Douglas Motor Cycles 1913

J. A. PHILP MOTOR CO.,

Gloucester Street,

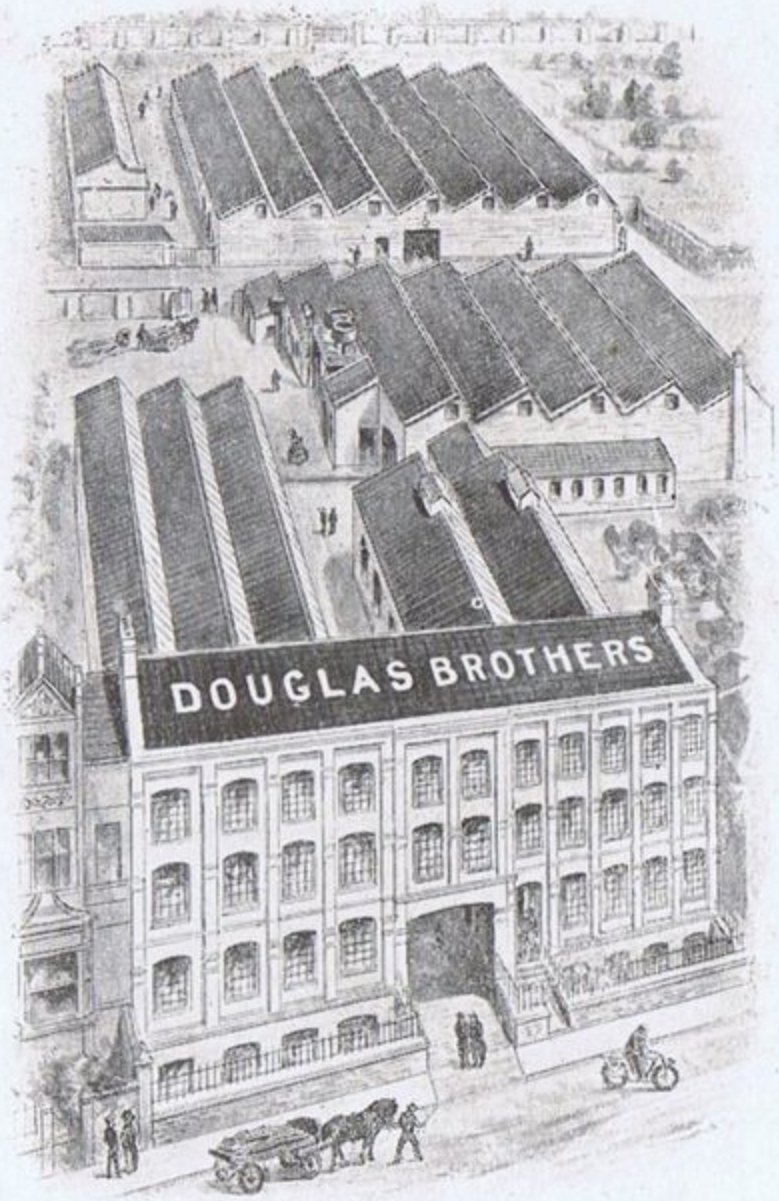
CHRISTCHURCH.

Sole Christchurch & District Agents for Douglas Motor Cycles.

— 1913 —

DOUGLAS MOTOR BICYCLES.

SPECIFICATIONS, PRICE LISTS, AND WORKING INSTRUCTIONS.



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INDEX.

THE DOUGLAS.

WE have pleasure in issuing for the year 1913 the Descriptive Price List of the Douglas Motor Bicycle. In so doing we desire to thank the many riders of our Motor Cycle for the practical appreciation of our work which they have manifested. Our only regret during the past year was that we were unable to keep pace with the demand for our machines. Since beginning to manufacture motor cycles we have built an entirely new factory, and greatly enlarged our original works. A further extension is at present in hand so as to make it possible for us to keep faith with intending purchasers.

The history of the Douglas Motor Cycle has been given in previous lists. We think it right, however, for the benefit of new riders briefly to recapitulate here a few essential facts.

For over thirty years we have been established as Engineers, Machine and Tool Makers, and Ironfounders at Kingswood, a suburb of Bristol; but prior to the year 1907 we did not manufacture petrol motors. In our capacity of Ironfounders we had made cylinder-castings for some of the most celebrated makers of motor cars and launches. In 1907 we decided to add to our business the manufacture of Motor Bicycles.

At that time the 3½ horse-power single-cylinder motor cycle had assumed practically its present form. Since that date there has been little real development of this type. Machines built in 1907 are in use now, and, for practical purposes, giving as much satisfaction as later models. We had no desire to enter into competition with this type of motor. It was a sound and practicable but uncomfortable vehicle; and not, in our opinion, calculated to encourage motor cycling in any but the young and

athletic. Our problem was to construct a light motor cycle, easy to start, vibrationless, fast, sensitive to control, able to do anything that could be done by a heavy motor cycle for a smaller initial outlay and with a cost of upkeep that should be almost negligible. Our attitude towards the heavy 3½ single was effectively stated by one of our clients in 1908. "If I had not come across your machine," he wrote, "I had made up my mind to foreswear motor cycling for ever. My 3½ single eats up too many tyres and belts, it skids frequently and each fall costs me a new lamp, a new footrest, or both; and I feel the strain of starting it too much for me."

The success of our design is now a matter of history.

A motor cycle is essentially an engineering job. The fact that this was not at first recognised, explains the failure of the early motor cycles. The work was taken in hand by firms who, with undue optimism, imagined that, because they could build a good pedal cycle, they were qualified to build a motor cycle. They were unaware of the strains to which a power-propelled vehicle is subjected and they had neither experience in, nor facilities for, treating the special material required. As a result, the early motor cycles were crude, ill-considered, and wholly unreliable. They spent most of their time in the repair shop. The makers complained that riders did not have a sufficiently sporting appreciation of mechanical problems to refrain from complaining. In the view of the makers, a repair or adjustment was part of the pleasure included in the price. Unfortunately, the man who purchased a motor cycle, often wanted it for purposes of locomotion, and not as a means for developing his latent faculties as an engineer. Therefore, he got rid of it on the first suitable opportunity and determined to foreswear motor cycles until a better day dawned. That time has now arrived, and we claim to have had no small share in hastening its advent.

The moral is that the engineer, rather than the cycle builder, should have taken up the manufacture of motor cycles. The engineer includes the cycle maker, as the greater includes the less; and it is now well recognised that the widest resources and highest skill of the engineer are necessary if the problems of self-propelled vehicles are to be tackled with success.

Many motor cycles, and indeed not a few motor cars, are not built by the firms whose name they bear. They are merely assembled from purchased parts, and usually in a very inadequately-equipped workshop. The engine is bought from one firm, the petrol tank from another, the carburetter from a third, the two-speed gear from a fourth. If the self-styled manufacturer makes the frame, he thinks himself amply justified in attaching his name to the completed vehicle. This is not our way. From the first we set ourselves to manufacture every essential part of the motor cycle in order that, if fault existed, we should ourselves be able to rectify it, instead of transferring the blame to another or receiving discredit for articles over whose production we had no control.

We are proud of the celerity with which we have been able to establish ourselves in the motor cycling world. We had to compete with many firms whose reputation was established; and, notwithstanding our confidence in the general excellence of our work, we anticipated a number of years during which our output would be comparatively small. But we had not reckoned with one important factor, viz.:—the skill of the average motor cyclist in discerning a good thing. In point of fact, we were successful from the first, and at all times we have found the utmost difficulty in keeping pace with the demand for our machines. Each year we have endeavoured to provide for the maximum number of sales and each year our estimate has been enormously exceeded by the

demand. We have built a large separate factory, and already it is too small. During the past season it is probable that no other firm in the trade manufactured more motor cycles than we did ; and, we have been obliged to make provision for a larger output during the present year. We can, however, assure our clients that this success, instead of making us arrogant as to the merit of our work, has had the effect of inspiring us to make further efforts to justify the confidence reposed in us.

We are constantly subjecting our designs and methods to the closest scrutiny and most searching tests, and we remorselessly discard designs and machinery, not because they have ceased to be valuable or efficient, but because we have discovered better. Other manufacturers slowly and grudgingly modify petty details. Till now each year's issue of the Douglas Motor Cycle has been a revolution.

Last year, however, we achieved such a degree of perfection that, for the present year, we have decided to refrain from materially modifying our engine-design. As will be seen from perusal of the following pages we have improved many details ; but, essentially, the engine of our 1913 Models is the same as that of our 1912 Models. Why we have refrained from alteration may be stated in a word : we can hardly conceive it possible to produce a more efficient motor cycle than our 1912 Model. The Douglas engine, with a cubic capacity of only 350 cubic centimetres, will do everything on the road that a single-cylinder of 500 cubic centimetres will do. On the Brooklands Track it has attained a speed of 68 miles per hour. Our standard touring models are capable of covering over 45 miles in an hour, and it is easy to maintain an average speed of over 30 miles per hour over all sorts of roads. In short, our standard Touring Model is a more efficient machine than the 3½ h.p. single-cylinder machine

ordinarily issued to the public. We need not do more here than refer to the fact that in the last Junior Tourist Trophy Race in the Isle of Man the Douglas Motor Bicycle took first and second places.

It has been our endeavour to make every rider of the Douglas Motor Bicycle a friend of the firm. We shall certainly at all times treat him as such. But we are especially grateful to those who honoured us with their confidence when our work was comparatively unknown; to those whose experience and advice enabled us steadily to improve our designs till we produced the extraordinarily successful model of 1912. We have done our best to provide good material and good workmanship; but we attribute a great part of our success to the fact that we have steadfastly endeavoured to meet the views of riders, and have never hesitated to modify or strengthen any part of the machine which, in their opinion, was defective.

We value success and prosperity as much as most people; but we value much more the name of honourable business men which we have maintained for thirty years. We are not disposed to sacrifice our reputation for the sake of wringing a few shillings from a motor cyclist who probably can afford the loss less readily than we can. We value fair play and the esteem of our clients more than money making; and we believe that a business based on such principles is far more likely to endure and to grow than a business whose sole aim is to earn dividends. Fortunately, we have no shareholders to dictate to us an ungenerous policy; and we know that, if we satisfy our customers and give scrupulous fair play, we shall achieve a lasting and substantial prosperity.

While our motor cycle business has grown with phenomenal rapidity, we have not regarded it as a milch cow from which we were to draw nutrition. We have devoted a very large proportion of our profits to the

development and improvement of the motor cycle. We have built an entirely new factory fitted with the finest machinery, and a large part of our staff is specially devoted to research and experimental work. We have greatly refined our original processes. This has been rendered possible only by the unsparing use of capital; but we recognise that such is necessary if we are to retain the high position we have gained. We continue to strive for perfection.

OUR AIM.

For purposes of experiment we have made motors of different sizes, but we have found no reason to change the opinion which we have already publicly stated. We favour neither a speed-monster nor a toy. Our design is to make a practicable vehicle, capable of ascending any hill to be met with on our roads, and faster than it is safe or expedient to drive. It may be permitted us to quote what we previously said in reference to our motor bicycle :—

" Of late years the motor bicycle has developed on lines which we frankly confess to thinking altogether wrong. Consider the function of a pedal bicycle : It is a safe and speedy means of locomotion—it causes few accidents and excites no fear. With the advent of the petrol engine, it was felt that a bicycle's sphere of usefulness would be enlarged if the bicycle were propelled by a motor. For such persons as doctors, ministers, commercial travellers, road surveyors, etc., the self-propelled bicycle promised to be an inestimable boon. But no sooner was the motor bicycle fairly established than it became the victim of sport, in the form of races, hill-climbs, and reliability trials. It soon became apparent to manufacturers that they could sell only such machines as distinguished themselves in competitions. As a result, the motor bicycle became, not a thing for pleasant and inexpensive use, but a monster

of great bulk and weight, requiring an athlete to use it and a rich man to maintain it.

"In consequence, many persons to whom a motor bicycle would be a source of utility and pleasure are deterred from purchasing one. The high powered single or twin-cylinder motor bicycle has no advantage that the Douglas Motor Cycle does not possess; and it is uncomfortable to ride and dangerous in traffic or on wet roads. These serious defects restrict the use of the conventional type of motor bicycle to young persons of good physique who wish to use their machine for purposes of sport."

"In order that the Douglas Motor Bicycle may be of general use, we have entirely broken with accepted tradition, but we claim to have produced a machine possessing the following advantages:—

(1) **Easy to start.**
(2) **Vibrationless.**
(3) **Easy to handle in traffic.**
(4) **Small cost of upkeep.**
(5) **No tendency to side-slip in grease.**
(6) **Great reduction in weight.**
(7) **An engine so flexible that the motor bicycle will climb any hill and travel at any speed from 5 to 45 miles per hour on the road.**

"We have, therefore, refrained from making any essential alteration in the now famous Douglas design. We believe that a twin-cylinder motor is necessary to eliminate that jerkiness of drive and tendency to side-slip that in the past has turned many enthusiasts from motor cycling. Further, we are of opinion that the horizontally-opposed cylinders, by equally dividing the time between the explosions, produces a much more comfortable and silky drive than the common V-type of twin. In fact, we claim to have eliminated engine-vibration from the Douglas Motor Bicycle."

We have, therefore, refrained from placing on the market as a motor cycle either the heavy highly-powered twin or the pigmy single-cylinder. Either machine would be easier to produce than the finely-finished, highly-efficient motor that is our specialty. Instead, therefore, of entering the field of our rivals and endeavouring to compete with them in the production of monsters or dwarfs, we have kept within our own well-defined province, viz. :—the production of a light motor bicycle, comfortable in use, easy to handle, able to resist every strain, and to face anything that the heaviest machines will face in common use.

We are proud of the fact that, as regards cost of upkeep, the Douglas Motor Bicycle is probably the least expensive on the market. The petrol consumption averages 100 miles to the gallon. Our exhaust-valves (which are made from bars of nickel steel) have been known to outlive three seasons, while the inlet valves seem indestructible. We make a point of this economy of upkeep ; for we know that, if a rider has continually to be putting his hand into his pocket, it detracts materially from the pleasure of using a motor bicycle.

We think it right to place some emphasis on the fact while the Douglas Motor Cycle is from 50 to 80 pounds lighter than the average $3\frac{1}{2}$ h.p. single cylinder, it is in all respects as strong and as able to bear heavy strains as the latter. Every part of the machine—frame, wheels, foot-rests, steering-head, carrier, etc.—is as strong as corresponding parts on the heaviest machine made. The chief saving of weight is in the engine and we do not need to defend this ; for numerous public tests, and the adoption of the Douglas Motor by the War Office, the Admiralty, and the Marconi Wireless Telegraph Company afford ample proof that it is the most efficient small petrol motor in the market.

THE 1913 MODEL.

For 1912 the Douglas Motor was re-designed. Mechanical inlet-valves were then introduced for the first time, and the valve-gearing was made external instead of cryptic. The result was an enormous gain in efficiency, the average speed of the motor cycle being increased from ten to fifteen miles per hour. A speed of forty-seven miles per hour has been maintained for five consecutive hours on the road and speeds of over sixty miles per hour have frequently been attained on Brooklands Track. We were anxious to produce a "no-trouble" motor cycle, and in this we claim to have succeeded. A machine will now run for a whole season, covering many thousands of miles, without the engine requiring tuning-up. Our system of semi-automatic lubrication effectually prevents over-lubrication and consequently deposition of carbon on the piston-head and inside the combustion chamber. Our balanced cranks are practically indestructible and they run in three substantial ball-races—two on the fly-wheel side, and one on the valve side. Most critics would have regarded our engine as perfect, and, considering its small size it gave off results that seemed little short of miraculous. On a bench test these motors, which we rate at $2\frac{3}{4}$ horse-power, have actually given off more than eight horse-power. But now, as always, we are our own severest critic. We were not satisfied with the induction pipe. Those who used our 1909 Model will remember that on it the induction pipe ran with an even curve from cylinder to cylinder. On that model we obtained certain results in carburation that we have not equalled in any of our subsequent models. Having enormously increased the efficiency of the motor it seemed to us that we ought to endeavour to obtain as perfect carburation as possible. Perfect carburation means economy of petrol, increased engine flexibility, and a mixture that will give regular

explosions even when the engine is running at a low speed. After careful experiments we found that the type of induction pipe used in 1909 gave better results than our later type. Accordingly we have reverted to an improved type of the 1909 induction pipe. The alteration seems small, but its effect in promoting flexibility is quite pronounced. Needless to say it meant the costly process of preparing new cylinder patterns, new jigs, etc., as effectually as though an entirely new type of cylinder had been introduced, Many makers would have been contented with the results we had achieved. For us it would have been impossible to continue manufacturing a motor in which we were conscious of an imperfection, however slight.

We have slightly increased the bore of the cylinder on our 1913 Models. The result is that the engine capacity will now be 350 cc. instead of 340 cc. as formerly. This adds perceptibly to the speed-potentiality of the motor cycle.

The clutch is now very much larger in diameter than formerly.

A special mudguarding device (patent applied for), is now fitted to all our clutch models. This device, which is graceful in appearance, and offers little wind resistance, effectually screens both rider and engine from mud.

By adopting mechanical valves we were able to meet the criticism sometimes directed against our earlier models, viz. : that the timing-gear was not sufficiently accessible. This criticism is just, although in actual practice it did not constitute a serious disadvantage, as, in the event of anything being sufficiently wrong to involve alteration of the timing, it may safely be asserted that the crank-case required to be taken apart anyhow. In the new model, the timing is on the outside of the crank-case and free access is obtained to it by removing the external cover. The free ends of the timing shafts are rigidly locked in

position by a cage, so that the gears cannot in any circumstances work loose. As hitherto, the valve-tappets are adjustable.

In order to give riders the lowest possible saddle-position we have sloped the end of the tank and curved the top tube underneath the saddle. There is no other motor cycle that affords a lower riding position. The petrol tank has more capacity than formerly, and the saddle is placed as nearly as possible in the centre of the machine—a position in which the rider is subjected to less vibration than when the saddle is directly over the back wheel.

All our models are fitted with a very efficient system of semi-automatic lubrication. A description of this device will be found elsewhere. As stated, our wish is to make the Douglas Motor Bicycle proof against unskilled handling, and we have observed that riders frequently experience trouble by dosing their machines too liberally with oil. This practice, even when it does not foul the sparking plugs, causes accretion of carbon in the combustion chambers and on the piston heads, rendering it necessary ultimately to dismantle the engine and clean the cylinders and piston. The device that we have fitted should render excessive lubrication impossible and assist us in realising our ideal of a " no trouble " machine. It should be noted that a pump is fitted, so that, when desired, the lubrication can be controlled by the rider. A sight-feed is on the top of the tank, the action of the lubricator being at all times visible.

The frame of the motor cycle is now very strong and all the tubes are butted, so that there should be no possibility of breakage, even under the severest strain.

The demand for our two-speed model was so great that we now regard this as the standard. Of course, we still supply a model (N) with fixed gear. When we

first adopted a two-speed gear, we had no idea that it would be so eagerly sought after, as we imagined that the extra cost would deter riders from buying. Such, however, was not the case, and for a time the resources of our factory were severely taxed in keeping pace with the demand for two-speeds.

It will be remembered that in our previous list we thus stated the case for the two-speed gear: "For ordinary work a two-speed gear is unnecessary, but there are occasions when it is supremely useful. The position is very frankly and fairly stated in a letter which we received from a rider in the Shetland Islands. He says: "Yours is the first motor bicycle that I have been able to use with unqualified success in Shetland. While all our roads are hilly, there are some very bad hills indeed—notably Wormadale from Whiteness, Tresta Scord from Tresta, and Mavis Grind from Brae. One can hardly go anywhere without having to face one or other of those hills. The problem of getting up is complicated by the fact that frequently a gale is blowing in one's face. Now, to face a hill and a gale, the motor wants to be kept in very good tune, and one has not always time for that. A two-speed gear would be a great boon. Locomotion in Shetland is further hindered by the fact that most of the roads are crossed at short intervals by gates, frequently in the middle of a hill; a machine less easy to handle and less easily started would be worse than useless. With a two-speed gear, the Douglas would be perfect."

What applies to Shetland applies generally to all mountainous districts, and there is a very large Colonial and Continental demand for the Douglas Motor. In England, we anticipate, the two-speed gear will be used chiefly as an aid to slow locomotion in traffic.

The same writer in a recent letter says: "I am delighted with the two-speed gear, but it has had conse-

quences which I did not anticipate. The first of these is economy. Formerly I used to get from 1,500 to 2,000 miles out of a belt. Now I know you will think it incredible, but it is the fact, that I have ridden nearly 3,000 miles with my present machine and have never once had to shorten the belt. It looks like new as yet and promises to last for a couple of seasons. I don't know what the belt-makers will say to this, but it is an economy that will endear the Douglas to every rider. The other point is that I never require to tune-up the two-speed model. I have used it daily for four months, and have done nothing except fill in petrol and oil with occasional lubrication to the bicycle proper. Notwithstanding such flagrant neglect the motor does not show the least falling off in power and speed, and I have ceased to be conscious of the fact that I run a motor cycle—a very rare unconsciousness indeed. I attribute this freedom from trouble to the fact that, owing to the presence of the second speed, I never strain or overheat the engine. Such freedom from petty trouble and waste of time is just what was needed to make a motor bicycle perfect."

We were so impressed with what our correspondent and numerous other riders point out as to the economy in belts resulting from the use of the very large pulley of the two-speed gear that we decided to fit a countershaft with this pulley even to those models that have a fixed gear. It was something of a revelation to learn that such economy in belts could be effected by a large pulley, and we think it right that every purchaser of a Douglas motor cycle should have the benefit of the device, as it seems to us probable that it is just the man who can least afford the extra cost of a two-speed gear that will benefit most by economy in belts. Externally the countershaft gear is similar in appearance to the two-speed gear. It runs on ball bearings, and is a sound piece of work. The drive from the engine to this gear is by means of a Renolds chain.

STANDARD MODELS FOR 1913.

For 1913 we are making the following models :—

1. Model N.

Single gear with countershaft, large pulley, foot-rests and pedals.

2. Model O.

Two-speed gear and foot-boards (no free engine clutch).

3. Model P.

Light touring model with two-speed gear, foot-rests, dropped or raised handle bars (no free engine clutch).

4. Model R.

Two-speed gear, free engine clutch with kick starting pedal, and foot boards.

5. Model S.

Open frame or ladies' model, two speed gear, free engine clutch with kick starting pedal, and foot-boards.

SPECIAL FEATURES OF THE DOUGLAS MOTOR BICYCLE.

1. Absence of engine-vibration, resulting from perfect balance of cranks and equal interval between explosions.
2. Semi-automatic lubrication on all models.
3. Efficient mudguarding.
4. Low riding position.
5. Silent exhaust.
6. Kick starter on clutch models.
7. Front wheel stand to models, N, O, R, & S.
8. Combined belt and chain drive on all models.
9. An efficient and durable two-speed gear.

In addition to the above we have introduced numerou minor improvements and refinements in construction a material. For example, the fly-wheel is now machined f-n

a plate of solid steel. This is a much more homogeneous metal than cast iron, and we anticipate that the new fly-wheel and balanced cranks will eliminate the last traces of vibration on what is even now the least-vibratory engine fitted to motor bicycles. The engine and gears are fitted with ball-bearings; and, generally speaking, everything has been done to render available at the road-wheel the maximum proportion of the power generated by the motor.

DESCRIPTION OF THE DOUGLAS MOTOR BICYCLE.

A fierce controversy has always raged as to what constitutes a "light-weight" motor bicycle. So far as mere weight is concerned, we hold that the Douglas is a "light-weight"; in other respects we should be sorry to see it ranked with machines of that class. The Douglas is essentially a **motor bicycle** with ample power, speed and strength—not a pedal bicycle with puny engine and fittings awkwardly and absurdly attached. The frame is sufficiently strong to carry the heaviest rider over the roughest roads, and every fitting to be found on the heaviest machines will be found equally strong and substantial on the Douglas. The spring forks, designed and made by us, have received the highest praise; they are efficient, noiseless, and capable of infinite wear. One of our two-speed gears was taken apart after running 5,000 miles (including the Scottish Trials) and no sign of wear was detected. During 1911 and 1912 some thousands of our gears have been in constant use and have given absolute satisfaction. The tank holds petrol sufficient for over 100 miles and lubricant for 300 miles. The back carrier is large and well-stayed. Number plates are incorporated with the machine.

It is, of course, the unique design of the engine that specially distinguishes the Douglas Motor Bicycle. In

order to eliminate vibration, the cylinders are opposed horizontally, and the pistons work against each other. The cylinders are beautiful examples of what can be done in an English foundry. The crankshaft is a piece of mechanism as elaborate and as carefully finished as may be found in the highest-priced car. It is cut from a steel forging, balanced, and carefully hardened, ground true. Ball bearings are fitted to the crank case. The connecting-rods are bushed with phosphor bronze, so that it is practically impossible for them to seize. The stroke is 60 millimetres and the bore is 60.5 millimetres. Both exhaust and inlet valves are mechanically operated. The tappets can be adjusted for wear. Access to both exhaust and inlet valves is obtained by unscrewing carefully-constructed valve-caps. Into one of these caps the sparking plug is screwed. Compression taps, to enable paraffin or petrol to be injected into the cylinders, are fitted to each cylinder.

The engine receives an impulse at each revolution, and the intervals between the explosions (unlike those in the V type of twin) are exactly equal. As pistons and cranks are most carefully balanced, there is practically no vibration, even at highest speeds. The consumption of petrol is low, from 100 to 120 miles being obtained to the gallon. The magneto is specially designed for this engine and is sheltered from rain and mud, and possible short circuiting. The value of this arrangement is greatly enhanced by the fitting of a dust-proof aluminium gear-case. As the magneto is gear-driven, it—unlike magnetos driven by chains, which are liable to stretch—never requires adjustment.

We are fitting as standard, heavy Hutchinson non-skid tyres. The bicycle wheels are most carefully constructed; and the belt rim is built separately on the back wheel instead of being merely clipped to the spokes, as is common with other makes of motor bicycles.

We think it right to point out—and every engineer will agree with us—that there is infinitely more work, and work of a more exacting kind, on our motor than on any single-cylinder motor such as is sold usually for ten pounds more. In buying a Douglas, the purchaser receives much better value for his money than in buying any single-cylinder machine now in the market. This, of course, means that our profit as manufacturers is less ; but we have the satisfaction of knowing that our work is appreciated, and we believe that our bicycle appeals to a class who, if they had no alternative but the uncomfortable and costly single-cylinder machine, would never have joined the ranks of motor cyclists.

It is unnecessary to explain our design in placing several models on the market. In every case the engine is the same ; but it is now in the power of riders to obtain a Douglas Motor Bicycle exactly fitted for the work it has to perform and for the country in which it is to be used.

We should add that in the various public tests to which we have submitted the Douglas Motor Bicycle, the judges have commented on the silence, cleanliness, and pleasing appearance of the machine. To most persons its hill-climbing powers and capacity for speed seem little short of miraculous.

GENERAL.

We have determined to give absolute satisfaction to every purchaser of the Douglas Motor Cycle. Our aim is to produce a motor bicycle that shall be at once beautiful, reliable, and able to be used by anyone, irrespective of age or sex. Our original conception admittedly placed us in the front rank of motor engineers ; but our previous models seem crude when compared with the models we now make. **Our aim is to produce an engine that shall be able to run for an indefinite period without tuning-up.** All the

members of our staff use our motor cycle, and every weakness is ruthlessly exposed. We have to thank numerous private riders for excellent suggestions. We have spared neither time nor expense in experimenting, and fortunately the resources of a large and well-equipped factory have always been available to our experts. The fact that iron, brass, and aluminium founding is an integral part of our business has been of the utmost advantage to us. Most firms buy their castings, and in consequence have little control over the quality of the metal employed. Our castings consistently earn the highest praise. We have tried to produce a " no-trouble " motor, and we think that the experience of Mr. Eli Clark in his English End-to-End Record ; of Mr. J. Stewart in his Irish End-to-End Record ; of Mr. Bashall, the winner of the Junior Tourist Trophy Race ; of Mr. Bailey in his consistent breaking of records on Brooklands ; his great achievement in winning the Grand Prix at Le Mons in France when he averaged 47 miles per hour on the road for 5 hours ; and of Mr. H. V. Swift in his six days' run of 2,025 miles ; sufficiently indicates that, to a very large extent, we have achieved our object.

Amateurs accustomed to enclosed flywheels are at first inclined to look askance at the outside flywheel of the Douglas Motor Bicycle. They forget that in all high-grade motors—whether car, marine, or aerial—the enclosed flywheel is now obsolete, and that it is retained on motor bicycles only because the average maker finds it difficult so to re-design his machine as to make the fitting of an outside flywheel possible ; also he finds it cheaper to dispense with the use of an accurately-machined crank. The chief advantages of the outside flywheel are : (1) It can be made very much larger than an enclosed flywheel ; (2) it reduces vibration ; (3) it makes the engine more flexible ; (4) it gives more effective momentum than

internal flywheels four times the weight ; (5) it consumes much less power than two heavy internal flywheels dragging among thick engine oil.

The magneto on the Douglas motor gives better results than the magneto on the common V-type of twin. As the cylinders lie on the same horizontal plane, there is an equal interval of time between each explosion. This not only gives perfect regularity of running, but enables the electric current to be tapped at the point of maximum intensity.

In the Douglas motor a special feature has been made of accessibility. We see many motors that cannot be taken to pieces and re-assembled without the aid of experts. We also see motors whose parts are so small and so fragile that they will not bear to be taken to pieces with any degree of frequency, and require adjustment with every run.

The Douglas motor, though the lightest in the market for its horse-power, is so strongly made, and all the parts are so big, strong, and accessible, that the merest novice can take it to pieces and build it afresh an infinite number of times, without doing it the least injury. The position and attachment of each part is so obvious and simple that it is impossible to err in reconstruction. Though engineers ourselves, we realise that we are building a machine for plain men who not only are not engineers, but who have neither the training nor the facilities to enable them to handle machinery complicated by all sorts of mechanical tricks. Simplicity and strength is the keynote of our work. We may add that, for experiment, the engine has been dismantled, cleaned, and re-assembled within one hour.

It is specially with a view to make it impossible for a novice to err in lubricating the engine that we have designed and fitted a thoroughly effective, yet simple,

system of semi-automatic lubrication. The induction pipe, can be removed by unscrewing two nuts. The valves can be removed without disturbing the induction pipe. The exhaust-valve tappets have a simple screw-adjustment for wear. The engine is fitted to a special cradle brazed to the frame, and is secured by four bolts. It can be separated from the bicycle and placed on the bench within ten minutes; so that, notwithstanding the security and strength of its attachments, it is as easy to handle as some motors for which it is claimed as a merit that they are secured to the frame by thumb-screws. The cylinders can now be removed for cleaning purposes without removing the crank-case.

Our carburetter has received much praise for its uniform efficiency and for the ease with which it can be handled. It is secured to the induction-pipe by two nuts, and can be removed for examination in something under two minutes. It is impossible to make a mistake in refitting it. The air and throttle pistons can be pulled out for inspection by merely undoing one milled nut with the fingers. The jet and the choke-tube are now detachable. This will afford the rider greater latitude in using his machine for different kinds of work. In appearance the design of the carburetter is more pleasing than formerly. The Douglas carburetter has proved consistently satisfactory and very economical.

Our engine work has received the highest commendation from experts. In proof of this, we may state that, last year, the Marconi Wireless Telegraph Company, after experimenting with many types of light petrol motor, finally placed with us a very large and continuous order for our standard motor, which it is designed to carry on horseback and to use for working a wireless telegraph in the field. The order was given only after the Douglas Motor had been subjected to searching scientific tests.

This fact alone indicates that our motor is a real power unit, irrespective of its situation. We continue to supply a large number of these motors for purposes of wireless telegraphy. We also build a 6—8 h.p. motor, either air or water-cooled, for the same purpose. We have supplied both types of motor to the War Office and Admiralty.

In concluding these remarks, we affirm that no rider of the Douglas Motor Bicycle has ever approached us with a grievance or complaint which we did not instantly exert ourselves to rectify, even when there was cause to think that the rider himself was at fault.

As in the past we have been, so in the future we mean to be, the friend and adviser of every rider of the Douglas Motor Bicycle. We shall at all times be ready to lend him a willing ear or to extend him a helping hand when in difficulty.

SPECIAL FEATURES OF THE 1913 MODELS.

We believe that progress is the law of life. If a manufacturer thinks that his work has reached perfection, and is content to rest on his laurels, he is in a fair way to ruin. It is very pleasant to be praised, but it is more helpful to be criticised. Accordingly we have cheerfully set ourselves to effect every improvement which our clients and staff regard as desirable. It will readily be understood that every improvement means considerable loss to us, as it involves the obtaining of new machinery and new patterns, and a certain loss of industrial efficiency until the new methods of construction are thoroughly understood. The chief new features in our model for 1913 are :—

Improvements on 1913 Models.

1. New pattern induction pipe (described page 9).
2. Capacity of engine, increased from 340 cc. to 350 cc.
3. Special channel in wall of front cylinder to ensure perfect lubrication of upper portion of piston.

4. Clutch to be of larger pattern and made to prevent oil leaking into it.
5. Wedge to be altered, giving easier clutch movement.
6. New pattern clutch pedal.
7. Improved sight-feed, semi-automatic lubricator.
8. Large filler-caps for oil and petrol.
9. Extended new pattern front mudguard (patent applied for) on clutch models.
10. Rear mudguards partly closed.
11. Gear quadrant to be brazed to top tube of frame.
12. Tank supports to be brazed on frame.
13. Improved lever for foot-brake.
14. Larger tank.

Description of the Douglas Two-Speed Gear as Fitted to Models "O" and "P."

The Douglas two-speed gear is of the simplest character and is composed of two trains of gear wheels, the shafts of which run on ball-bearings.

The secondary shaft is turned solid with its two gear wheels, and the main shaft carries the high and low gear pinions. These revolve freely at each end of the shaft, the centre part of which is square, and carries the dog clutch.

The dog clutch is fitted with a tough phosphor bronze sleeve in two sections, to which is attached the operating fork, actuated by the lever, which is fitted conveniently athwart the petrol tank.

The lever moves along a quadrant, which has three locking positions, marked "high," "free" and "low." The lever, when moved, communicates with the actuating fork by means of the rods, and causes the dog clutch to move transversely on its square until it engages either the high or low gear, as indicated by the words "high" and "low" on the lever quadrant. When the lever is in the free position, both gears are out of engagement and the engine is free.

It will be noticed that there is not a slipping clutch fitted to this type of two-speed gear; *therefore it is not*

possible to start from standing with the engine running.

The drive from the engine to the gear box is by means of a chain running in a neat chain guard.

The transmission from the gear box to the road wheel is by means of a $\frac{3}{4}$ inch rubber belt running on a large pulley (6 inches in diameter). The great size of the pulley ensures a most efficient drive, and greatly prolongs the life of the belt.

The gear is attached to the lower frame tube by means of two studs with washers exactly fitting the tube, which at this part is reinforced by a slotted lug.

The slots ensure lateral rigidity, but allow of the gear box being slid along should the gear chain require adjustment.

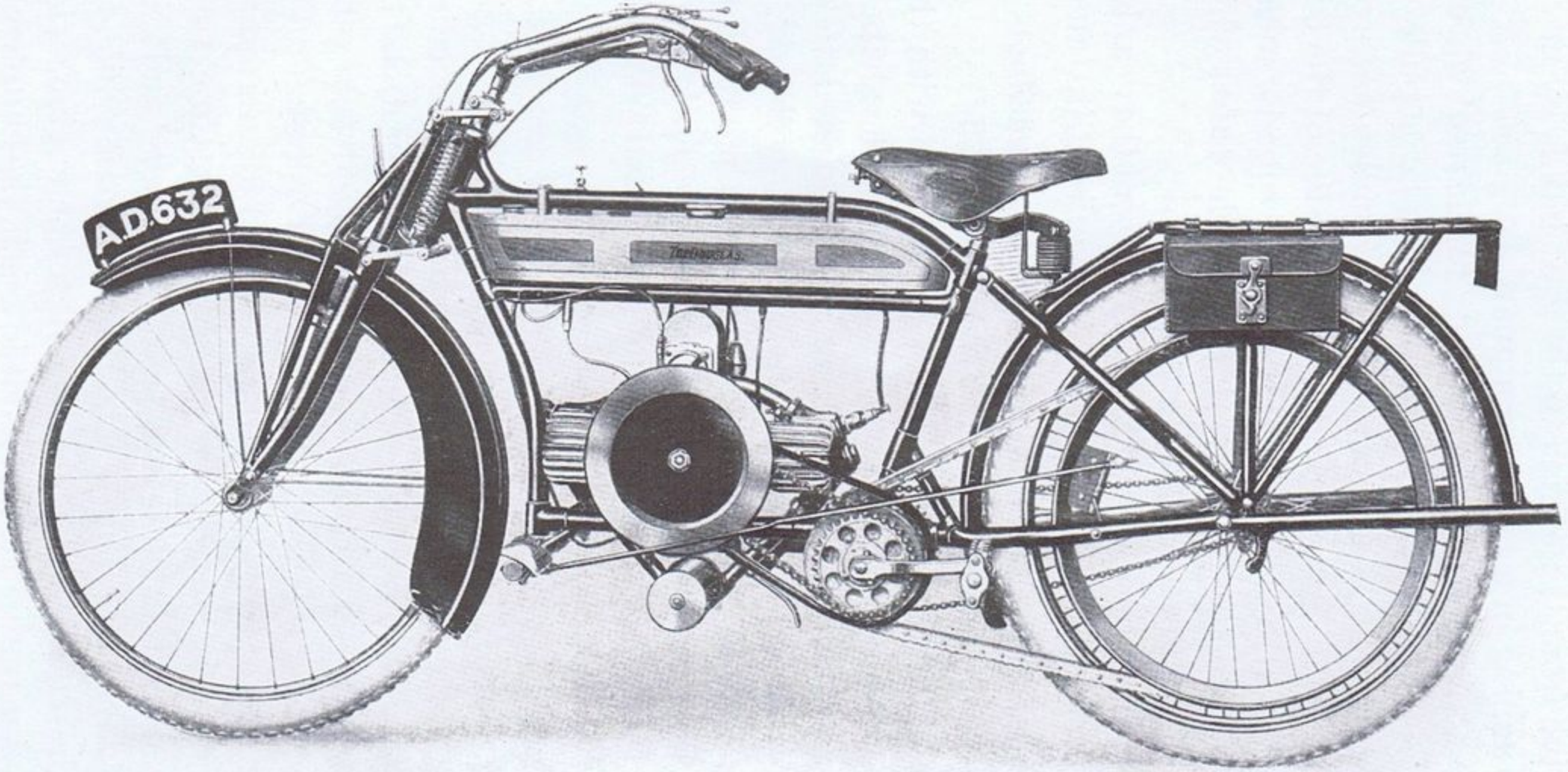
The Douglas Two-Speed Gear, with Clutch, and Foot-Starting, as Fitted to Models "R" and "S."

The Gear fitted to these models is identical with that on Models "O" and "P," with the exception of the shape of the gear box (which has been altered to accommodate the foot-starting device) and of the main shaft, which is, of necessity, longer at both ends, as it carries the clutch on the right side of machine. With these two exceptions, the gear box is the same as that on Models "O" and "P," and the parts are standardised.

The Clutch is of the cone variety, is of ample size, and of great simplicity. It is placed in the free engine position by depressing a double pedal, fitted in a convenient position on the foot board. Pressure of the toe frees the engine; pressure of the heel engages the clutch. The end thrust caused by disengaging the clutch is taken up by several ball races, so that the friction is reduced to a minimum.

The engine is started by pressure of the foot on a pedal-lever conveniently placed at the left-hand side of the machine. One sharp push of the pedal while the rider is in the saddle is sufficient to start the engine. The low gear, having previously been put in mesh, the clutch may then be let in, when the machine will move away. The operation of starting is thus greatly simplified and accelerated.

THE 2¾ H.P. TWIN DOUGLAS.



Model N.

Single gear with countershaft, large pulley, foot-rests and pedals.

SPECIFICATION.

MODEL " N " (Single Speed).

Engine.—$2\frac{3}{4}$-Douglas. (Patent).

Ignition.—Magneto ; handle-bar control.

Tank.—Petrol capacity : 1 gallon ; sight-feed lubricator ; filler-cap $1\frac{3}{4}$-inches diameter.

Carburetter.—Improved design.

Frame.—1913 pattern ; butted heavy gauge steel tubes ; top tube curved to allow of low saddle position ; height of saddle from ground—29 inches ; detachable and adjustable footrests. Pedals with chain and free-wheel with Douglas patent dust-caps.

Front Stand.—Incorporated with foot-rests.

Drive.—Chain to counter-shaft ; $\frac{3}{4}$-inch rubber belt from counter-shaft to back wheel.

Rear Stand.—Can be put in or out of action by pressure of foot ; secured by spring catch.

Mudguards.—$3\frac{1}{2}$-ins. wide ; front mudguard fitted with side wings and number-plate.

Carrier.—Specially strong ; wholly reserved for luggage ; number plate attached.

Tool Bags.—Two, metal fastenings, clipped to sides of carrier.

Saddle.—Lycett's special large.

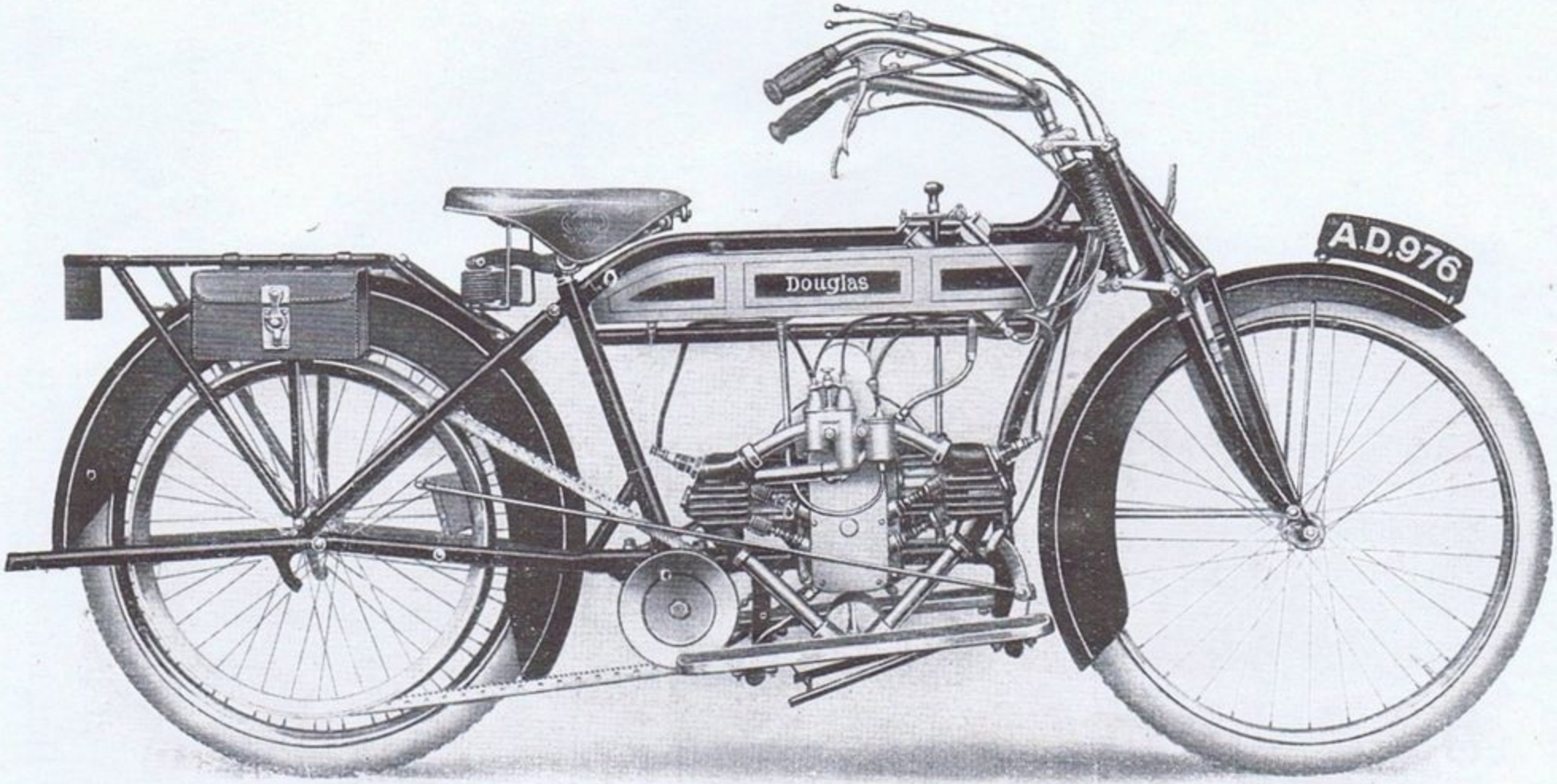
Brakes.—Front Bowden brake, with improved handle. Powerful rear brake, acting on the belt rim.

Wheels.—26-inches.

Tyres.—Hutchinson, 2-inch. Heavy non-skid.

Gear Ratio.—$5\frac{1}{2}$ to 1.

THE 2¾ H.P. TWIN DOUGLAS.



Model O.

Two-speed gear and foot-boards (no free engine clutch).

SPECIFICATION.

MODEL " O " (Two-speed and Footboards).

Engine.—$2\frac{3}{4}$-Douglas. (Patent).

Ignition.—Magneto ; handle-bar control.

Tank.—Petrol capacity 1 gallon, 2 pints ; sight-feed lubricator ; filler cap, $1\frac{3}{4}$-inches diameter.

Carburetter.—Improved design.

Frame.—1913 pattern, butted heavy gauge steel tubes ; top tube curved to allow of low saddle position ; height of saddle from ground—29-inches ; foot-boards carried on cross tubes which form an integral part of frame.

Drive.—Chain to two-speed gear ; $\frac{3}{4}$-inch rubber belt from gear to back wheel.

Rear Stand.—Can be put in or out of action by pressure of foot ; secured by spring catch.

Front Stand.—Folds up under foot-rests.

Mudguards.—$3\frac{1}{2}$-inches wide. Front mudguard fitted with side wings and number plate.

Carrier.—Specially strong ; wholly reserved for luggage ; number plate attached.

Tool Bags.—Two ; metal fastenings ; clipped to sides of carrier.

Saddle.—Lycett's special large.

Brakes.—Front Bowden brake, with improved handle. Powerful rear brake, acting on the belt rim.

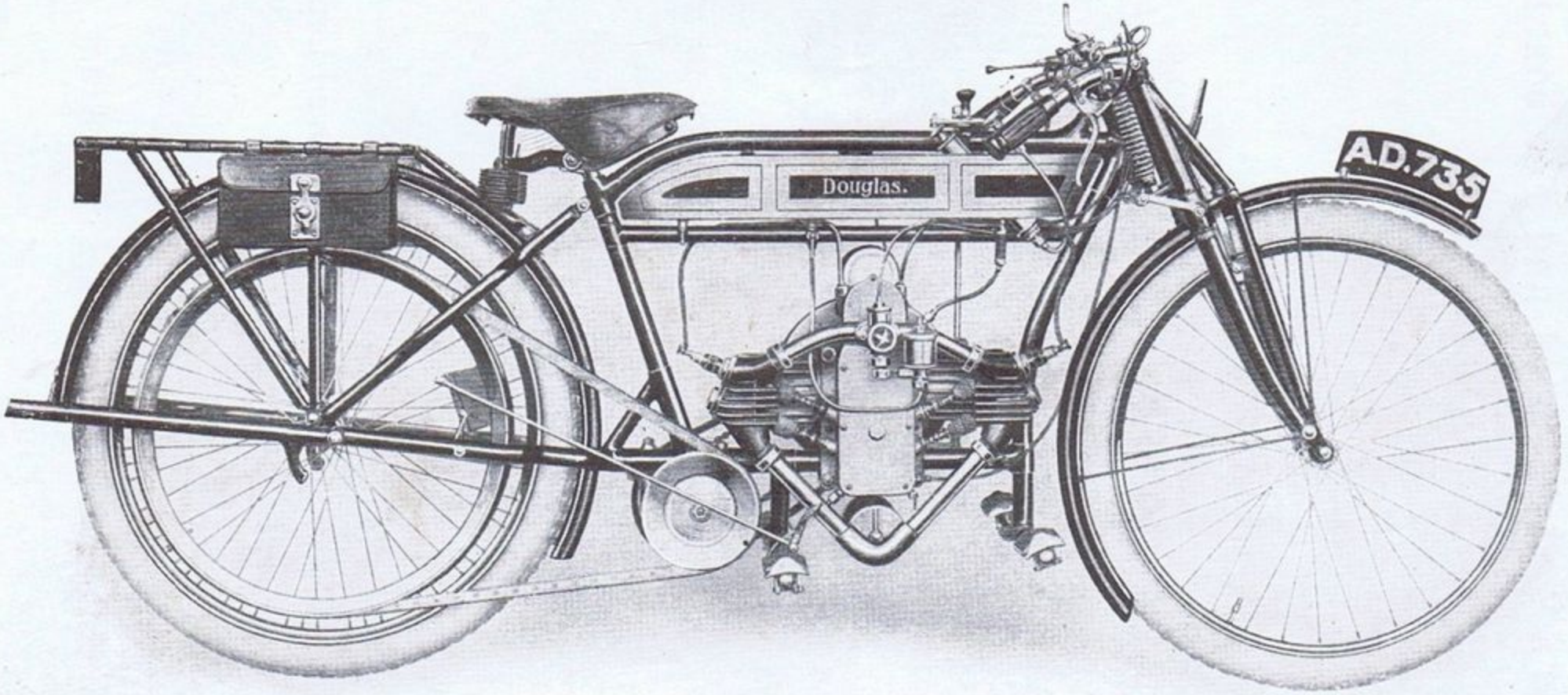
Wheels.—26-inches.

Two-speed Gear.—The Douglas.

Tyres.—Hutchinson, 2-inch. Heavy non-skid.

Gear Ratio.—$5\frac{1}{2}$ and $8\frac{1}{2}$ to 1.

THE 2¾ H.P. TWIN DOUGLAS.



Model P.

Light Touring Model with two-speed gear, foot-rests, dropped or raised handle bars (no free engine clutch).

SPECIFICATION.

MODEL " P " (Two-speed and Foot-rests).

Engine.—$2\frac{3}{4}$-Douglas. (Patent).

Ignition.—Magneto ; handle-bar control.

Tank.—Petrol capacity : 1 gallon, 2 pints ; sight-feed lubricator ; filler cap $1\frac{3}{4}$-inches diameter.

Carburetter.—Improved design.

Frame.—1913 pattern, butted, heavy gauge steel tubes ; top tube curved to allow of low saddle position ; height of saddle from ground—29 inches ; double foot-rests.

Drive.—Chain to two-speed gear ; $\frac{3}{4}$-inch rubber belt from gear to back wheel.

Rear Stand.—Can be put in or out of action by pressure of foot ; secured by spring catch.

Mudguards.—$3\frac{1}{2}$-inches wide ; number plate fitted to front guard.

Carrier.—Specially strong ; wholly reserved for luggage

Tool Bags.—Two ; metal fastenings ; clipped to sides of carrier.

Saddle.—Brooks.

Brakes.—Front Bowden brake, with improved handle. Brake guides and clips are embodied in the spring forks. Powerful rear brake, acting on the belt rim.

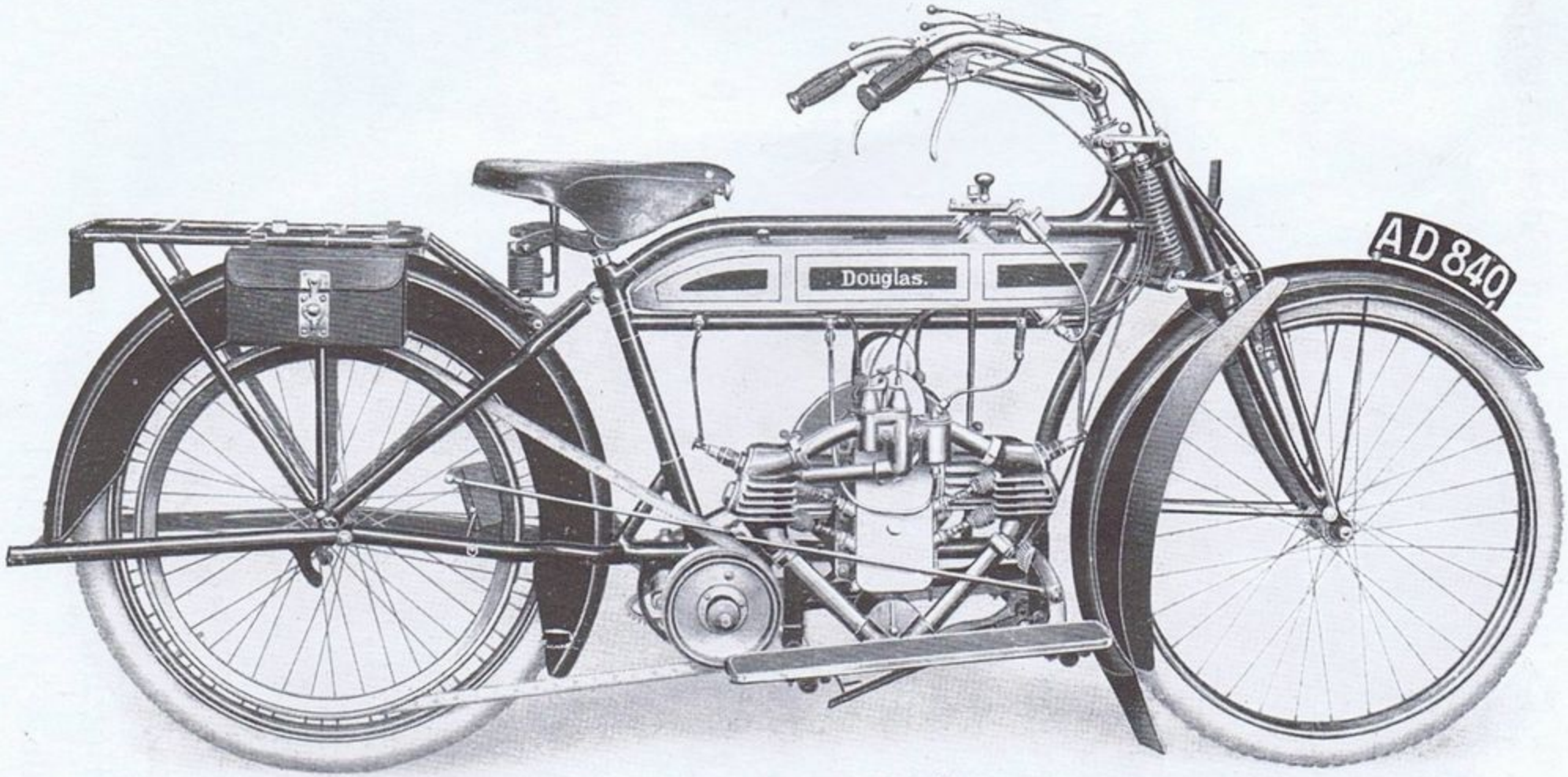
Wheels.—26-inches.

Two-speed Gear.—The Douglas.

Tyres.—Hutchinson, 2-inch. Heavy non-skid

Gear Ratio.—$5\frac{1}{2}$ and $8\frac{1}{2}$ to 1

THE $2\frac{3}{4}$ H.P. TWIN DOUGLAS.



Model R.

Two-speed gear, free engine clutch with kick starting pedal, foot-boards, and new model mudguards.
(Patent applied for).

SPECIFICATION.

MODEL " R " (Two-speed, Free Engine and Footboards).

Engine.—$2\frac{3}{4}$-Douglas. (Patent).

Ignition.—Magneto ; handle-bar control.

Tank.—Petrol capacity : 1 gallon, 2 pints ; sight-feed lubricator ; filler cap $1\frac{3}{4}$-inches diameter.

Carburetter.—Improved design.

Frame.—1913 pattern, butted heavy gauge steel tubes ; top tube curved to allow of low saddle position ; height of saddle from ground—29-inches. Foot-boards carried on cross-tubes which form an integral part of frame.

Drive.—Chain to two-speed gear ; $\frac{3}{4}$-inch rubber belt from gear to back wheel.

Rear Stand.—Can be put in or out of action by pressure of foot ; secured by spring catch.

Front Stand.—Folds up under foot-rests.

Mudguards.—$3\frac{1}{2}$-inches wide. Improved front guard. (Patent applied for).

Carrier.—Specially strong ; wholly reserved for luggage ; number plate attached.

Tool Bags.—Two ; metal fastenings ; clipped to sides of carrier.

Saddle.—Lycett's special large ; pan seat.

Brakes.—Front Bowden brake, with improved handle. Powerful rear brake, acting on the belt rim.

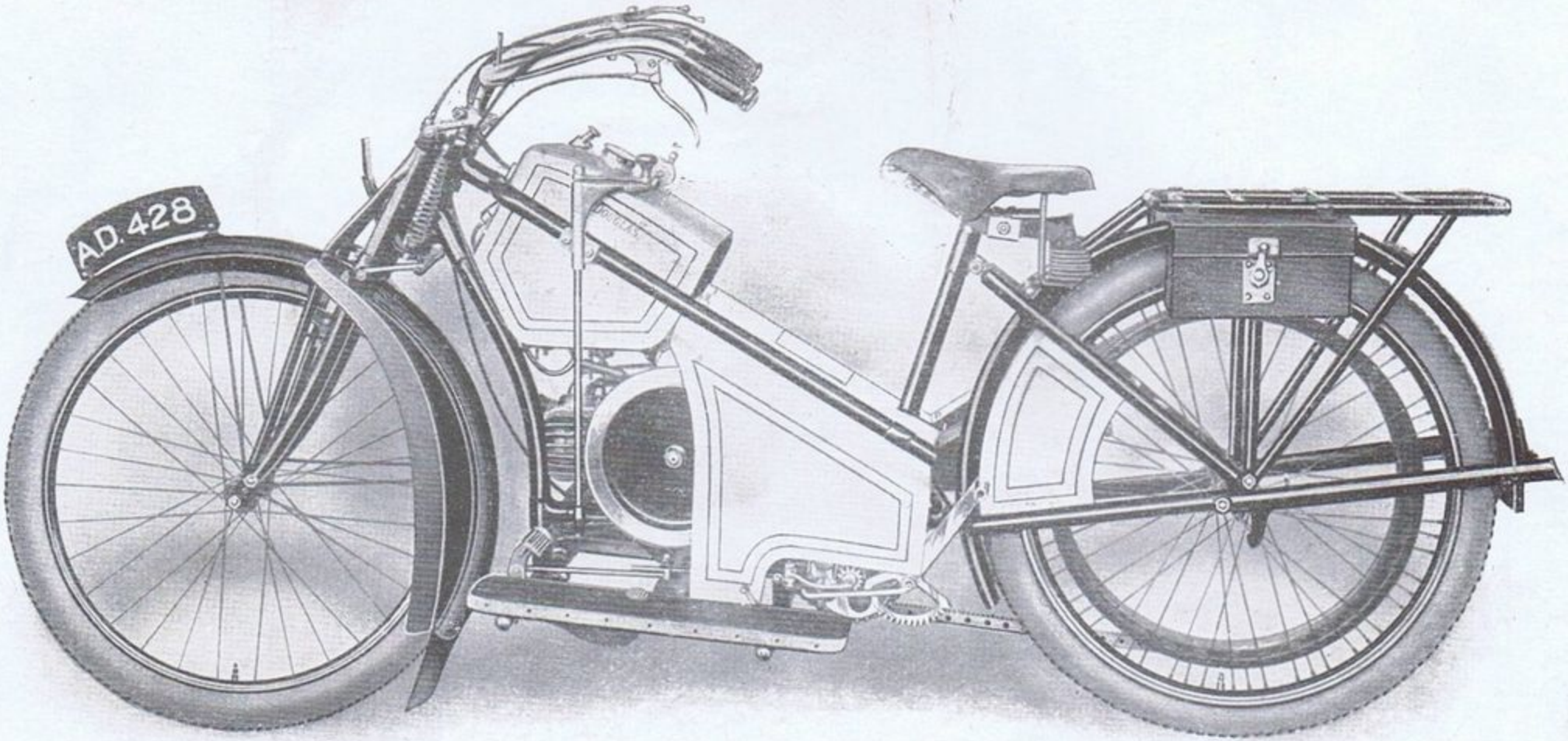
Wheels.—26-inches.

Two-speed Gear and Free Engine.—The Douglas two-speed gear, with free engine and pedal clutch ; pedal lever for starting engine by pressure of foot.

Tyres.—Hutchinson, 2-inch. Heavy non-skid.

Gear Ratio.—$5\frac{1}{2}$ and $8\frac{1}{2}$ to 1.

THE $2\frac{3}{4}$ H.P. TWIN DOUGLAS.



Model S.

Open frame or Ladies' Model, two-speed gear, free engine clutch with kick starting pedal, foot-boards. and new model mudguards (patent applied for).

SPECIFICATION.

MODEL " S " (Open Frame, Two-speed, Free Engine and Footboards).

Engine.—$2\frac{3}{4}$-Douglas. (Patent).

Ignition.—Magneto ; handle-bar control.

Tank.—Petrol capacity : 1 gallon ; sight-feed lubricator ; filler cap $1\frac{3}{4}$ inches diameter.

Carburetter.—Improved design.

Frame.— Open Frame (registered design), giving adequate dress clearance. Height of saddle $28\frac{1}{2}$-inches. Footboards carried on cross tubes which form an integral part of frame.

Drive.—Chain to two-speed gear ; $\frac{3}{4}$-inch rubber belt from gear to back wheel.

Rear Stand.—Can be put in or out of action by pressure of foot ; secured by spring catch.

Front Stand.—Folds up under foot-boards.

Mudguards.—$3\frac{1}{2}$-inches wide. Improved front guard (Patent applied for).

Carrier. — Specially strong ; wholly reserved for luggage.

Tool Bags.—Two ; metal fastenings ; clipped to sides of carrier.

Saddle.—Lycett's special, pan seat.

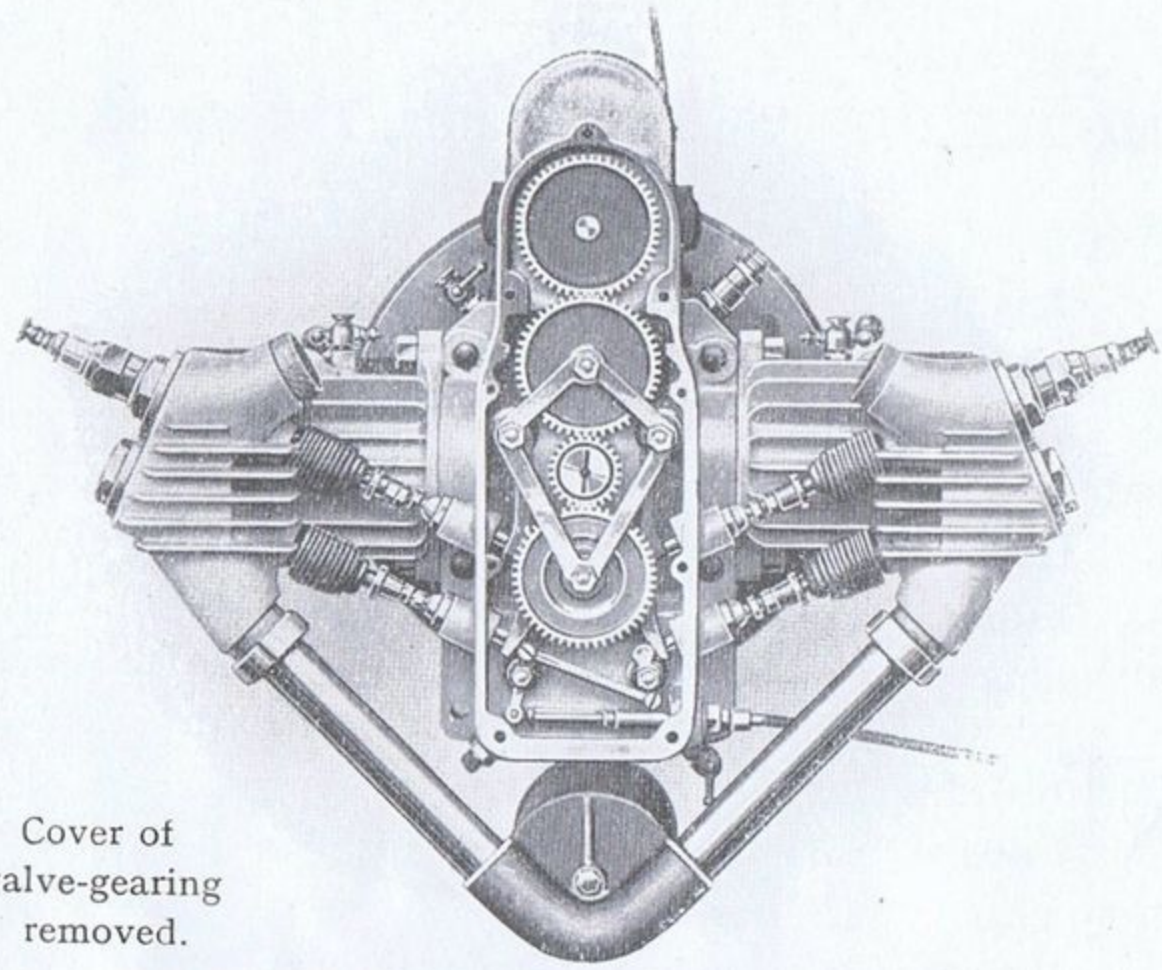
Brakes.—Front Bowden brake, with improved handle. Powerful rear brake, acting on the belt rim.

Wheels.—26-inches.

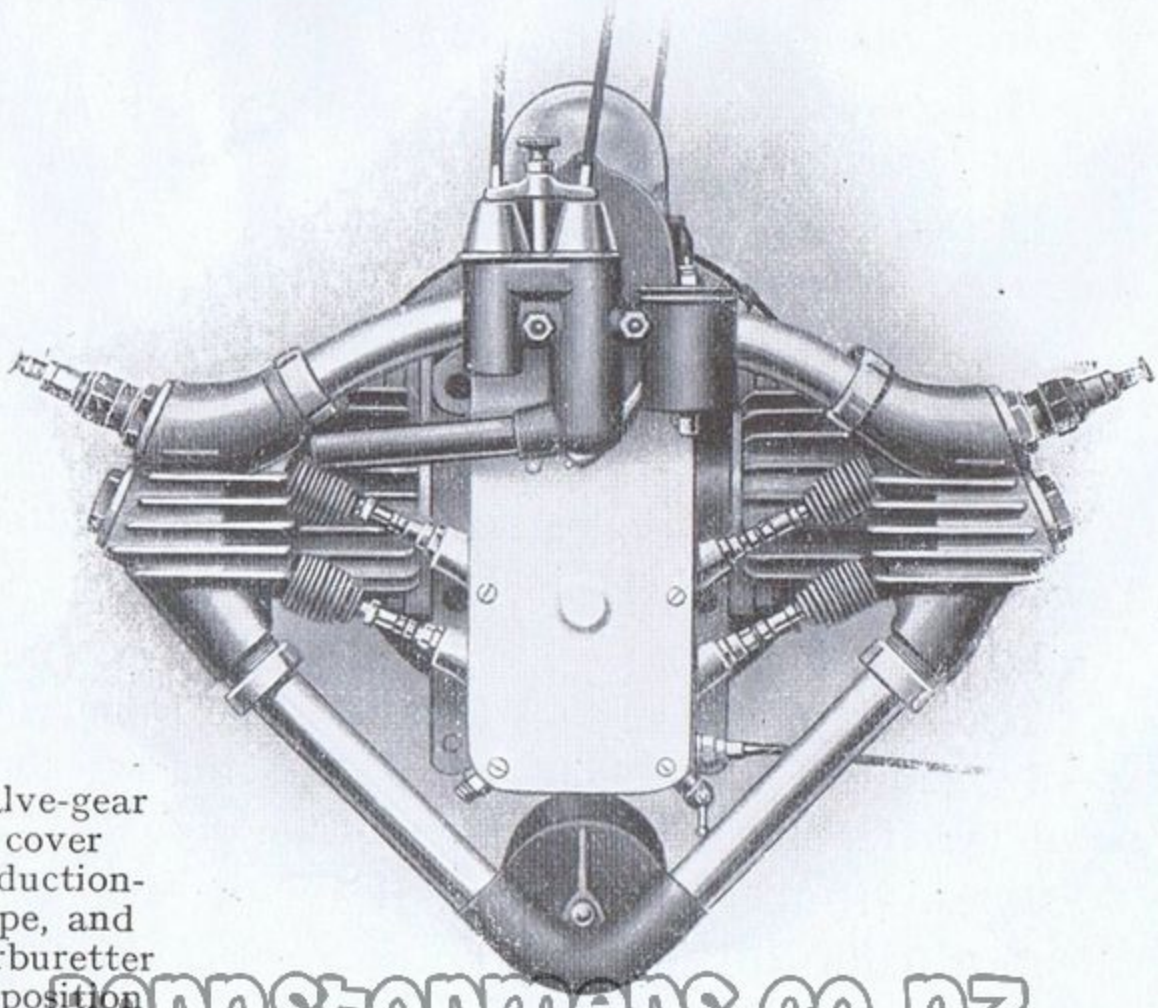
Two-speed Gear and Free Engine.—The Douglas two-speed gear with free engine and pedal-actuating clutch ; pedal-lever for starting engine by pressure of foot.

Tyres.—Hutchinson, 2-inch. Heavy non-skid

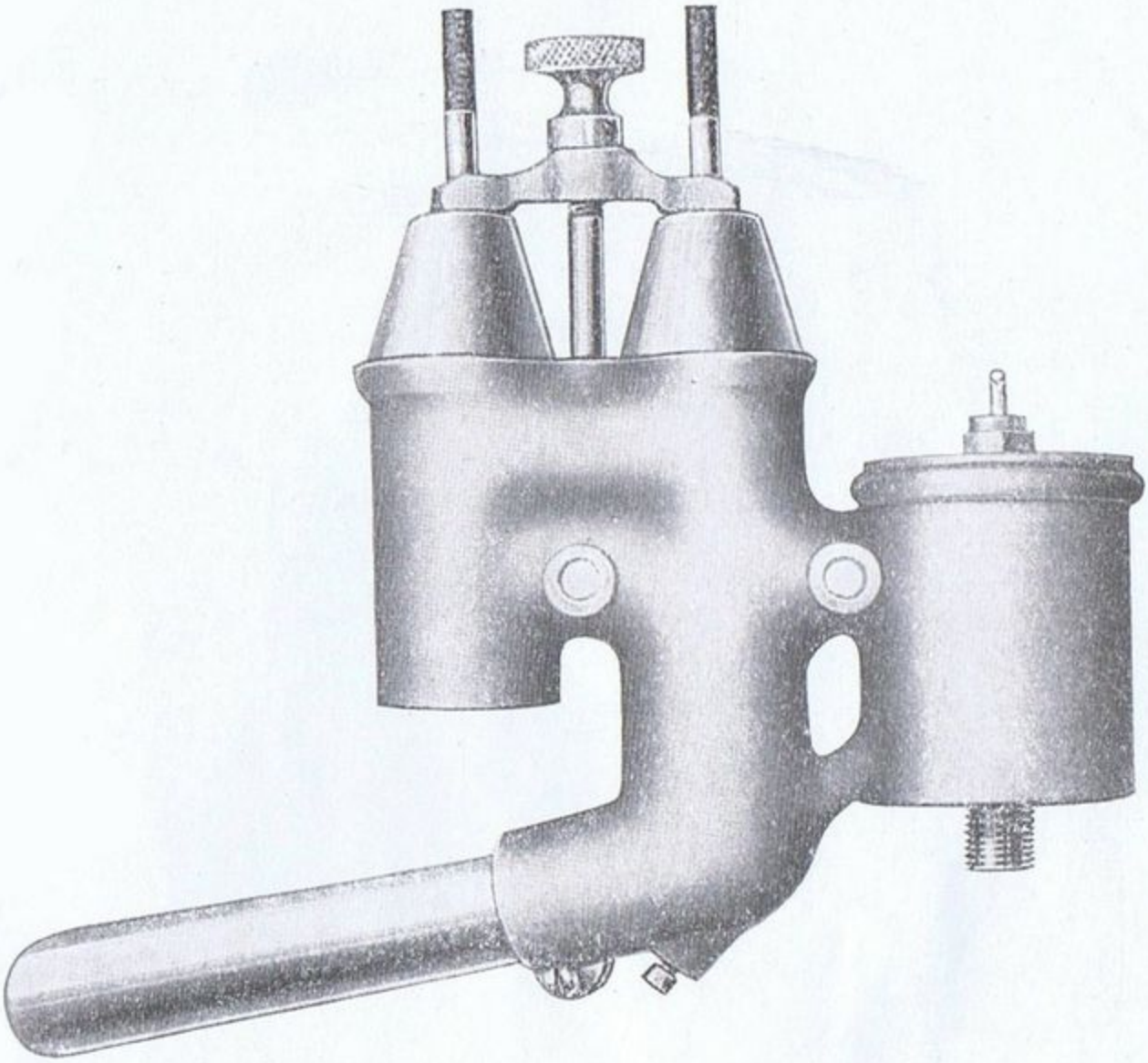
Gear Ratio.—$5\frac{1}{2}$ and $8\frac{1}{2}$ to 1.



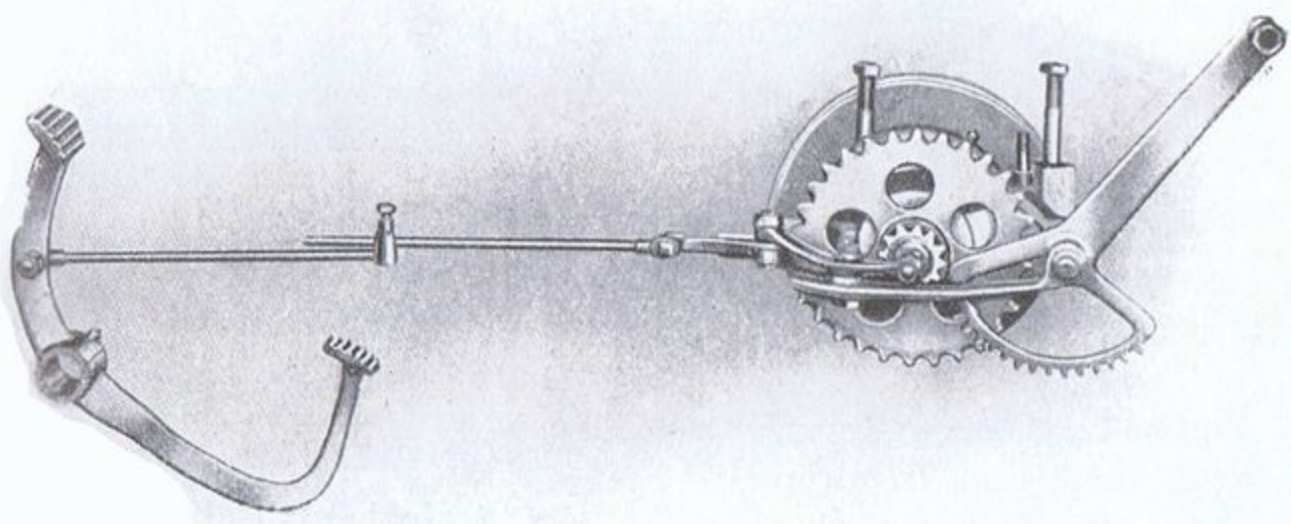
Cover of valve-gearing removed.



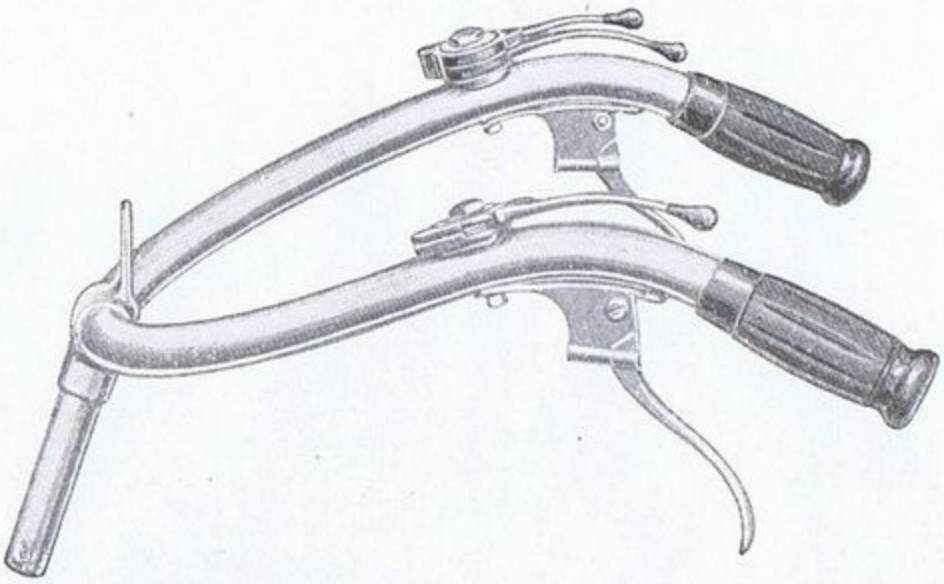
Valve-gear cover induction-pipe, and carburetter in position



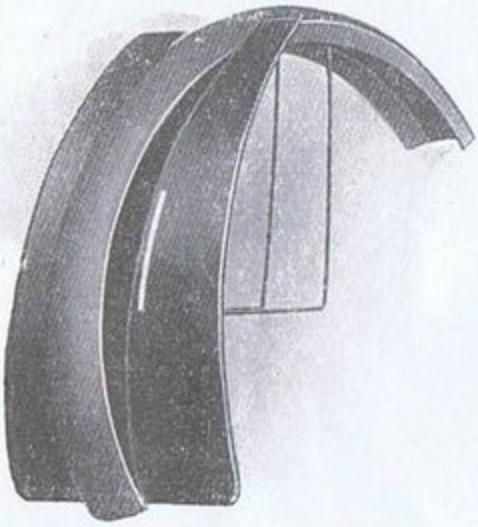
1913 Douglas Carburetter. Choke-tube and jet detachable and interchangeable, valves removable by unscrewing milled nut.



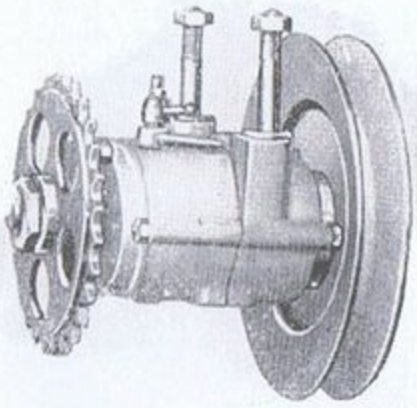
1913 Douglas Two-speed Gear, Free-engine Clutch and Actuating Pedals, and Pedal for Foot-starting.



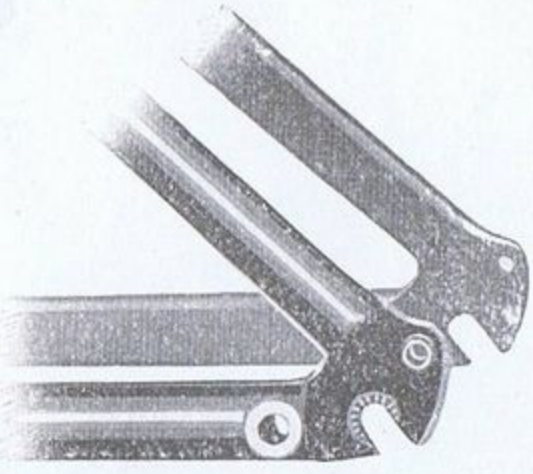
1913 Handlebar, with Carburetter and Magneto Control.



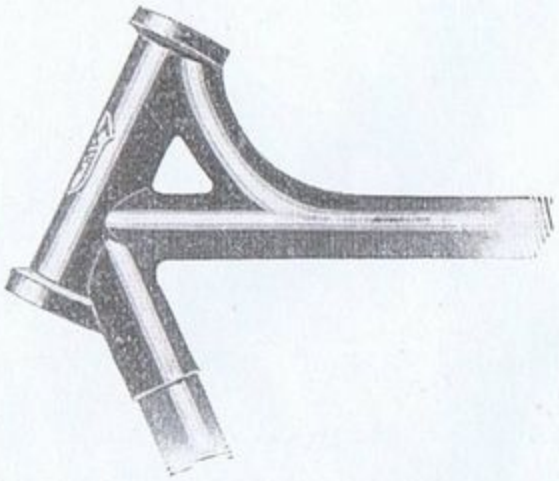
Improved **Front Mudguard**
(Patent applied for.)



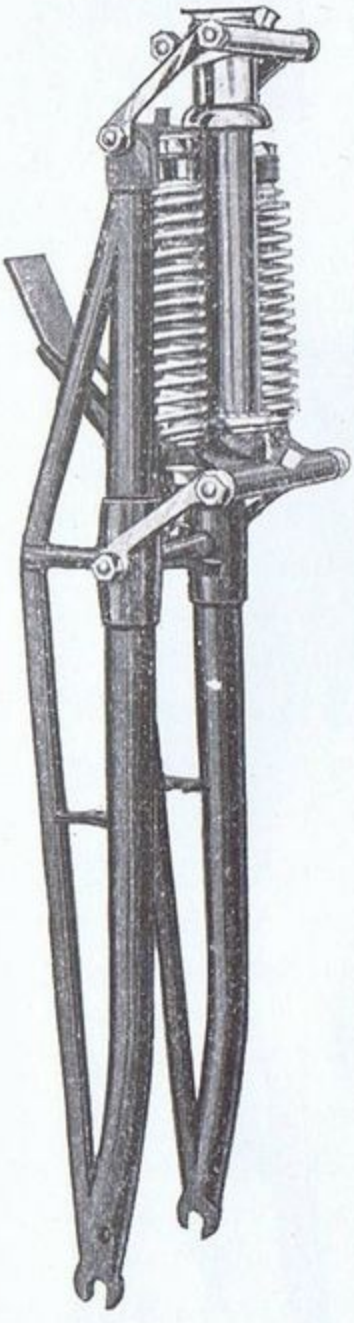
Two-speed Gear for Models "O" and "P."



Slotted Lugs on rear-stays, allowing wheel to drop out by simply unscrewing nuts. The stand lies forward clear of the wheel.

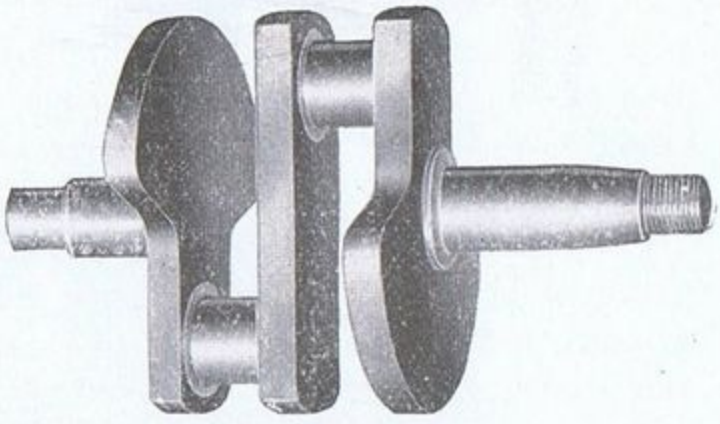


Steering Head formed of a single malleable casting.

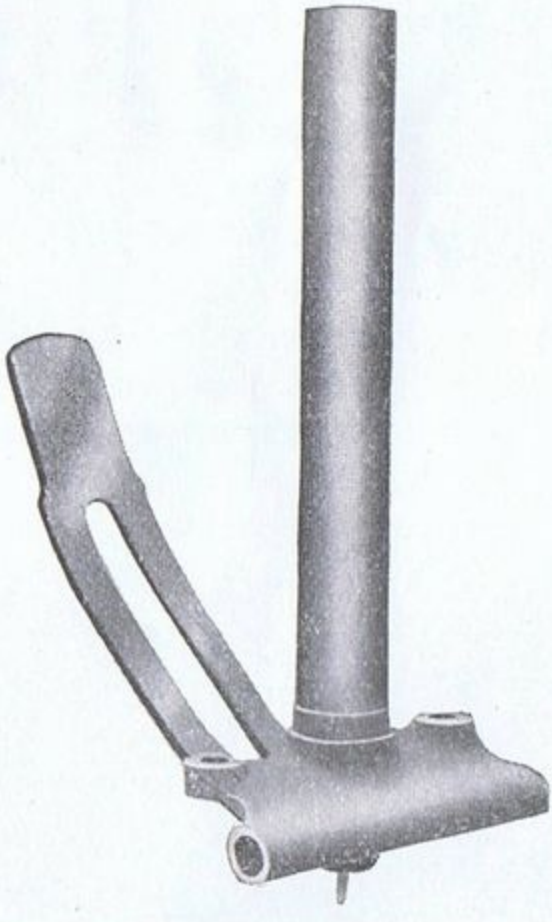


The Douglas Spring Forks.

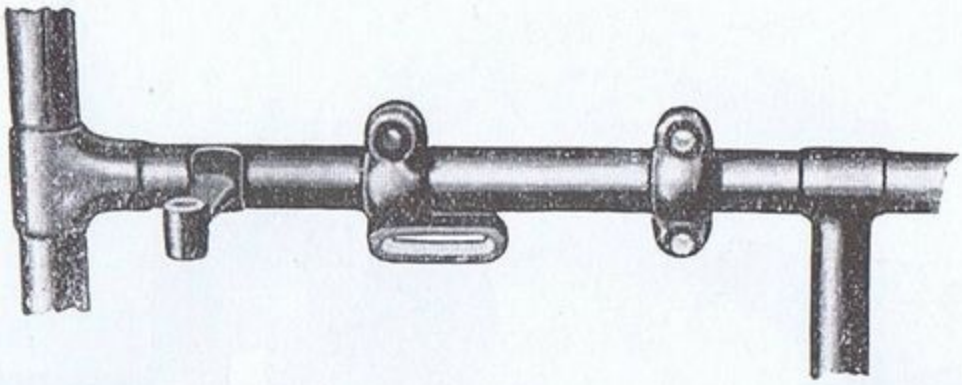
Fork-ends are slotted, allowing wheel to drop out after slackening nuts. Brake guides are incorporated with fork.



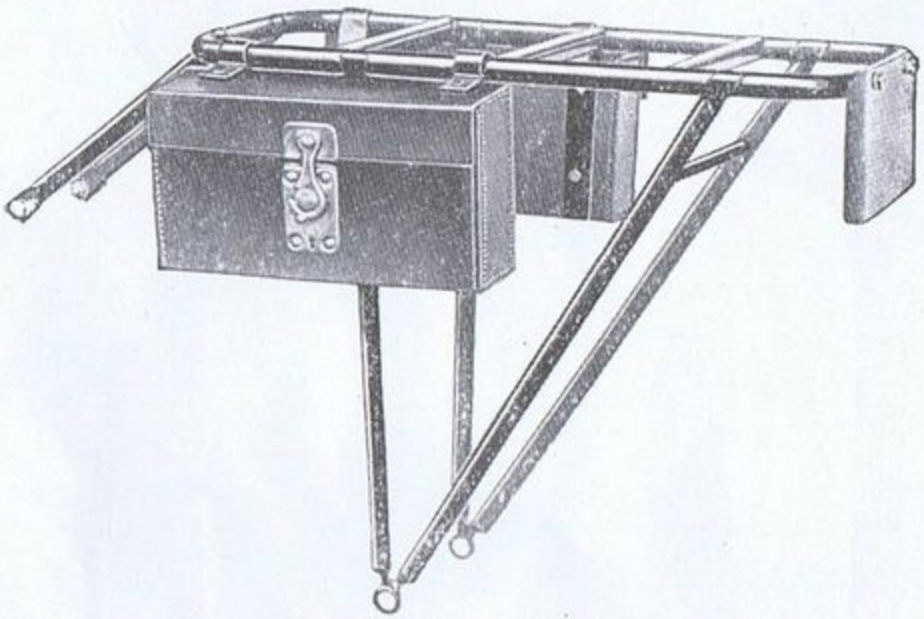
Balanced Crank.



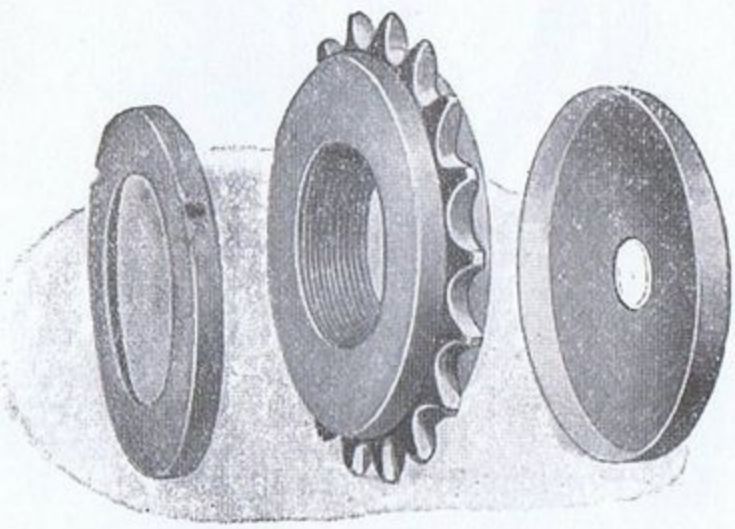
The Douglas Lamp Bracket which is designed to carry lamp in the most convenient position on sprung part of machine.



Bottom Bar of Frame, showing method of fixing engine



Carrier, with number-plate, and improved tool-bags.



The Douglas Patent
Free-wheel Cover.

Rear Stand.

INSTRUCTIONS.

The Petrol Motor.

In principle, the petrol motor is identical with the stationary gas engine. Each has the same working parts in the cylinder into which the explosive mixture of gas and air is drawn, compressed, and then exploded by an electric spark, the burnt gases being finally exhausted into the atmosphere. The power is transmitted from the piston by a connecting rod driving on to a crank, which is an integral part of the main shaft. On this latter is mounted a fly-wheel, which, by its momentum, keeps the engine moving smoothly during the idle strokes of the piston, for there is only one power stroke out of every four.

The small engines used for motor cycles are air-cooled; that is to say, the onrush of the cold air maintains them at a temperature not too high for efficient lubrication. To regulate the admission of gas into the cylinder, and to enable the burnt gases to be ejected, valves worked from the crankshaft are provided. These valves are fitted in the combustion head, and open inwards.

This is what happens when the engine is working:—The inlet valve opens just as the piston is about to descend. The piston descends and creates a vacuum. Gas rushes in and fills this vacuum. This is called the "induction" stroke. The piston begins to ascend and the inlet-valve closes. The piston continues to ascend and compresses the gas. That is the "compression" stroke. Just as the piston is about to begin its second downward journey an electric spark occurs within the cylinder. This sets fire to the compressed gas and causes it to expand violently, thrusting down the piston with great force. That is the "power" stroke. Just before the "power" stroke is completed the exhaust valve opens and the burnt gas escapes from the cylinder at a high pressure. It is the sound of these burnt gases escaping or "exhausting" that gives the petrol motor its characteristic noise. The actual explosions are never heard. The piston now ascends once more, the exhaust valve remaining open, and drives out all the burnt gas. This is known as the "exhaust" or scavenging stroke. This cycle of operations is repeated as long as the engine is running. Once an explosion has been obtained, the engine goes on automatically; but, as will be readily seen, before the engine can start at all the initial movements have to be conveyed to it from an outside source.

In all the Douglas models a man can start the engine by walking

alongside the machine; but in the single-speed model (N) the engine can be started by revolving the pedals. Models O and P requires the machine to be pushed along the ground. Models R and S start by downward pressure of a pedal lever while the machine is stationary. This produces a movement of the pistons similar to that obtained by turning round the starting-handle of a car.

Carburation.

The action of the engine is dependent on the efficient co-operation of two other factors, viz.: ignition and carburation. "Carburation" is the production of an explosive gas from petrol and air. This is done by means of a carburetter, which is really a very simple apparatus. On most motor cycles the carburetter consists of three chambers, viz.: a float chamber in which the petrol which issues from the tank is maintained at a constant level; a jet or "mixing" chamber; and a separate air-chamber.

The float chamber is connected with the jet by means of a small channel. The petrol, therefore, rises in the jet to the same level as in the float chamber. The level of the petrol is so adjusted that its height in the jet is just a shade below the lip of the jet. If it rose higher it would be oozing all the time, even when the engine was at rest. If it were too far below the lip of the jet the suction of the engine would not be able to draw out sufficient petrol to make an explosive mixture. The jet is enclosed in a funnel, known as the choke tube; through this tube air rises and mixes with the petrol. The size of this tube is carefully calculated with reference to the normal gas consumption of the engine. The air chamber is required to enable the gas to be varied to suit different engine speeds. But for this provision, it would practically be necessary to run the engine always at one speed. When the engine was going very fast its great suction would pull too much petrol from the jet. The effect of this suction is neutralised at high speeds by the admission of more air. The carburetter does not begin to work until the engine fly-wheel has been rotated. The motive power of the carburetter is the suction created by the vacuum in the cylinder on the induction stroke.

It is usual for the jet chamber and extra air-chamber to have piston valves which are actuated from the handle-bar of the motor cycle. The piston valve in the jet chamber regulates the amount of gas given to the engine. It is usually termed the "throttle" valve.

Ignition.

In the earlier days of motor cycles ignition was by coil and accumulator. The accumulator was simply a small battery which had to be charged whenever its store of electricity was used up. Sometimes it ran down in places where there were no facilities for re-charging. It was made of grids filled with lead paste and in time the vibration of the motor cycle caused the paste to drop out of the grids which produced internal short-circuiting. The accumulator system was very troublesome, and the introduction of the magneto has proved a great boon to motor cyclists.

The magneto contains a fixed amount of magnetism which, by the rotation of a suitable armature within its field, can be converted into a very powerful electric current. The armature is driven directly by the engine, so that once the engine is started it goes on producing just exactly the amount of electric current that is required. The electricity is not created by the energy of the motor. What happens is that the latent electricity of the magnets is focussed, set in motion, and made to pass through the sparking plugs, then returned to the magnets.

Complete Power Unit.

Before the petrol motor can be of any practical value it must be fitted up in such a way that it can be fed with petrol and lubricant, and be able to transmit its power to the vehicle which it is meant to propel. This is the problem which every designer of a motor bicycle has had to solve, and a very difficult problem it has proved. Generally speaking the tank lies above the engine and between the legs of the rider. It has two compartments, one for petrol and one for lubrication. Two pipes run from the tank—a petrol pipe to the carburetter, and an oil pipe to the engine. The petrol is gravity-fed to the carburetter. A pump or other such device is necessary to force oil into the crank-case. On the Douglas Motor Bicycle, the oil is first drawn up by the rider into the barrel of the pump ; then it is automatically made to drip into the crank-case. The rate of drip can be adjusted to suit the needs of the engine, and at any time an extra pumpful of oil may be put into the crank-case. This forms a singularly perfect and reliable system of lubrication. It should be mentioned that the interior of the crank-case is so contrived that the oil drops directly on the big ends of the connecting-rod and that the excess oil is received into a sumph (or trough) which remains at a constant level.

Transmission of Power, etc.

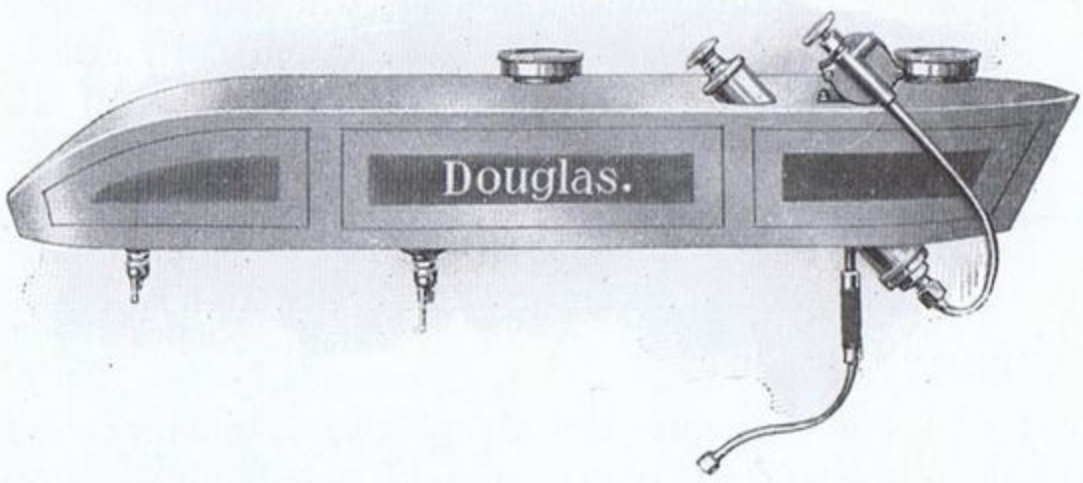
There are three recognised methods of transmitting the power of the engine to the road wheel. The most popular method is by means of a belt running from a pulley on the engine to another and larger pulley on the road wheel. In a few cases a chain is substituted for the belt. On two machines a shaft drive is used as in the case of a car. Both shaft and chain give a harsh drive, however, and the belt has on the whole been found most satisfactory. The chief objection to it is that, owing to the very small pulley attached to the motor, the belt is subjected to the stress of acute bending, and does not last so long as it ought to. It should be explained that, in order to obtain the desired power from the small petrol motors used on motor bicycles it is necessary to run the motor at a high rate of speed. Assuming that a motor gives off three horse power at 2,000 revolutions per minute, it would give off just one-and-a-half horse power at 1,000 revolutions. A motor able to give three horse power at 1,000 revolutions per minute would require to be twice the size and weight of the higher-speed motor. This excess of size and weight would unfit it for use on a motor bicycle. Consequently, only very high speed motors are suitable for motor bicycles. The result is that the motor has to be geared down, because the wheels of the bicycle cannot be made to travel at the same rate as the fly-wheel of the engine. This is accomplished by making the belt pulley on the engine very small and that on the driving wheel of the bicycle very large. On the Douglas Motor Bicycle the normal ratio between the two wheels is 5½ to 1. This, of course, is varied by the two-speed gear which is dealt with at length hereafter. It was found that, if a large pulley were substituted for the small engine pulley, the life of the belt was enormously increased. Instead of a mileage of from 1,500 to 2,000 being got from it, it became possible to obtain a mileage of from 4,000 to 6,000 miles. It was, therefore, resolved to take the drive from the small engine pulley to a counter-shaft pulley by means of a chain, this arrangement allowing a very large pulley from the counter-shaft to the road wheel. Accordingly, the form of transmission adopted on the Douglas Motor Bicycle is a combined chain and belt drive, which has on the whole proved to be the most efficient and most economical yet discovered. The soft yet tenacious pull of the belt directly prolongs the life of the tyres and of the engine, and it undoubtedly assists in minimising the effect of road shocks on the rider.

Starting Model N (Single-speed).

Having jacked up the machine on the back stand and fitted the belt, the tanks should be filled—the front one with oil, and the second with petrol. In filling the petrol tank care should be taken to pour the petrol through a filter containing a fine gauze strainer. Then inject three pumpsful of oil into crank-case and see that the petrol tap is open. The petrol tap is open when pointing downwards.

When the machine is received from the makers, the oil has been drawn out of the crank-case, and, before starting, three pumpsful should be forced into the crank-case by means of the pump. In a high-speed engine, such as the Douglas, it is found that a good quality of oil for water-cooled motors gives, on the whole, as good results as an oil for air-cooled motors, especially in winter, and with the former oil, the engine inclines to start more easily from the cold. It is not good for either machine or rider that one should have to use force when starting the machine on the stand. If the Douglas motor has been adequately lubricated with good oil, the pistons will not gum up, and it should start readily without injection of paraffin. But, if really stiff, a few drops of paraffin squirted through the compression taps will free the pistons. A simple method of ensuring that the machine shall always start easily is: after one has returned from a ride, and before the engine has quite cooled down, inject a few drops of paraffin into each cylinder and turn round the engine a few times with the exhaust-lift raised. This practice tends also to keep the cylinders in nice condition.

Tank, Filler-cap and Oil Tap, and Sight-feed Lubricator.



It is desirable at this stage to say something about the semi-automatic lubricator which is fitted to all Douglas models. Primarily

this consists of a pump with a non-return valve between it and the oil tank. In the barrel of the pump there is a spring which presses down the plunger. Above the pump and resting on the top of the tank is a globe of glass, the function of which is to enable the rider at all times to see whether the pump is actually feeding oil into the engine. The rate at which the oil passes to the engine is regulated by means of a valve with a milled head just beside the glass globe. If this valve is screwed tightly down, no oil can possibly get into the engine. If, on the other hand, this valve is fully open, one can pump oil into the engine as fast as it will run. In practice, therefore, what one has to do is to determine by experiment what opening on the valve best suits his engine, remembering always that, when new, the engine requires more oil than after it has run five or six hundred miles. Assuming that the machine has just been received from the makers, and that the crank-case is empty of oil, open the valve fully, draw a charge of oil into the pump, and then slowly depress the handle of the pump. The oil will be seen rushing to the engine from the nozzle under the sight-feed glass. This operation should be twice repeated after the first pumpful. Normally, of course, the handle of the pump should not be pushed down at all. In actual running one simply pulls the handle up and leaves it to be returned by the pressure of the spring inside the barrel. This spring-pressure would very speedily empty the pump if only the oil could get away rapidly enough. Here the valve of the sight-feed comes into play. This valve should, generally speaking, be opened only so far as will allow the pump to empty itself in about half-an-hour. This will suit moderate speeds of from 25 to 30 miles per hour. If higher speeds are indulged in the valve should be set so as to allow the pump to empty oftener, say, three or even four times in an hour. But for average running, twice per hour will generally be found to afford adequate lubrication. We have found both Price's and Vacuum Oils suitable for our engine. Probably the oil for air-cooled engines will be found to give best results in actual running; but, in cold weather at least, the use of oil for water-cooled engines facilitates starting. We have no hesitation in saying, however, that any good brand of oil for air or water cooled high speed engines will work well with our engine.

Before being sent out, the Douglas machines are carefully tuned up and tested on the road; so that it should not be necessary for the purchaser to make any adjustments or indeed to touch the machine with a tool.

Having filled up with petrol, etc., proceed thus :—

(1) Flood carburetter by raising needle valve. The petrol should squirt through the small hole drilled in the cover of the float chamber.

(2) Advance magneto (lever on left handle) NEARLY full forward. The lever is advanced by pushing inwards.

(3) Close extra air (short lever on right handle). Push inwards.

(4) Three-quarters open throttle (long lever on right handle). Push outwards.

(5) Pedal the machine with the valve-lifter raised (lever under left handle) ; drop valve-lifter sharply ; when the engine will start at once. When the engine is going, the magneto lever can be retarded, and the speed regulated by means of the throttle.

It should be kept in mind that, though nominally the magneto allows a certain amount of latitude in regard to the timing of the spark, in reality there is just one position at which the maximum intensity of spark is secured. If the timing lever is behind or in advance of this position, the spark will be feebler and the explosions less powerful. In the Douglas motor the magneto is so timed that the spark is at its maximum efficiency when the lever is nearly fully advanced. Consequently, this position will be found best for all-round work, and it will rarely be necessary to retard the spark unless on very steep hills or when it is desired to reduce the speed of the machine in traffic.

One must be careful not to run the machine on the stand for more than a minute, and for not more than a few seconds at a high speed. The dangers incident to running the machine for a prolonged period on the stand are these : (*a*) as the cylinders are not exposed to the cooling draught induced by quick passage through the air, they are apt to become overheated. If the overheating is prolonged, the oil may dry up, in which case the pistons will seize. (*b*) When the engine is running on the stand it is not doing work. Consequently its speed is excessive, and the undue vibration set up is apt to produce a deleterious effect on the machine generally, i.e. nuts and unions may be loosened.

If the above instructions are followed, and the engine is warmed up on the stand, the machine will be found to start on the road with the first turn of the pedals.

Starting Models O and P.

As a rule it will be found preferable to start on the low gear, as the machine will then fire at a walking-pace. When the machine is fairly under weigh, the exhaust-lift should be raised and the gear lever pulled backward into the notch marked " High."

The following procedure should be followed :—

(1.) Jack machine on stand, fill tanks, lubricate, etc., as for model N.

(2.) Inject a few drops of paraffin into compression-taps Remember to close compression-taps.

(3.) Set various levers and flood carburetter as for model N.

(4.) Hook up stand to mudguard.

(5.) Move machine forward slightly, at same time pushing gear-lever into notch marked " Low."

(6.) Stand on left side of machine ; take hold of handles and raise exhaust-lift (under-lever left side).

(7.) Walk or run with machine a few yards. Engine should instantly begin to fire.

(8.) When engine begins to fire, raise exhaust-lift, and without reducing pace step on to footboard with left foot. This may easily be accomplished by making a quick hop with right foot.

(9.) Fling leg over saddle and simultaneously release exhaust-lift. Engine should at once begin to fire and machine travel with rider.

(10.) When machine is well under weigh, the exhaust-lift should be raised and the gear-lever placed in the notch marked " High."

NOTE.—It takes some time to describe this operation. In reality it is quite simple and may readily be acquired by anyone, irrespective of age or sex. The operation is greatly facilitated by the fact that on the low gear, the machine will start at a walking pace.

Starting Models R and S.

(1) Fill up tanks, inject paraffin, set levers, etc., as for other models.

(2.) Place gear lever in " Low " position.

(3.) Get astride machine.

(4.) With left foot depress forward left pedal. This withdraws clutch and frees engine.

(5.) With left foot sharply depress starting pedal. Engine should now fire.

(6.) With heel of left foot gently depress clutch pedal. The bicycle should now move away.

(7.) When the machine is fairly under weigh, the exhaust-lift should be raised and the gear-lever moved forward to the " High " position.

Care should be taken to prevent the clutch from going in too rapidly. Should the clutch go in with a jerk the engine will probably stop. It is intended that the drive of the engine should be taken up gradually, or, in other words, that the clutch should slip appreciably until the machine is fairly under weigh.

Lubrication.

It will be obvious that, with intelligent use, the type of lubricator on the Douglas Motor Bicycle cannot fail to give satisfaction. The fact that the drip is continuous should do much to prevent the internal carbonisation of the cylinders that results from the ordinary form of splash-lubrication, which consists in injecting large quantities of oil into the cylinder at stated intervals. Under this system an engine is alternately starved and over-lubricated —a condition of affairs rendered impossible by the system now adopted.

The life of the engine depends on careful lubrication. Insufficiency of oil ruins the engine ; too much oil fouls it. If an error is made at all, it should be on the side of excess.

If the country is hilly and the engine using much gas, a correspondingly larger quantity of oil is necessary, because the excessive heat tends to vaporise the oil.

Open the tap at the bottom of the crank-case and drain out the waste oil every 500 miles.

Care of Motor.

The motor as sent out, if properly used, should run for 2,000 or 3,000 miles without requiring attention. It will then probably be found that it is not just quite so efficient as it was, say, after the first 1,000 miles had been covered. It will be fast enough on average roads, but probably a shade less strong on hills. Also, when the compression is tested by pressure on the pedal, it will be found that this is not quite so strong as at first.

A Speedy Overhaul.

What one should now do is very largely a question of the time available. Suppose one is about to set out on a long journey, and wishes first to give the engine an overhaul, but has just an hour at his disposal for the purpose. This is how he would proceed: Put some paraffin in a basin or other large dish. Unscrew valve-caps and drop them among the paraffin. Take out valves. It is quite easy to do this with the special tool supplied in the kit. Carefully wash valves and springs with paraffin. Put in new cotters if those in use shew signs of wear. If the stems of the valves are black with burnt oil, clean with fine emery. Now smear edge of each valve with fine emery powder moistened with paraffin, and grind in with long screwdriver, using a back-and-fore-movement, and changing the position of the valve frequently. Do not use too much emery, as an excess might tend to get into the cylinders. Five minutes should be sufficient for the grinding-in of each valve. Take soft cloth and carefully wipe out all traces of emery from valve chambers. Wash valve chambers thoroughly out with paraffin, allowing paraffin to run through valve guides.

Inject paraffin copiously into crank-case through tap provided for that purpose. Inject paraffin into each cylinder. Give engine a few revolutions. Unscrew waste-oil tap underneath crank-case and allow used oil and paraffin to drain away. Close waste-oil tap. Give engine three pumpsful of oil. Replace valves and valve caps.

The valve-tappets may have worn somewhat, and require adjustment. Slacken lock-nut and unscrew tappet until there is just enough space to admit a visiting card between tappet and stem of valve. Tighten lock-nut.

Next examine contact-breaker of magneto. Note the distance that the points separate, and keep this in mind as a guide to future adjustments. If dirty, clean the contacts either with a file or with fine sandpaper. A minute drop of oil may be placed on the arm on which the bell-crank lever pivots. A touch of oil may also be placed on the cams of the contact-ring. The cleaning of the points will probably have removed so little platinum that it will be unnecessary to make any adjustment of the distances between the contacts.

It may be stated, however, that it is now quite common for a magneto to run for 4,000 or 5,000 miles without attention other than lubrication with ordinary cycle oil, say, every 150 miles.

When an engine is firing regularly, it is probably sound policy on the part of the rider to leave the magneto alone.

Finally clean sparking plugs, passing a piece of fine emery between the points. A small wire brush with petrol will be found very useful for cleaning out the cavity of the plugs.

The engine should now be practically as efficient as at first, and fit for an End-to-End record.

In practice this list of operations is by no means so formidable as it reads, and by all persons who are in the least degree mechanically-inclined, will be found a most fascinating occupation.

A Thorough Overhaul.

This will occupy about three hours. The difference between it and that just described is that one begins by taking off the engine, and, after removing the cylinders, cleans out its interior.

To Remove Engine from Frame.

First detach oil and petrol pipes and exhaust-lift lever on handle-bar; detach chain guard and lever of two-speed gear; take bolt out of chain from engine to gear box or counter-shaft, undo the thumb screw that bolts air and throttle pistons on carburetter, lifting both pistons out. Then remove the four bolts attaching engine to frame, care being taken to prevent engine toppling over. The engine should now lift out.

To Remove Cylinders.

First remove induction pipe with carburetter; then undo the nuts on cylinder flanges, when cylinders can be pulled out. If the cylinders cannot easily be pulled away, slightly slacken nuts clamping crank-case together.

Carburetter.

This is held in position by two nuts fitted to corresponding studs on the induction pipe.

The carburetter is of a well-tried and efficient type, and its construction is very simple.

The petrol is fed from the tank, through a fine gauze cone, to the float chamber. When the proper height of spirit is reached, the float rises, and prevents the admission of petrol by pressing down the needle valve on its seating.

It will not be found necessary to alter the level of petrol, the

jet, or the choke-tube, all our carburetters being correctly adjusted when sent out.

Some riders have, however, represented to us that they wished to have it in their power to vary the normal action of the carburetter for such things as speed and hill-climbing competitions, or for petrol-consumption tests. To make such variations easily practicable, we have made the jet and choke-tube detachable and interchangeable on the 1913 models. Jets and choke-tubes of varying size may be obtained from us. Both jet and choke-tube are simply screwed into the base of the mixing-chamber. The average rider will find this adjustment of little value; but the rider who wishes to ascend a steep hill at high speed will temporarily be able to get more power from his engine by fitting a larger jet; or a competitor in a petrol-consumption test may obtain better results by fitting a smaller jet. A smaller choke-tube will enable the engine to run at lower speeds when the machine is intended principally for use in traffic.

When the engine is being dismantled for a general clean, it is advisable to remove the carburetter, take it to pieces, and wash every part with paraffin or petrol. See that the needle valve moves up and down freely, that there is no grit in the jet or in any of the ducts, and that the small hole in the lid of the float chamber is open.

When replacing carburetter, see that the brown paper washer between the carburetter and the induction pipe is in position.

The adjustment of the carburetter is a delicate operation, and we have frequently found amateurs giving themselves much trouble and vexation by altering the original setting. We would greatly prefer, in the event of a rider finding any defect in his carburetter, that he would at once return it to us, when we will make the necessary adjustment free of charge. But we take great pains to secure that every carburetter is accurately adjusted when sent out, and generally speaking, this is a feature which should give the rider absolutely no trouble.

We supply a cap to fit over the needle-valve on the outside of the lid of the float chamber. This will prevent the admission of mud or fine dust, but under normal conditions it is unnecessary.

It is desirable at intervals to take out the pistons which regulate the throttle and extra air valves of the carburetter and to wipe them with an oily cloth. The air and jet chambers should at the same time be wiped clean with a fine rag. Owing to the simple method of attachment, the pistons can be removed in a few seconds. Be careful to replace fibre washers.

To Remove Silencer.

Unscrew union nuts joining exhaust pipes to combustion-head ; also undo nuts of stay at side of silencer.

The silencer must be removed before the engine can be taken apart. It is advisable to clean carbon deposit from exhaust pipes and silencer by means of a stiff wire brush. If the holes in the silencer have got choked up with mud or dust they should be cleaned out with a rimer or piece of wire.

To Remove Flywheel.

After removing nut, get someone to pull the wheel towards him, while you give a few sharp taps on the end of shaft, first placing a piece of copper or brass on the end of shaft to prevent damage. When replacing the fly-wheel, **screw the nut very tight, using the special spanner supplied with the machine.** It is desirable to give the end of the spanner a few sharp taps with a hammer in order to secure adequate locking of this nut.

Removal of Magneto.

This, of course, can be readily effected by unscrewing the nuts at each side. We cannot, however, impress too strongly upon the average user of our machine that the magneto should never be removed unless (*a*) there is something seriously wrong with the magneto itself, or (*b*) there has been some breakage inside the crank-case which renders it necessary to take this apart. The engine can be thoroughly cleaned and tuned-up without the fly-wheel, magneto-fixing, or crank-case being interfered with. Before sending out the machine we are very careful to see that the magneto is properly timed.

Finish of General Overhaul.

Assuming that the engine has been taken apart as indicated in the preceding paragraphs—i.e. had removed from it the carburetter, induction-pipe, silencer, and cylinders—the first thing to do is to scrape the tops of the pistons with a blunt knife until they are free from all carbon deposit. The crank-case—inside and out—and the pistons, should then be thoroughly cleansed with paraffin, and put aside in a clean place to drain. The cylinders should now be taken in hand and the valves removed, as described on page 48. All carbon deposit should be chipped from the heads of the cylinders

by means of a long, blunt, and heavy screwdriver. The exhaust-valves should next be ground in position. It is rarely necessary to grind in the inlet valves. The cylinders should be very thoroughly cleansed with paraffin and replaced on the crank-case. Before doing so the sides of the pistons should be smeared with a thin film of engine-oil. Take care that the gaps in the rings are not in line, and that the rings are moving freely in their slots. If any ring is gummed fast it must be slackened—an operation requiring great care, as the rings are very brittle. The rings should be bright and polished. If any ring is discoloured, that indicates that gas is getting past it; a new ring is then necessary. The rings should not be too loose in the grooves.

When the cylinders have been secured, the valves should be put into position and the other adjustments made as described on pages 48, 49. The engine should then be re-attached to the frame, especial care being taken to secure an equal tension to each of the four nuts securing the engine to its cradle (e.g., if the lower nuts are screwed up harder than the upper nuts the engine will be put off the plumb.)

Before starting up the engine, three charges of oil should be injected into the crank-case.

It will, as a rule, be found that the engine has much more life in it after this general overhaul and clean. It certainly should not be necessary to do this oftener than once in every 3,000 miles; and, if care is taken with the lubrication it may run for double that distance without internal cleaning.

Timing the Magneto.

If, for any reason, the magneto has been removed, the following is the method of timing it:—

Turn flywheel round until the exact moment of closing of the exhaust valve of either cylinder. The pistons should then be at the outward end of the stroke. This position may be located by the keyway in flywheel being at the rear of machine.

When the rear valve just closes, the front cylinder is at the firing point, and *vice versa*, and the following instructions are given, assuming that the timing is effected when rear valve closes: (i.e. one is timing the spark for the front cylinder).

Place magneto advance lever midway between fully advance and retard and turn magneto driving wheel until the contacts are just

separating, by the fibre tip striking the upper steel segment on contact-breaker. The gears can then be meshed, and the magneto secured

When the spark is correctly timed for one-cylinder it is correctly timed for both.

Timing the Exhaust-Valve.

The valve-chamber is now on the outside of the crank-case. Access to it is obtained by removing (*a*) the carburetter and induction pipe, and (*b*) the cover of the valve-chamber, which is secured by screws.

Two things have to be kept in mind :—

(1.) The exhaust-valve closes just the least shade, say, one-sixteenth inch after the piston has completed the exhaust-stroke.

(2.) The inlet-valve opens a shade, say, one-sixteenth inch after the piston has begun the induction stroke.

Time for one cylinder. If one cylinder is accurately timed, the other is accurately timed.

Remove cage and washers securing spindles of timing wheels.

Slacken nut securing toothed wheel to which valve cams are attached. Slacken this wheel by pulling it forward.

The inside cam operates the exhaust-valve.

Bring piston to top of its stroke. Move round cam against valve tappet (in direction opposite to flywheel) till cam has just ceased to bear against tappet. Move flywheel forward so that piston descends one-sixteenth inch. Mesh gears. Every valve will now be found to be accurately set.

This operation is so simple that it should be possible for a novice to perform it without trouble. But we do not advise any except experienced riders to try experiments in valve-timing.

Compression.

A loss of compression may sometimes be traced to a faulty spark plug or spark plug washer. These can be tested by smearing them with engine oil and trying the compression with the pedals. when, if they are leaky, the oil will bubble at the defective part. The remedy is to substitute another plug or washer.

There are also washers under the valve plugs and under the ends of the induction pipe. If these are suspected of a leak, they should be replaced. The compression may also be lost by gas escaping past the piston rings (but this is very infrequent), or past the valves if they become dirty or pitted, when they should be ground in as follows :—

Valves.

The inlet valves should occasionally be ground on to their seatings with fine emery powder (flour emery), and the exhaust valves with 220 emery, finishing off with flour emery.

The method is to remove the cotters, caps, and springs, mix the emery with a thin oil, and apply to face of valve, and give this a semi-rotary motion on its seating by means of a screwdriver inserted in a slot on top of the valve head. Care should be taken not to give complete turns, as this tends to make grooves. When the surfaces of the valves and seatings are quite smooth, they should be washed clean of emery with paraffin and replaced in position ; and if the copper and asbestos washers are in good order, the compression should be restored.

Piston Rings.

When an engine has run, say, 3,000 or 4,000 miles it is probable that the grooves in which the piston rings lie require cleaning. The rings should be removed, and the grooves and the backs of the rings thoroughly cleaned from carbon. The lower ring should be removed and replaced from the lower end of the piston. Its slot can easily be sprung over the connecting-rod.

Valve Spring Tension.

After a time the valve-springs may lose thfer temper and become too weak. This should not happen for several thousands of miles ; but, if it is suspected that this is the cause of irregular running, new springs should at once be inserted.

It will be observed that the ends of the valve-springs that lie nearest to the engine are always weaker than the other ends on account of the heat which they have to withstand. When replacing the springs after they have been removed for any reason, be careful to place the compressed ends next to the engine. Otherwise both ends will be effected by the heat, and the spring will be

ruined. When making the springs we allow for the compression of one end.

Riders are recommended to carry an inlet valve and an exhaust valve complete (i.e. with spring and cotter) as spares.

Note that the exhaust valve is longer than the inlet valve, so that the valves are not interchangeable.

How to look after Two-Speed Gear.

To lubricate the two-speed gear inject into gear box several pumpsful of the thick grease used for the gear boxes of motor cars, pump being provided.

A pumpful of grease should be added about every 300 miles; at the same time the chain may be examined to see if it is at the proper tension.

If the chain is sufficiently slack to require tightening, this can be done by slackening the two nuts which hold the box to the frame, and sliding back until the chain has the proper tension, then screw nuts tightly.

If at any time the gear should get out of adjustment, and is not free when indicated by free engine position, the set screw on the adjusting rod connected between the bottom lever and gear-box should be slackened, the pulley-wheel pulled round, and the adjusting-rod shifted until the dog clutch is in a free position ; the screw holding the two rods rigid may then be tightened.

Care of the Clutch.

The clutch is now so large that it is rare to find it giving trouble by slipping.

If it does slip, hold it out by forward pressure of the clutch pedal, and wash out the clutch and clutch-case with petrol. After the clutch is dry, a trial run should be made, and it may be found that the slipping is cured.

If the clutch persists in slipping, slacken the screw on the end of the cap which covers the spring of the clutch by, say, one or at most two turns. In order to do this the locknut will first have to be loosened. After adjusting the screw care should be taken to tighten up the locknut. Again make a trial run.

If the clutch still slips, this probably indicates that the spring requires tightening. Take off the clutch-cap by undoing the three

screws that attach it to the clutch, and tighten the clutch-spring by screwing up the large nut which holds it in compression. Several turns may be given to this nut. Again make a trial run.

If slipping continues, note whether the surface of the clutch is very dry and polished. If so a little castor oil may be spread on it by means of a small camel-hair brush.

If none of these expedients cure slipping, it will only be because the material of the clutch has worn out. In this event the clutch will require to be taken out and sent to us to be refaced. With fair treatment, however, the surface of the clutch should not require renewal until the machine has travelled some 5,000 or 6,000 miles, if even then.

If the clutch should be too fierce a little powdered graphite may be spread on its surface by means of a thin knife.

Another method for reducing fierceness is to screw in the adjusting screw on the clutch-cap by, say, halt a turn, or more if found necessary. Care should be taken to keep the lock nut of this screw absolutely tight.

Use and Abuse of Free Engine and Clutch.

We think it right to give riders some advice as to the best means of using the free engine and clutch.

We find that this type has been greatly appreciated, everyone who could afford it cheerfully incurring the extra expense. For the average rider, the free engine is by no means a necessity. Nine persons out of ten will prefer to start the machine by pushing and jumping on. Still, there are occasions when even the expert rider finds the clutch a great convenience, as, for instance, when starting on a hill or in crowded thoroughfare. One rider who never uses the clutch for ordinary work instances a case in which he finds it of the utmost utility. He frequently takes his machine across a ferry, the road leading from which is rough, narrow, winding, and very steep. There is no room to start the machine by ordinary methods, and formerly he had to take off the belt and push for 200 yards—no light task on a warm day. Now he starts the engine on the landing stage, sits across the machine, slips in the clutch, and glides up into the main road with ease. For that experience alone, he affirms, the free engine is worth the extra cost. No doubt, many others can suggest parallel instances.

In traffic the clutch is of great utility. Though one may have reduced the speed to a mere crawl on the low gear there are times

when it is necessary to draw up altogether. Without a free engine this means a dead stop and an undignified descent from the machine. With the free engine pressure on the clutch reduces the machine to the lowest pace at which it can be balanced ; or, if that is still insufficient, one foot may be put on the ground while the clutch is out of engagement. Whenever the traffic block is removed, a touch of the heel pedal sets the machine again in motion.

It is not necessary to declutch when changing the gears. It is sufficient to raise the exhaust, but in no case should a change of gears be attempted without this being done. In changing from low to high it is desirable to race the engine slightly before the gear lever is pulled backward. As a rule a change will not be made from high to low until the pace of the machine is sufficiently reduced to permit of this being done. Gear-changing is facilitated by allowing the lever to rest for a moment in the neutral position before pressing it home.

We have had brought under our notice many instances of gross abuse of the clutch. Some riders seem to forget (*a*) that the engine is not water-cooled, and (*b*) that a high speed engine cannot be raced for any length of time without some degree of injury. Sometimes the engine is allowed to race when free for purposes of ostentation on the part of the rider. Recently one of our staff reported that he had seen a rider start up his engine, and then, while it was racing at something like 2,500 revolutions per minute, deliberately fill and light his pipe, put on an overcoat and gloves, before getting on the machine. It says much for the engine that it stood this treatment at all ; but it may be stated that such practices, if persisted in, will bring any high-speed, air-cooled petrol motor to a premature end.

When the engine is started by foot-pressure, the throttle should at once be closed so as to pass the least amount of gas that will keep the engine running. Any tendency to race should be corrected by frequently raising the exhaust-lift.

The only permissible acceleration is just before one engages the clutch, so as to prevent the strain of starting from stopping the engine.

When the clutch is used in traffic, equal care should be taken to prevent racing or heating. Frequently recourse should be had to the exhaust-lift to prevent the engine from developing a high speed.

If these precautions be adopted, the clutch will be found a

most valuable addition to the motor cycle. Indeed, it may be affirmed that no rider of a motor cycle with free engine and clutch will ever go back to the old type of fixed gear.

Possible Causes of Unsatisfactory Running.

(1.) Over-Oiling of Engine.—This may cause sooting of sparking plugs, and fouling and sticking of valves. Drain crank-case by means of tap fitted below same. Take out sparking plugs and valves and clean with petrol.

(2.) Sparking Plug Points Mal-adjusted or Foul.—Clean plugs with petrol, and verify the gap of the points. This should be equal to the thickness of a post card. The points should be free from carbon or oil.

(3.) Magneto Contacts Pitted or Incorrectly Adjusted.—These should be cleaned with petrol to remove oil or grease, and, if found pitted, should be trimmed with fine emery cloth or a small file, such as manufactured by the Bosch Magneto Co. for this purpose. The points, when breaking contact, should gap about the thickness of a post card (or half a millimetre). For testing this, the gauge supplied by the Bosch Magneto Co. will be found useful.

(4.) Stopped Petrol Pipe or Tap.—Clear with a piece of copper wire, or blow through with tyre pump.

(5.) Choked Carburetter.—Raise the needle-valve. If petrol is reaching the float-chamber it will spray through the air-hole in the lid. If this is in order, the spraying jet should be examined. If the needle valve is agitated up and down, the petrol should spray out of the jet. If this does not occur, it is evident that either the jet or the channel connecting spraying-chamber to float-chamber is obstructed. These can be cleared with a piece of fine wire (such as a strand of Bowden cable) passed through the openings, which will be found closed by screws, one under the spraying jet, the other at the side of the float-chamber. If the jet is obstructed, it will probably be best to unscrew it with special key provided, and clean it thoroughly before replacing.

(6.) Leaking Valves.—If the valves have become pitted, and compression is poor, the engine will run weakly, and be slow at starting. The valves should be ground in about once every 1,000 miles.

(7.) Dirty Valve Guides.—If oil reaches the stem of either the exhaust or the inlet valve, it will tend to stick in the guide.

and the valve will not close with sufficient rapidity. A loss of power in the engine may be cured by taking out the valves and giving them and the guides a thorough clean with paraffin.

(8.) Mysterious Loss of Power.—If one is satisfied that the engine is clean, the carburetter free from obstruction, and that the valves and plugs are in good order, a loss of power is almost certain to be due to mal-adjustment of the magneto contacts. These should be experimented with until the correct gap is obtained.

(9). If the engine refuses to start or if it stops suddenly :—

(*a*) Test carburetter to see that jet is not choked.

(*b*) Take out sparking plugs, and see that plugs have not sooted-up or that central electrodes have not come loose so as to touch the opposite points.

(*c*) Test spark to see that the magneto is working properly.

(*d*) Examine valves.

(*e*) Satisfy yourself that engine is sufficiently lubricated, and that neither pistons nor cranks have seized.

(*f*) Satisfy yourself, by turning the flywheel, that neither the valve tappets nor the valves have jammed in their guides.

(*g*) If noises appear to come from the crank-case, it is possible (though unlikely) that something in it has broken, in which case the engine should be sent to us.

(*h*) Make certain that valve-tappets are properly adjusted.

(*i*) Make sure that current is not leaking through high tension cable or short-circuiting from brass end to some part of motor.

(*j*) Examine carbon brushes. Perhaps one is broken.

(*k*) Make sure that petrol tap is turned on.

(*l*) Make sure that tank contains petrol and lubricant.

(*m*) Make sure that lubricator is working properly and that engine is sufficiently oiled.

(*n*) If stoppage occurs during rain, thoroughly dry magneto, high-tension table, and sparking plugs.

How to Keep Magneto in Working Order.

The armature runs on ball bearings, which should be lubricated by injecting a few drops of oil into the oil cups not less than every 200 miles. All the other parts of the apparatus require no lubrica-

tion, especially the contact breaker, which is designed to work without oil. It is therefore necessary to prevent any oil from getting on to the contact-breaker and its platinum contacts. After having travelled a considerable distance the machine should be thoroughly cleaned and the platinum contacts carefully examined. The contact breaker disc should likewise be cleaned from time to time. Unless as a last resort the magneto should not be taken to pieces. Should this, however, be absolutely necessary it should be carried out in the following manner: The machine should be detached, the cover removed, and the two carbon holders taken out. **Place upon the pole-shoes a thick rectangular piece of soft iron in order to prevent the interruption of the magnetic circuit which would occur were the armature withdrawn without first placing a keeper between the pole-shoes.** The gear wheel should now be removed from the shaft of the magneto, care being taken that the shaft is not injured in any way in the operation. The rear bearings are then unscrewed, and the armature can be drawn out. The contact-breaker disc can be removed, and the rear bearings separated from the armature.

After all the parts of the machine, especially the bearings and oil cup, have been carefully and thoroughly cleaned, the machine is again re-assembled in the opposite order to that adopted when taking it to pieces. **The piece of iron placed upon the pole-shoes must on no account be removed until the armature has been placed in position.** When replacing the contact-breaker disc it should be observed that its key engages accurately in the armature shaft.

How to Ascertain Causes of Defective Ignition.

Should the ignition fail to work with certainty and regularity, the following method should be adopted in order to ascertain the reason for the failure. One of the high tension cables should be first disconnected from the magneto, and the spanner attached to the carbon holder by means of the wire clip, with which the magneto spanner is fitted. The spanner should be placed in such a position that a distance of about 1 mm. exists between it and the permanent magnet. The magneto should then be set for advance ignition, and driven by pedalling the machine. A powerful spark should then pass between the magnet and the spanner. Should this be in order, remove the spanner, replace the high tension cable, and try the other carbon holder in the same manner. Should a good spark be regularly obtained in this way from each terminal, it is proof that the magneto is in proper working order, and that the

fault must be due to a defect in some other part of the ignition gear. The sparking plugs should now be tested and fresh ones substituted if necessary. The high tension cables should also be examined and care taken that no short-circuiting or leakage occurs in the vicinity of the terminal ends.

If when testing with the spanner to the magnets it is found that a spark is obtained at one terminal and not at the other, the trouble may be due to some fault having arisen in the carbon holder itself, and this together with the carbon brush it contains should be replaced by a fresh one. Should it be found that no spark is obtained it can then be said that the failure is due to a defect in the machine.

The spring holding down the cover of the contact-breaker disc should now be turned aside and the cover removed with the object of ascertaining whether, when the fibre block of the contact-breaker lever leaves the steel segment, the lever makes contact with the contact-piece, and whether the contact is broken when the fibre block again reaches the steel segment. The distance between the two platinum contacts should be exactly 0.5 mm. If the contact is found to be in working order, the central screw which secures the disc to the armature should be unscrewed by means of the small spanner and the contact-breaker disc removed. The platinum contacts should now be examined to see whether their surfaces are quite clean. If this is not so, they should be cleaned with a little petrol to get rid of any oil or dirt. If the contact surfaces are found to be worn, they may be cleaned with a very fine file, but this expedient should only be resorted to if absolutely necessary. It is to be especially noted that the contact lever moves freely. The pivot of same works in a fibre bush and accordingly should not be lubricated. It may happen occasionally on new magnetos that owing to the expanding of the fibre bush the contact lever is prevented from working freely. By slightly widening the bore of the fibre bush by means of a reamer the fault can be rectified. Briefly, the method of tracing faults in the ignition gear would be as follows : First ascertain by means of the spanner whether the machine is in order, then change the sparking plugs, test the wires connected thereto, find out whether the lever of contact-breaker works freely, and finally remove the contact-breaker disc and examine platinum contacts.

To Remove Tyres.

The tyres are fitted to remove on the side of cycle opposite to belt pulley.

If the front tyre has to be repaired, the front wheel stand should be placed in position, when it will be found considerably easier to effect the repair.

The front stand will also be found useful when cleaning the machine; but the engine should not be run with the front stand fitted.

To facilitate easy removal of tyres it will be found expedient to obtain a set of three small tyre levers, such as are sold for pedal cycles. After the tyre is levered out of the rim, the lever hooks on to the spokes of the wheel. By using these levers, removal and replacing of tyres becomes a very simple process. Be careful to partly inflate tube before replacing a cover; otherwise there is a danger of the tube being ripped between cover and rim.

Don't Forget

That you have a cycle as well as an engine.

To oil wheels.

To inject grease into two-speed gear in models "O," "P," "R," and "S."

To oil countershaft, chain, pedal bracket, and pedal bearings (in model "N.")

To oil spring fork joints.

To oil magneto.

To go over the nuts of the whole machine occasionally.

To drain crank-case frequently.

To carry a pump and repair outfit.

That the face of the clutch should not be oiled.

NOTE.—Ordinary cycle lubricating oil should be used for the bicycle proper and for the magneto.

General.

To keep the engine always efficient, it should be taken apart, and the piston heads and the interior of the combustion chambers cleaned from carbon deposit, say, once in every 3,000 miles. It is also desirable that the piston rings should occasionally be taken off and the grooves thoroughly cleaned from carbon deposit. The rings may be removed by inserting under each three slips of tin, say $\frac{1}{4}$-in. × 2-in., which will enable the rings to be slipped over the grooves.

Over-lubrication is the main cause of carbon deposit, and attention to the lubrication will repay itself by the engine remaining longer clean.

Whatever lubricant is used, avoid one that gums up stiff when the engine is cold, and makes starting difficult.

Spares for Touring.

The following spares are recommended for touring :—

Two valves complete—one inlet and one exhaust valve.

Two spark plugs and washers.

Two copper washers for valve plugs.

Two magneto platinum-pointed screws (one of them being the long adjustable screw with nut).

One magneto carbon brush and spring.

One spare belt fastener.

Small supply of valve springs, cotters, caps, screws and nuts.

One fork spring.

One exhaust valve timing link.

Repairs.

Repairs will be executed at the Works, Kingswood, Bristol, at the lowest cost consistent with good material and skilled workmanship, and every care taken to ensure satisfaction, but no guarantee is given.

All repairs should be sent to us, carriage paid, otherwise we cannot accept delivery, and with the fullest instructions as to requirements.

If the engine is sent to us for repair or adjustment it should be enclosed in a very strong wooden box with ample packing of shavings or newspapers around it. The label on the box should distinctly state the name and address of the sender of the engine.

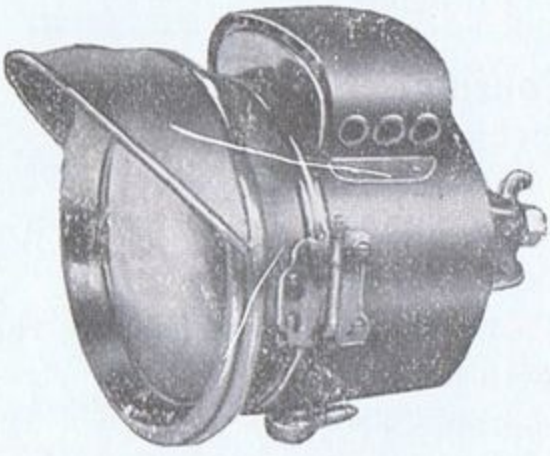
If a complete bicycle is sent up it should, if possible, be placed in a crate, otherwise it may be damaged in transit. The name and address of the sender should be stated on the label attached to the crate. All fittings such as inflator, horn, lamp, tools, speedometer, etc., should be removed from the machine, as we cannot accept responsibility for any fittings left on machines.

Personal.

We are anxious that every rider of a Douglas Motor Bicycle should be entirely satisfied with his machine. On our part, no effort will be spared to give such satisfaction.

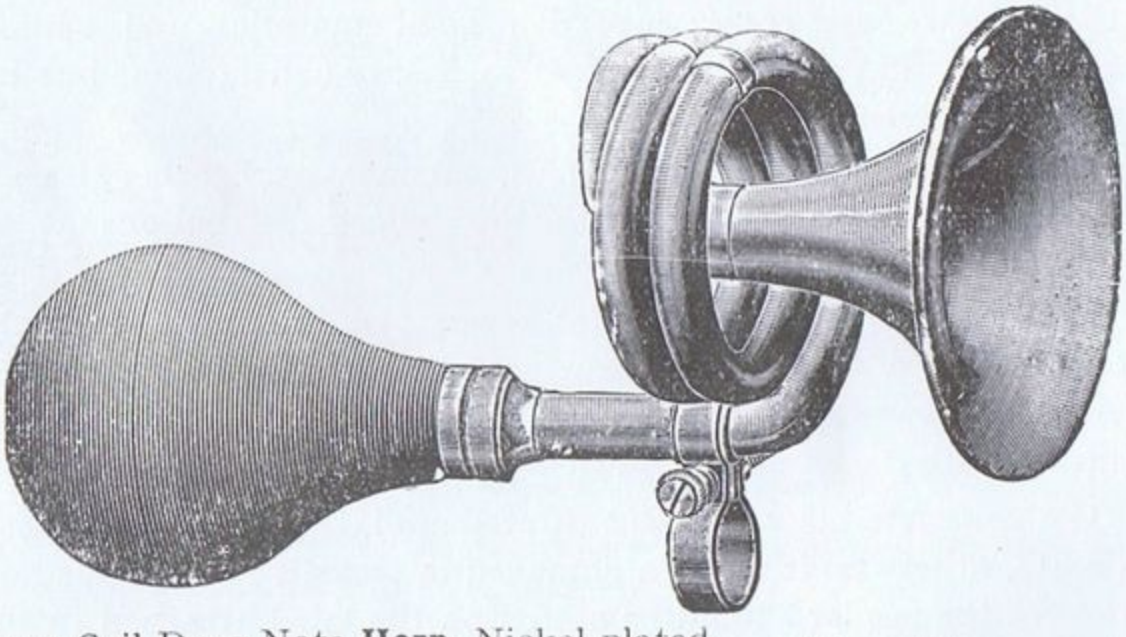
Should the rider of a Douglas Motor Bicycle experience any difficulty with his machine, he need feel no hesitation in communicating with us. Such communications will at all times receive our most careful attention.

ACCESSORIES.



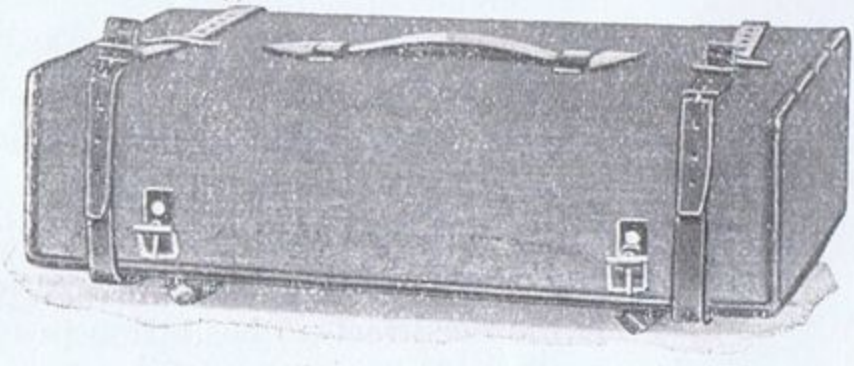
Powerful Nickel-plated **Lamp** with "Mangin" Lens Reflector, strongly rivetted and fitted with clip suitable for Douglas Motor ... ...

Strong Nickel-plated **Generator** for same with clip suitable for Douglas Motor ... ...



Three Coil Deep Note **Horn,** Nickel-plated ... ...

The Cowey **Cyclometer** is also fitted, if desired ... ...



Valise for use with carrier ... ...

SPARE PARTS.

IMPORTANT NOTICE.

OWING to the excessively rapid growth of our business we regret to state that, during the early part of last year, we were unable to supply spare parts so promptly as we should have wished. We have now taken effective steps, however, to prevent the recurrence of delay.

We have established a new and separate department for spare parts, and our intention is that goods shall be sent away by the first post after receipt of the order.

We think it right to mention that we have suffered considerable loss through customers not paying for goods forwarded to them. What frequently happens is that we receive a letter or wire stating that certain parts are urgently needed. Rather than cause delay by asking for a remittance, we have forwarded the goods with an invoice, relying on the honour of our customer to send the money. In many cases we found that our confidence was misplaced, and accordingly, we have been obliged to alter our practice.

In future, no spare parts will be issued until they have been paid for. When a customer is ordering spare parts by letter, he may either remit the exact amount (which will be found by reference to this list, pages 67 to 72) adding postage, or he may remit such sum as he thinks likely to cover the cost. If the amount remitted is in excess or insufficient, our dispatch

clerk will make the necessary adjustment. When cash is not sent with the order, we shall at once issue an advance invoice, and, when the amount is remitted the goods will be instantly dispatched. If the goods are urgently needed, a remittance may be sent by wire. In any case, we shall henceforth be unable to depart from our rule not to dispatch spare parts until their price has been received.

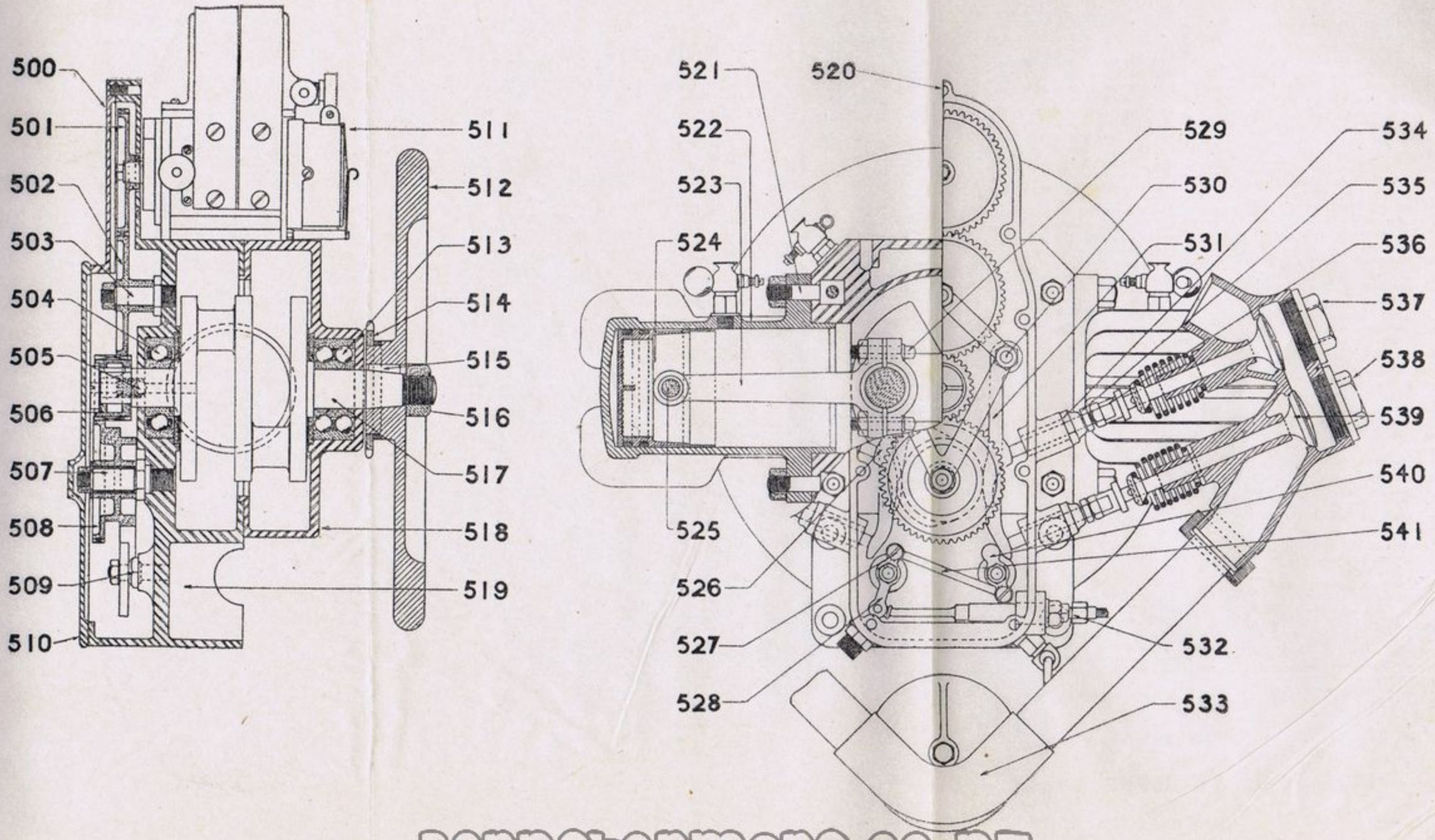
It is with reluctance that we have taken this step, as we know that it will sometimes cause inconvenience to genuinely honest, but thoughtless persons. *Where, however, inconvenience is anticipated, we would recommend our clients to open with us a small credit account.* A deposit of, say £1, will cover the cost of many spare parts, and will save the customer all inconvenience. If this is done, it is desirable that when ordering goods one should specify "Deposit A/c." A statement of the account will be rendered periodically.

When deposit account customers order goods by wire, the word "Deposit" should be written at the end of the telegram, and if wiring away from home, the name of the town in which they reside must follow the word "deposit." This is necessary to enable us to identify the A/c., and to avoid delay in dispatching goods from stock.

A telegraph money order should be accompanied by the name and address of the sender. The Post Office do not give this unless it is paid for in the private message.

Please give the Engine Number with each order for spare parts.

When returning parts for replacement, it is essential that the number of the engine should be quoted, as the matter cannot be dealt with until this information is received.



Douglas 2¾ H.P. 1913 Motor.

PRICE LIST OF SPARE PARTS.

Engine Parts.

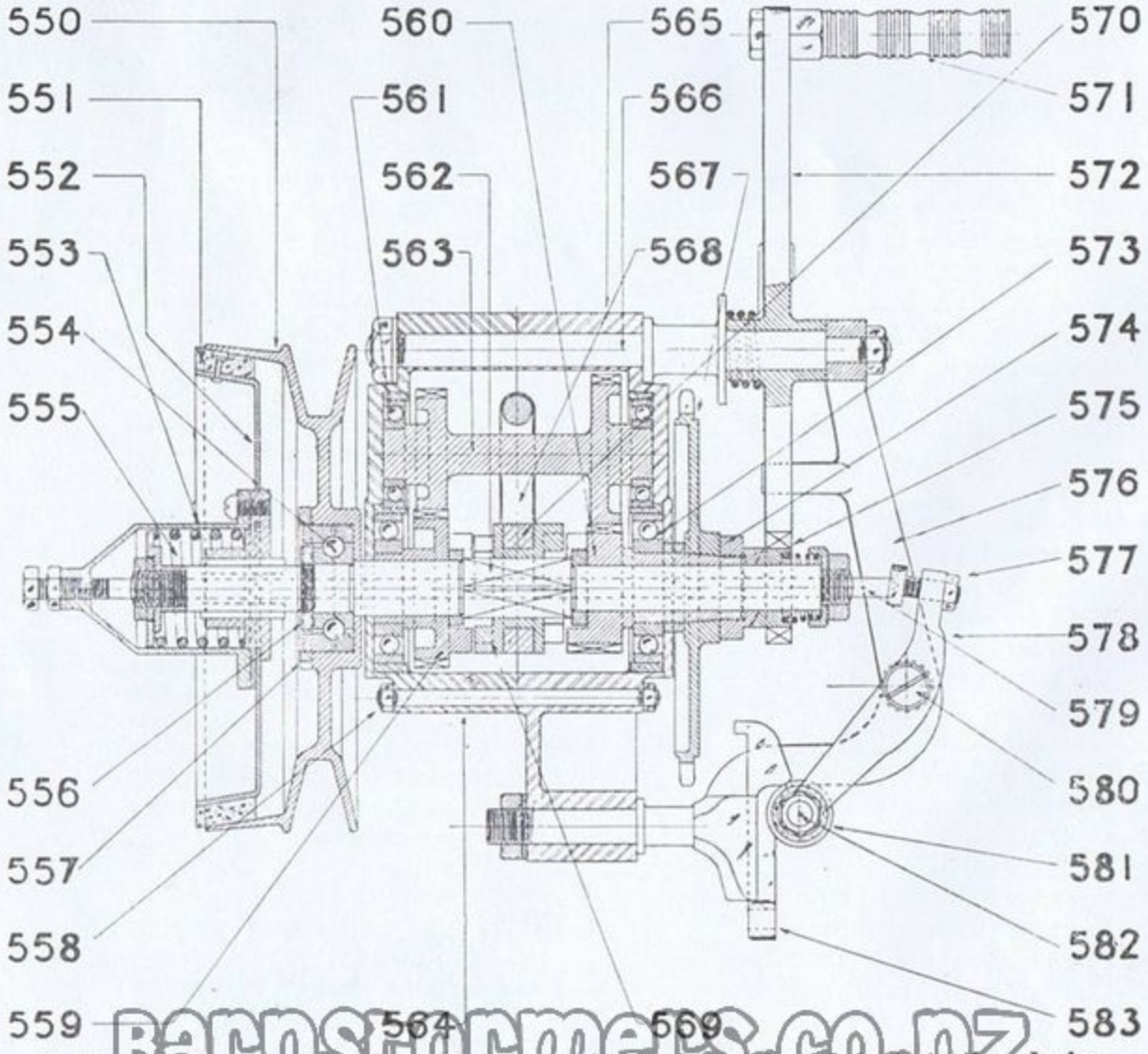
No.		£ s. d.
500	Cover for magneto driving wheel	
501	Magneto driving wheel ...	
501A	Key for ditto	
502	Intermediate wheel ...	
503	Pin for ditto...	
503a	Nut for ditto	
503b	Washer for ditto	
504	Crankshaft ball bearing (timing side)	
504a	Washer for ditto	
505	Ball for air release valve...	
505a	Spiral spring for ditto ...	
505b	Screw for ditto	
506	Timing pinion	
506a	Key for ditto	
507	Cam Wheel Pin	
507a	,, Nut	
507b	,, Washer ...	
508	Cam wheel	
508a	Cam wheel bush ... each	
509	Screws for exhaust lifting lever ... ... each	
509a	Nuts for ditto ... ,,	
509b	Washers for ditto ... ,,	
510	Cover for crank-case (timing half)	
511	Magneto complete with control, but less lever and wheel	
512	Flywheel (plated)	
513	Ball Bearing (flywheel side)	
513a	Washer for ditto	
514	Chain wheel 16 T or 17 T...	
515	Flywheel key	
516	Flywheel nut	
517	Crank-shaft	
518	Half crank-case (flywheel side)	
519	Half crank-case (timing side)	
519a	Release nipple for ditto ...	
519b	Drain tap for ditto ...	
519c	Bolts for ditto ... each	
519d	Nuts for ditto ... ,,	
519e	Clamping bolts securing case to frame	
519f	Nuts for ditto	
520	Screws for timing gear case covers	
521	Cylinder bolts	
521a	Nuts for ditto	
522	Cylinder (back) without caps	
522a	Cylinder (front) without caps	
522b	Compression taps for ditto each	
523	Connecting rod	

No.		£ s
523a	Connecting rod big end bush ... ... each (in halves, with packing pieces)	
523b	Connecting rod small end bushes ... ... each	
524	Piston (back cylinder) ...	
524a	Piston (front cylinder) ...	
524b	Rings for ditto ... each	
525	Gudgeon Pin	
525a	Copper end caps for ditto...	
526	Inlet valve timing links each	
527	Screws for exhaust-lifting levers ... ... each	
528	Exhaust-lifting lever (back cylinder)	
529	Connecting rod bolts each	
529a	Nuts for ditto ... ,,	
530	Pins for valve timing link ea.	
530a	Nut for ditto	
530b	Washer for ditto	
531	Exhaust valve timing links each	
532	Exhaust valve lift controlling rod and spring plunger ...	
532a	Bowden cable for ditto ...	
532b	Sheath for ditto	
533	Silencer end with exhaust pipes and unions	
533a	Silencer baffle	
533b	End caps for ditto	
533c	Rod for ditto	
533d	Nuts for ditto	
534	Inlet valve tappet rod guides	
534a	Exhaust valve tappet rod guides	
535	Inlet valve tappet rod ...	
535a	Exhaust valve tappet rod ...	
536	Inlet valve rod adjusting cap	
536a	Exhaust valve rod adjusting cap	
537	Inlet valve cap for sparking plug...	
538	Cap for exhaust valve ...	
539	Exhaust valve complete ...	
539a	Inlet valve complete ...	
539b	Exhaust or inlet valve only	
539c	Exhaust or inlet valve cap for spring	
539d	Exhaust or inlet valve cotter	
539e	Exhaust or inlet valve spring	
540	Exhaust valve lifting lever (front cylinder)	
541	Exhaust valve lifting lever (connecting rod)	
542	Locking plate for timing wheel Pins	
543	Locking washers with screw	

Price List of Spare Parts—*continued.*

Two-speed Gear with Free Engine Clutch.

No.		£ s. d.
550	Belt pulley	
551	Lining for clutch with rivets	
551b	Rivets for clutch lining each	
552	Clutch with lining	
552a	Keys for ditto	
553	Cap for clutch spiral spring with adjustable screw and lock nut ... ... each	
553a	Adjustable screw with lock nut	
553b	Nut for shaft	
553c	Washer for same	
553d	Screws for securing cap each	
554	Ball bearing for pulley ...	
555	Clutch spiral spring ...	
556	Small lock nut for pulley ball bearing	
557	Large lock nut for pulley ball bearing	
558	Gear case bolts ... each	
558a	Nuts for same ... „	
559	Plain sleeve (30 teeth) ...	
559a	Distance washer for ditto ...	
560	Screwed sleeve (24 teeth) ...	
560a	Distance washer for same ...	
561	Ball bearing for secondary shaft ... ... each	
562	Main driving shaft	
563	Secondary shaft	
564	Half gear case (pulley side)	
565	Half gear case (chainwheel side)	
566	Gear case bolt for quadrant striking lever support ...	
566a	Nuts for above ... each	
567	Chain wheel	
567a	Distance washer for ditto	
568	Operating fork with lever ...	
569	Dog clutch	
570	Half friction rings (bronze) per pair	
571	Tread on starting quadrant	
572	Starting quadrant	
572a	Spiral spring for ditto ...	
573	Main shaft B bearing on sleeve ... ... each	
574	Screwed ratchet for starting gear	
575	Geared ratchet for starting gear	
575a	Spring for same	
575b	Cap for above	
575c	Nut for same	
576	Support for lever and wedge	
576a	Nut for same	



Section of Two-speed Gear, with free engine and clutch and foot-starting device.

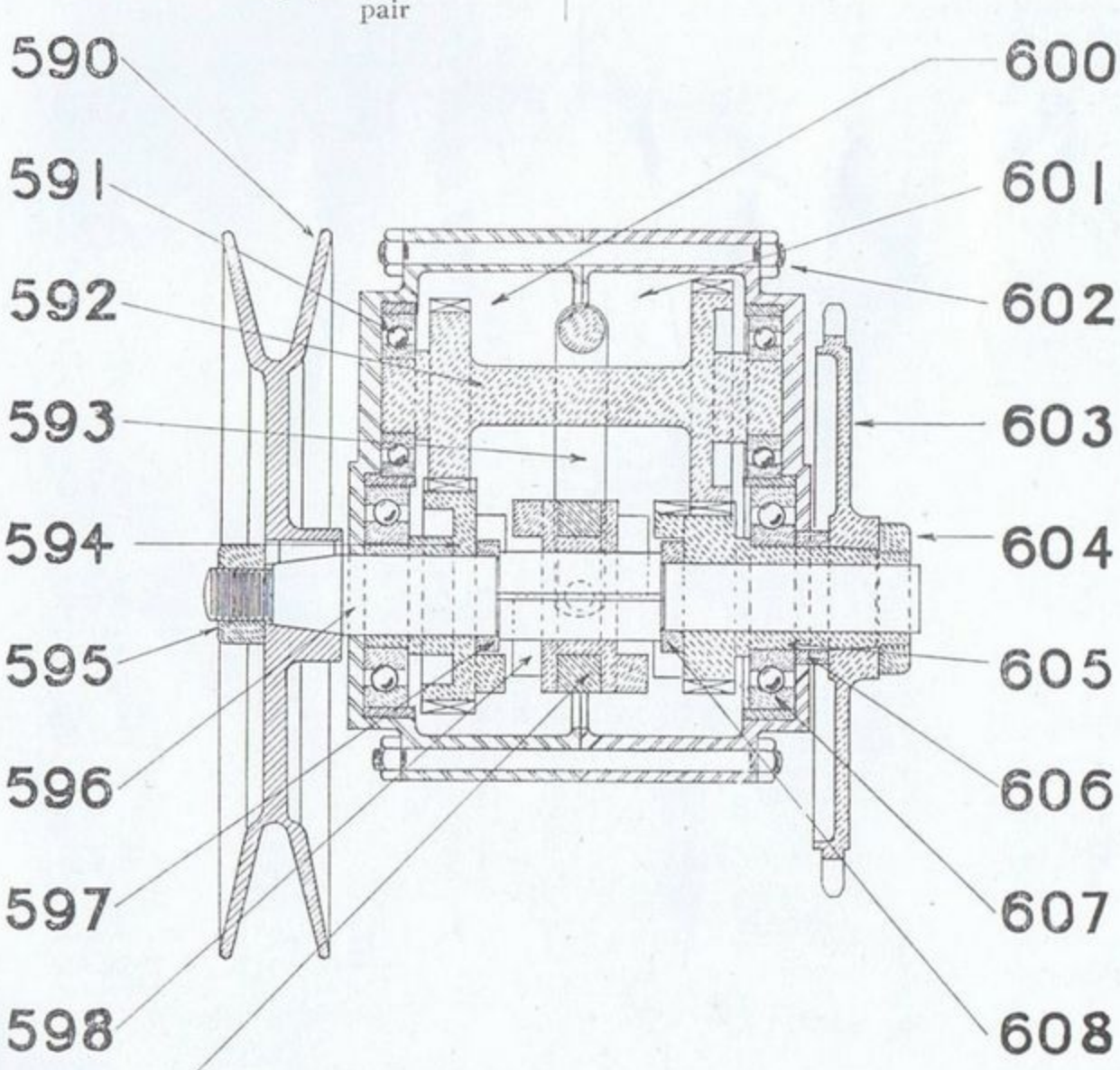
Price List of Spare Parts—*continued.*

Two-speed Gear with Free Engine Clutch—*continued.*

No.		£ s. d.
577	Adjusting screw for striking lever	
577a	Nut for same	
578	Striking lever	
579	Push rod for striking gear...	
580	Screw for securing striking gear	
581	Guide roller for wedge ...	
582	Screw for securing ditto ...	
583	Striking wedge	
583a	Screw for ditto	
584	Clutch pedal...	
585	Stop collar	
586	Rod for connecting to wedge	
587	Bolts for same with nuts each	

Two-speed Gear without Clutch.

No.		£ s. d
590	Belt pulley	
590a	Key for above	
591	Ball bearing for secondary shaft ... ... each	
592	Secondary Shaft	
593	Operating fork with lever...	
594	Plain sleeve (30 teeth) ...	
595	Nut for belt pulley ...	
595a	Washer for ditto	
596	Main driving shaft	
597	Distance washer for plain sleeve	
598	Dog clutch	
599	Half friction ring (bronze) pair	
600	Gear case (pulley side half)	
601	Gear case (flywheel side half)	
602	Gear case bolts ... each	
602a	Nuts for same ... ,,	
603	Chain wheel	
604	Nuts for above ... each	
605	Screwed sleeve (24 teeth) ...	
606	Distance washer for chain wheel	
607	Main shaft ball bearings on sleeves ... ... each	
608	Distance washer for screwed sleeve	

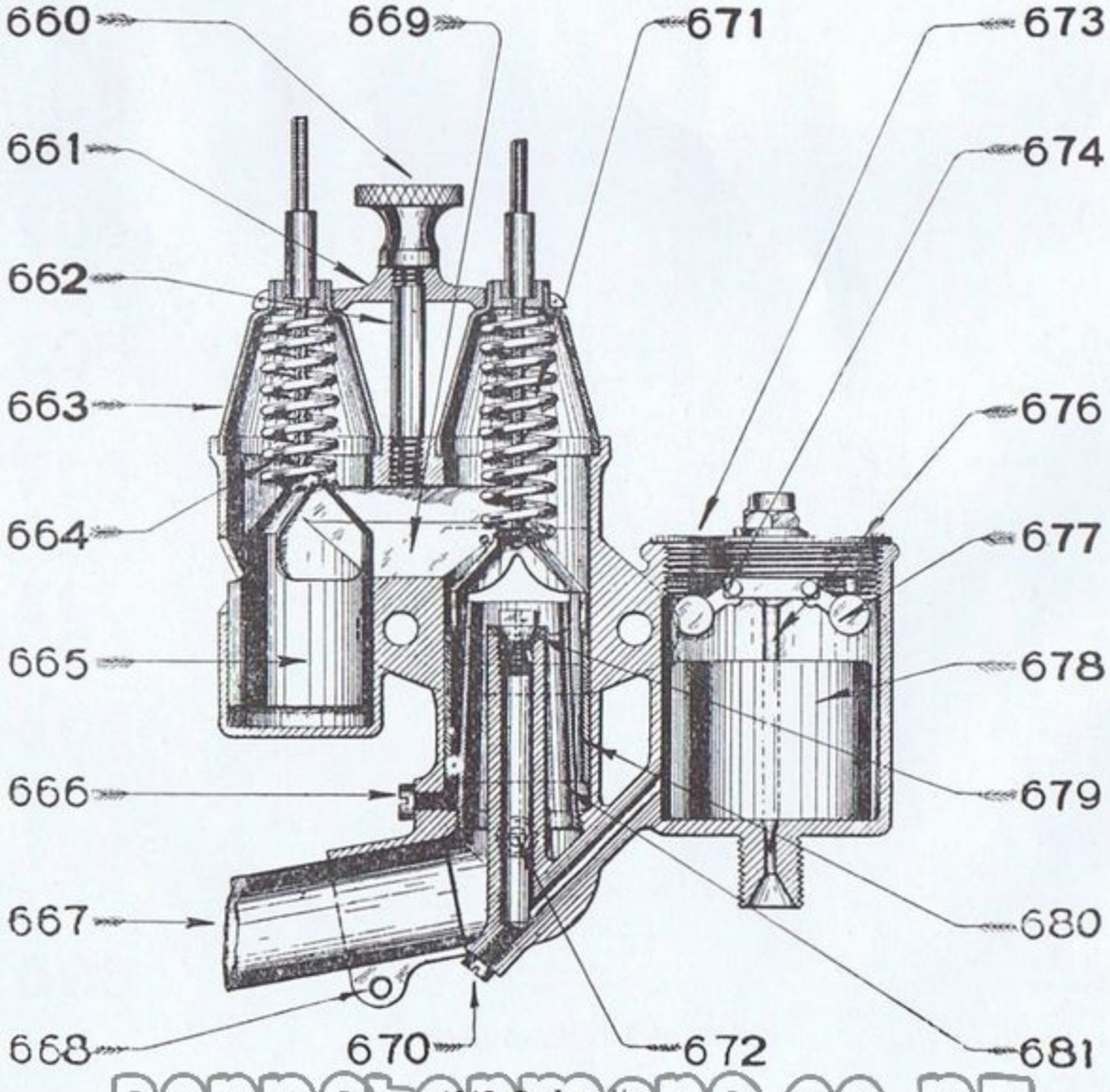


Section of Two-speed Gear.

Carburetter Spare Parts.

No.		£ s. d.
660	Milled edge nut for holding down bridge	
661	Holding down bridge for throttle and air tops ..	
662	Screwed pin for ditto ...	
663	Extra air chamber top ...	
663a	Spraying chamber ditto ...	
664	Extra air sleeve spiral spring	
665	Extra air sleeve	
666	Drain screw for spraying Chamber	
667	Hot air pipe	
668	Clamp screw for ditto ...	
669	Carburetter body only ...	
670	Drain screw for nozzle chamber	
671	Throttle sleeve spiral spring	
672	Fibre washers for fitting under domes	
673	Float chamber cover ...	
674	Toggle pins ... ... each	
675	Fibre washers for induction pipe ... ... each	
676	Needle valve with collar ...	
677	Toggle	
678	Float	

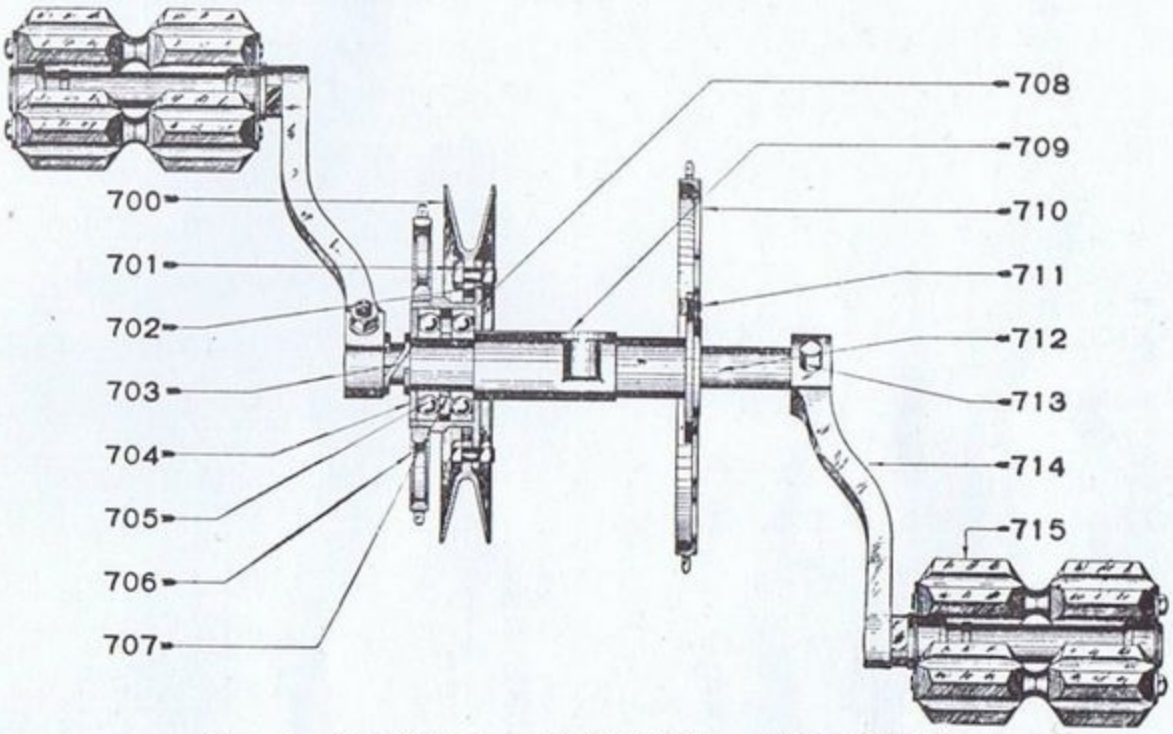
No.		£ s. d.
679	Jet nipple	
680	Throttle sleeve	
681	Choke tube	
682	Induction pipe	
683	Unions for induction pipe ea.	
684	Paper washer for carburetter joint	
685	Nut screwing carburetter to induction pipe	
686	Handle-bar control with cable	
687	Bowden cable with nipple for throttle	
688	Sheath for ditto	
689	Bowden cables with nipples for extra air	
690	Sheath for ditto	
691	Clip securing cable to cycle head	
692	Screws for ditto	
693	Petrol pipe	



1913 Carburetter.

Bottom Bracket.

No.		£ s. d.
700	Belt pulley	
701	Bolts for ditto ... each	
702	Nuts for ditto ... ,,	
703	Spring washer	
704	End cap for ball bearings ...	
705	Ball bearings ... each	
706	Chain wheel	
707	Distance piece for ball bearings	
708	Sleeve for pulley and chain wheels	
709	Bottom bracket	
709a	Bolts for securing same to frame	
709b	Nuts for ditto ... each	
709c	Washers for ditto ... ,,	
710	Chain wheel	
711	Screws for ditto ... each	
712	Crank spindle	
713	Cotter and nuts for cranks each	
714	Crank (right)	
714a	,, (left)	
715	Pedals ... per pair	



Counter Shaft fitted on Model "G." (Single Speed).

Tanks.

No.		£ s d.
720	Tank complete with taps, pump, sight filler, and filler caps, without lubricator	
721	Petrol tap	
722	Drain tap	
723	Washers for filler caps ...	
724	Screws for holding tank ...	
725	Sight filler cap for petrol ...	
726	Filler cap for oil	
727	Leather cups for oil pump...	

Lubricator.

No.		£ s. d.
730	Sight feed lubricator complete	
731	End plate only to carry Needle vlave	
732	End plate to carry delivery pipe	
733	Needle valve with union and handle	
734	Screws for holding lubricator together ... ... each	
735	Leather washers	
736	Glass tube	
737	Check plunger	
738	Spring for same	
739	Fixing screw for spring ...	
740	Screws for fixing lubricator to tank ... ... each	
741	Oil pipe from pump to lubricator	
742	Oil pipe from lubricator to engine	
753	Pointer	

Price List of Spare Parts—*continued.*

Spring Fork.

No.		£ s. d.
750	Spring fork complete ...	
751	Spring fork only	
752	Steering column with lamp bracket	
753	Head clip with bolt ...	
754	Links ... ... each	
755	Cross bolts ... ... each	
756	Springs ... ... ,,	
757	Nuts ... ... ,,	

SUNDRIES.

REAR BRAKE.

No.		£ s. d.
770	Brake Shoe	
771	Brake Block	
772	Screw with nut for same ...	
773	Brake rod, nicke plated, with eyes at ends	
774	Release spring	
775	Brake pedal	
776	Stop collar with screw for above	

FRONT BRAKE.

780	Front brake complete ...	
781	Brake shoes	
782	Brake pads	
783	Screw for brake shoe ...	
784	Sheath	
785	Cable	

FRONT WHEEL.

790	Front wheel complete without tyre	
791	Spindles ... ... each	
792	Nuts ... ... ,,	
793	Cups ... ... ,,	
794	Washers ... ... ,,	
795	Disc locking ring	

BACK WHEEL.

800	Back wheel with belt rim complete, less tyre ...	
801	Spindles ... ... each	
802	Nuts ... ... ,,	
803	Cups ... ... ,,	
804	Washers ... ... ,,	
805	Disc locking ring	

TYRES.

On account of market fluctuations, these can be quoted for on receipt of enquiry.

MUDGUARDS.

814	Front guard complete with stays and side wings ...	
814b	New pattern front mudguard (patent applied for) with stays	
815	Bolt for attaching to fork...	
816	Nut for stay eyes	
817	Cap-washer for same ...	
818	Back guard complete with clip and strengthening piece	
818b	New pattern rear mudguard with side wings	
819	Clips with nuts	

CARRIER.

820	Complete	
821	Bolts and nuts for same, each	

NUMBER PLATES.

822	Enamelled only, back or front ... ... each	
823	Clips for same with nut, each	
824	Painting identification numbers	
826	**TOOL BAGS** ... each	
827	Chainguard	
828	Handlebar raised	
829	,, dropped ...	
830	Belt, ¾-in. rubber	
831	Fastener	
832	Aluminium foot-pads with screw and rubber	
833	Pad holder	
834	Rubbers, per pair	
835	Grips, per pair	
836	Lamp and generator complete	
837	Plugs ... ... each	
838	Horn	
839	Cowey speedometer ...	
840	Strong valise for carrier ...	
841	Shield for front guard for winter riding	
842	Patent freewheel with dust covers	
843	Chains for two-speed gear each	
844	Pedal chain	
845	Valve washers ... each	
846	Plug washers ... ,,	
847	Taps for draining gear case and engine, each... ...	
848	Tap for injection of paraffin or oil to gear box, each...	
849	Front Stand	
850	Rear Stand	
851	Inflator	
852	Footrests complete.. ..	
853	Vent Pipe	
854	Jet Spanner	
855	Adjustable pulley	
856	Bolts for securing rear stand	
856a	Spring washers for same ..	
857	Spring clip for holding up rear stand	
858	Tool kit complete	
859	Grease Injector for two-speed gear	