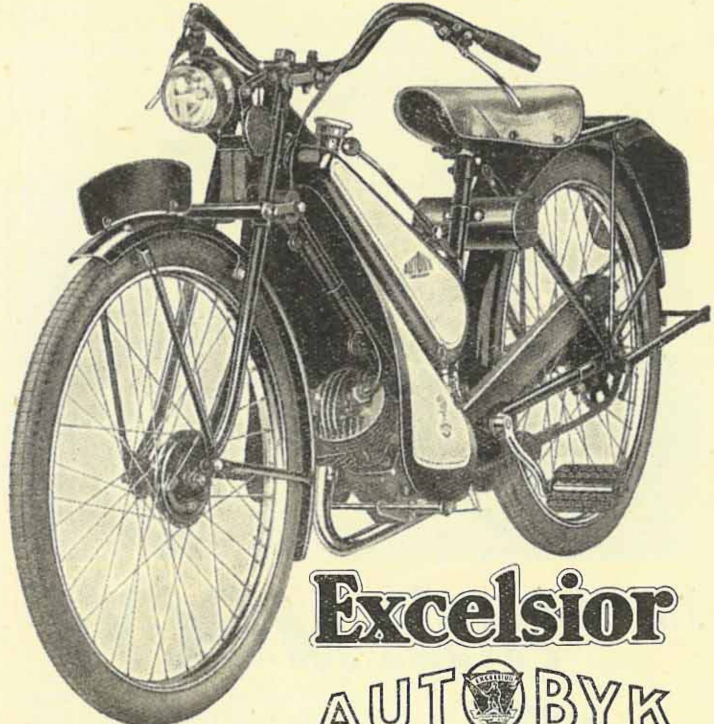

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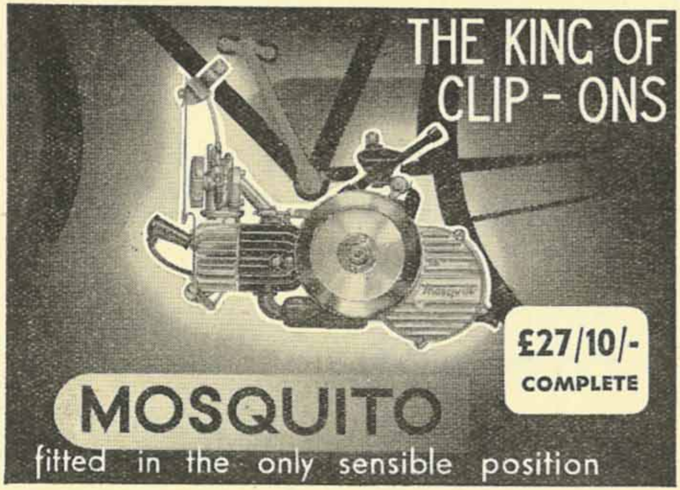

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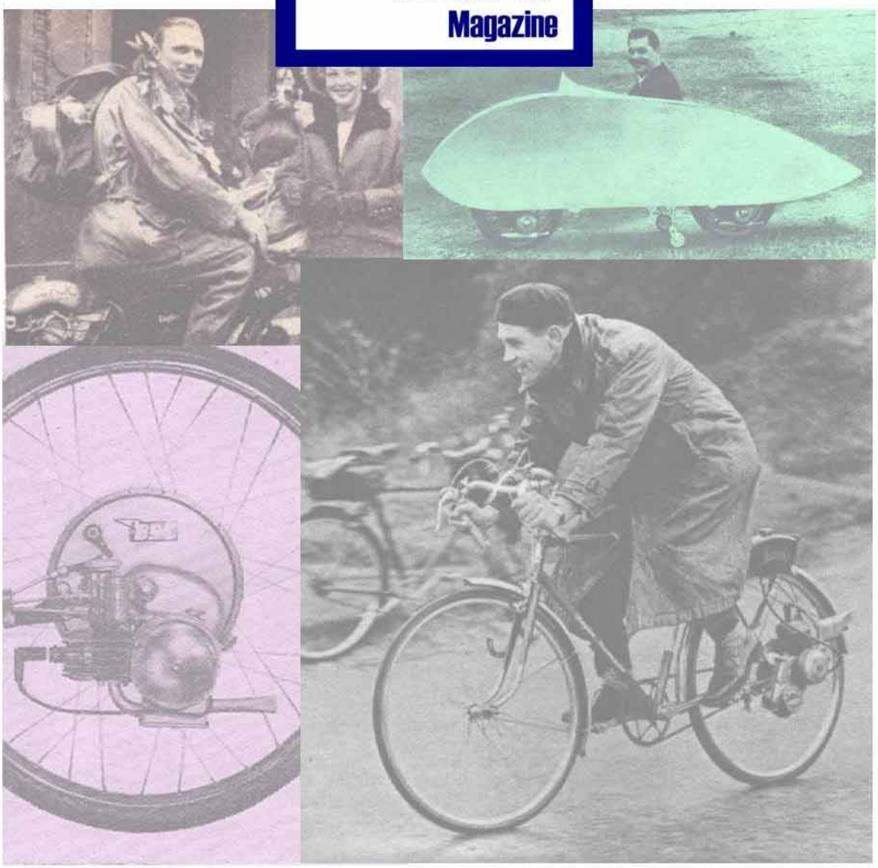

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