I N S T R U C T I O N S

FOR

E R E C T I N G A N D R U N N I N G

Imperial

"Super-Diesel" Engines

S, CC and FF TYPES.

FEBRUARY, 1932.

CONCRETE FOUNDATION INSTRUCTIONS.

GENERAL DIRECTIONS.-A new Engine requires more careful attention during the first few days it is being driven than after the parts have become thoroughly "worked in."

It may take several weeks (or even months) for the various working parts of a new or "green" Engine to get into nice working condition; consequently an Engine that has been properly treated and in use for some time will work more smoothly, give more power, and not "warm up" quite so much as a new or "green" Engine.

The Engine which is driven carefully and not allowed to "race" when new usually gives the most satisfactory service in the end.

The successful working of the Engine largely depends upon the skill of the driver. Varying conditions make it either harder or easier for it to do its work, and due allowance must be made for same.

Each Engine is required to pass exacting tests; the last test is made immediately prior to the despatch of the Engine from the works. We therefore deliver the Engine in first-class mechanical condition; afterwards it is plainly the duty of the driver to keep it in this condition.

When sending parts, attach label, giving your name and address. promptly advising us HOW, WHEN and WHERE consigned.

GENERAL DIRECTIONS-*Continued*.

Erection.-Engine to be solidly mounted on a concrete or heavy timber foundation, with crankshaft perfectly level, and lined up truly, to ensure belt working correctly.

Clean carefully, and thoroughly inspect all the vital and moving parts of the Engine. Revolve flywheels, making positively certain that the various adjustments on the Engine have not been interfered with, and that everything is in proper working order and condition, and that all bolts are tightened before any attempt is made to start the Engine.

CONCRETE FOUNDATIONS FOR IMPERIAL ENGINES.

Foundations for Stationary Engines should consist of a solid block of stone or concrete of ample size and weight.

The Engine is secured by long bolts embedded in the concrete. These bolts are made out of ordinary plain round mild steel or iron, with a hook at one end and threaded at the other end.

The top surface of the foundation should be high enough to enable the flywheels to clear the floor level, but the **depth to be excavated depends entirely on local conditions**. It is essential to excavate deep enough to secure a "**good bottom**," which must be at least 12 inches into the ground.

The site should be selected on solid, hard ground. If the ground is in any way of a yielding nature, the foundation must either be enlarged or a new site found.

Make a mixture of concrete, viz.:-

3 parts of **Clean** 3/4 in. screenings or good clean gravel.
2 parts of **Sharp** sand.
1 part of **Fresh** cement.

Our Foundation Blue Print and Instructions are based on general experience, but the purchaser must be responsible for the proper adaptation to his own circumstances. He must also satisfy himself that the materials for the foundation are of suitable quality.

The usual practice is to make up a wooden frame (the Inside Dimensions representing the finished size of the concrete foundation). This is placed over the excavation;

You can't compress a liquid, so don't try to start your engine with an excess of fuel in the combustion chamber; it may cause a breakage.

cross pieces of wood are nailed on top of the frame, and holes bored through at the correct place (to correspond with the holes in the bedplate of the engine) to support the bolts when pouring the concrete.

The Foundation Bolts must never be cemented in the concrete before the Engine is on its foundation.

At the positions where the foundation bolts are situated, tubes or square wooden boxes about 2 in. to 3 in. square should be made. These boxes are placed temporarily in position before the concrete is poured in, and are finally removed just before the concrete sets hard, thus allowing space for the bolts to be moved about to suit the holes in the Engine base, which may vary slightly from the dimensions shown on the Blue Print, and also allow of correct “lining” and “levelling” of Engine.

The top of the foundation should be left rough. When the concrete is set the engine can be placed in position, and then metal packing strips placed underneath the bed plate to line up with the belt pulley and ensure the belts running correctly in line, at the same time using a spirit level across the top of both flywheels to level the Engine crosswise.

A clay ridge should be made around the top of the concrete bed, and then cement grouting run in to extend about 1/4 in. up from the bottom of the Engine base.

Make sure the grouting completely fills the space under the engine.

The foundation is then allowed to stand until it is perfectly hard and dry.

Finally, again tighten the nuts of the foundation bolts just prior to giving the Engine the first run.

Exhaust Pipe.-The flanged elbow (1041), which is bolted to the cylinder head, is usually fitted in the reverse position with Engines that are despatched for local deliveries. This is done purposely to prevent rain water from entering the cylinder head and rusting up the valves whilst the Engine is in transit.

With stationary Engines it is the usual practice to run the exhaust pipe vertically through the roof of the Engine

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When ordering spare parts, always give:-

THE ENGINE NUMBER	stamped on name plate).
CLASS OF ENGINE	stamped on name plate).
REFERENCE NUMBER	as shown in spare parts list).

house; therefore on receipt of the Engine, unbolt the flange and reverse the direction of the flanged elbow, so the exhaust pipe will run vertically through the roof of the shed.

When installing the Engine, make sure there is no chance of rain water getting into the exhaust pipe and flooding the Engine.

Diameter of Pulleys.-To the inexperienced, the relative diameters of pulleys is of no consequence; but in this regard we must emphasise the necessity of the correct ratio of the pulleys on the Engine and the machine which is being driven. This is exceedingly important, because we have known the Engine to be blamed for not having sufficient power to drive the load, whereas the whole difficulty is simply due to the pulleys not being the correct sizes.

When the Engine is being used for driving chaffcutters or saw benches, it is of vital importance to keep the teeth of the saw and the chaffcutter blades sharp and set correctly. If the saw is not properly "set" there will not be sufficient "clearance"; it will "bind," and thus require additional power for doing work which should be easily accomplished if the saw is properly set.

If you require any additional information, or if you are in doubt regarding the adjustment of any particular part, write us fully in the matter, and we shall he glad to explain.

Should you happen to be in Melbourne, always make a point of calling and letting us know what results you have obtained.

EXPLANATION OF HOW THE ENGINE OPERATES.

Working Cycle.-The IMPERIAL "Super-Diesel" Engine works an the four-cycle principle.

1. **Suction Stroke**.-During the first or intake stroke pure air only is taken into the cylinder through the inlet valve, whilst a small amount of fuel proportional to the load is admitted into the fuel cup through the capsule or

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fuel valve, which is held open during the greater part of the intake stroke.

2. **Compression Stroke**.-During the second or compression stroke the air previously drawn into tho cylinder is compressed. The fuel in the fuel cup being in communication with the compressed air in the cylinder, the lighter constituent parts of the fuel are vaporised. This vapour ignites and expands, forcing the remainder of the fuel in the fuel cup through the small holes into the compressed air in the cylinder, where it burns slowly, generating considerable pressure, and thus producing the

3. **Power Stroke**, or third stroke, but just before the piston reaches the end of the power stroke the exhaust valve is opened, and then begins the

4. **Exhaust Stroke**, or fourth stroke, and as the piston returns towards the head of the cylinder the spent exhaust gases are forced out of the cylinder, through the exhaust valve and piping, into the atmosphere (the exhaust valve remains open during the whole period of the exhaust stroke), thus completing the cycle of operations, which is repeated over and over again.

PREPARATION FOR STARTING.

See that the fuel tank is properly mounted on top of Engine, so that fuel will flow to fuel cup by gravity.

Fuel.-The fuel may be any grade kerosene, the cheapest procurable, but it is positively essential that it must be free from dirt or grit. If you doubt its cleanliness, strain through three layers of cheese cloth. Take care there is no water in the fuel.

On Engines fitted with a double fuel tank, the smaller division is for kerosene and the larger division for fuel oil or a mixture of kerosene and fuel oil.

NOTE.-When using heavy fuel oil,

(a) Engine does not develop quite so much power.

(b) A gummy deposit tends to form on the stem of Exhaust Valve (causing the valve to close sluggishly).

PREPARATION FOR STARTING-*Continued*.

(c) Cylinder head Exhaust piping and piston head require to be cleaned more often.

(d) Always start the Engine on Kerosene until it gets thoroughly warmed up; the heavy fuel can then be used.

(e) When about to stop the Engine always run for the last ten minutes on kerosene fuel to make sure that the fuel oil will be washed out of the fuel pipe ready for the next start.

Leave no tools or other articles on or near the Engine, lest they be caught in flywheel, belting, or other moving parts.

Fill hopper with water.

Remove wicks of main bearings, fill oil well, then replace wicks.

OIL-

Grooved collar (745) on crankshaft.
Governor weight pin (744).
Bearings for governor side rod (802).
Timing gears (680).
Stud for timing gear (681).
Pushrod guide (622) and roller (623).
Rocking lever pin (628) and bearing for pushrod in rocking lever bracket.
Double offset lever (921).

Governor.-Carefully examine both of the governor weights (741) and the needle feed valve (866), making sure they work freely, as sometimes paint (on a new engine) or rust collected in transit causes these parts to stick, and thus prevents the Engine from governing properly. It may happen that the gland nut (870) on the needle valve (866) has been screwed up too tightly, causing the needle to jamb. (It should he just sufficiently tight to enable the needle to slide through the packing comfortably, and at the same time prevent any fuel from leaking. sometimes this needle valve may be bent, and might require straightening). **Also see special direction under the heading of Needle Feed Valve.**

Remove splashguard of the crank chamber, unscrew cap

of big end oiler, remove wick, and fill with Macsdiesel Cylinder Oil; replace wick, screw cap up **firmly** (as it may come loose and the oil will be lost, resulting in an over-heated or spoiled bearing).

Fill the Sight Feed Lubricator with fresh, clean Macsdiesel Cylinder Oil, raise the signal lever (at top of lubricator), then adjust the knurled nut so that the oil will drop at 8 to 16 drops per minute.

Oil Pump.-When starting the Engine for the first time, or if the Engine has been standing idle for some time, remove the lubricator and keep pouring a quantity of oil into the oil pump, move the plunger backwards and forwards by hand for a few minutes, so as to ensure A GOOD FILM OF OIL ON THE PISTON. Whilst doing this revolve the flywheels, so that the film of oil will be distributed over the working surfaces. The lubricator can then be replaced and adjusted to flow freely until you are sure there is a good film of oil on piston and cylinder.

Pour a liberal supply of oil over the skirt of the piston where it projects out of the cylinder.

Over-lubricate, rather than under-lubricate. There is no economy in sparing oil on your Engine. "Oil is cheaper than machinery"; but use it when required and not waste it.

Be positive that a sufficient and continuous supply of oil is supplied to each bearing.

Valves.-It is a good practice to always examine the Exhaust Valve (320) Inlet Valve (323), and Fuel Valve (863) to make sure they are free to operate. Push them backwards and forwards by hand. If they work sluggishly due to rust, carbon or congealed oil, put kerosene on to the stems and work them backwards and forwards.

To Start.-Assuming that the belt has been placed on a loose pulley (or when starting the Engine for the first time, remove the belt altogether), and that **Fuel, Water, Lubrication, and the testing of the valves** have all been properly attended to, proceed as follows:-

Move speed regulator lever (807) to "midway" position.

When despatching parts, securely attach a label with your name and address and promptly advise us how, when and where consigned.

TO START-*Continued.*

Push down lever (629) for holding inlet or exhaust valve open to release compression. When this lever is in this position there is no compression to pull against; consequently it is easy to turn the Engine at a good speed. (Speed is essential in order to ensure a prompt and satisfactory start.)

Turn on the fuel (**momentarily**) at the kerosene cock and then turn it off again.

Take hold of the starting handle in the right hand (keep the left hand in readiness to **pull up** the lever).

Revolve the Engine in a right-hand direction, promptly increasing the speed, so that after turning three to eight revolutions, the flywheel will have acquired sufficient momentum to easily enable the operator to keep on turning the Engine against the full compression.

When this stage is reached the lever (629) is promptly **pulled up** with the left hand, whilst the right hand still continues to revolve the Engine (it is impossible for Engine to "back fire"), when the Engine will start immediately.

The fuel cock is then promptly opened to the full extent, and the speed regulator (807) moved to the **Left** to reduce the speed, or to the **Right** to increase the speed of the Engine to suit the work in hand.

The sight feed lubricator is inspected, adjusted and watched periodically the whole time the Engine is working.

IF THE ENGINE SHOULD FAIL TO START, it may be due to lack of:-

The necessary momentum.

Shortage of fuel.

Insufficient lubrication of the piston.

Before making the next start, pump a plentiful supply of oil on the piston, also allow the kerosene supply to remain on for a slightly longer period than formerly. This will allow a larger quantity of fuel to flow into the fuel cup.

You can't compress a liquid, so don't try to start your engine with an excess of fuel in the combustion chamber; it may cause a breakage.

TO START-*Continued*.

Then start the Engine in the usual manner.

After having started the Engine several times, the operator will be able to judge how long an interval is required for the fuel cock to remain open prior to starting.

"Konking" or "**knocking"** noise produced in the Engine when starting indicates too much fuel has been allowed to enter into the fuel cup. This can be easily remedied by reducing the interval the cock is allowed to remain open before starting. If the Engine continues to "knock" when starting, momentarily drop or push down the lever which holds the inlet valve open (629), then lift it. The Engine will then pick up speed, and the knocking will usually cease, although it is sometimes necessary to lower and raise the lever several times before the whole of the excess fuel (which has been allowed to enter the cylinder of the Engine) has been consumed.

Starting Handle.-When letting go flywheel handle, draw it backward a little, so that it falls into its recess (S and C Type Engine only); never run the Engine with handle projecting-it is dangerous, and may cause an accident by catching clothing.

"Back-firing."-There is no danger of "back-firing" or "pre-ignition," because the ignition of the charge does not take place until the piston is at the end of the compression stroke.

TO STOP ENGINE.

Turn off fuel (always keep fuel shut off when the Engine is not working), then:-

When the Engine is about ready to stop, drop the lever (629) which keeps the Valve open. (It must always remain in this position when the Engine is not working.)

Turn off lubricators.

Note.-The Engine invariably stops in a position where the fuel valve (863) is fully open, thus allowing the fuel (should the cock be open) to how freely into the Engine, washing the oil film off the piston and cylinder, resulting in:

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THE ENGINE NUMBER (stamped on name plate).

CLASS OF ENGINE (stamped on name plate).

REFERENCE NUMBER (as shown in spare parts list).

TO STOP ENGINE-*Continued*.

Difficult starting of Engine.
Undue wear on piston and cylinder.
"Knocking" when starting Engine.

It is most important, therefore, that the operator should he particularly careful to have the lever "down" when stopping the Engine, and it must always remain in this position until the Engine is ready to be started; in addition, **always keep the fuel shut off when the Engine is not working**.

CARE OF ENGINE.

Never allow anyone to "monkey" or meddle with the Engine or any of the parts, or alter any adjustments. If you are in doubt about any parts. and desire further information, communicate with us direct.

It is foolish to take an Engine down which is running satisfactorily just to find out what is inside.

Make a practice of attending to every repair or adjustment as soon as the necessity is discovered. This attention requires but little time, and may avoid delay or possible accident.

Cleaning.-After every run, or at least once a week, the Engine and vital parts should be wiped down, cleaned thoroughly, and closely inspected.

It should be a point of pride with every driver to keep his Engine clean and in tip-top order; by doing so he will lengthen its life and retard its depreciation.

The Engine and Engine-room should always he kept free from dust and dirt.

The whole of the working parts and the bearings should feel moderately cool on trying them with the hand when the Engine has finished working.

Cooling.-Always drain off the water in your Engine in frosty Weather when not running. Freezing of the water in the hopper and cylinder jacket will crack the cylinder.

Heat of Engine.-The water in the hopper evaporates slightly owing to the heat, which, in turn, causes the Engine to get "warm all over." It is essential, however, for the Engine to "get warmed up" in order to get the

best results. With a new Engine (especially during the first few weeks-and particularly in the summer time), it is quite likely that an inexperienced operator will consider the warmth of the Engine excessive, but as long as a plentiful supply of lubrication is provided, and the vital bearings do not become excessively overheated, no damage will result, even though the water in hopper boils occasionally.

Remove the silencer and exhaust piping every three months; thoroughly clean out, and replace.

While the exhaust elbow is off scrape exhaust valve stem (turning the valve at the same time), as hard carbon forms there and prevents valve seating.

Care of Bearings.-SHOULD A BEARING BECOME LOOSE, IT SHOULD HAVE IMMEDIATE ATTENTION. A rhythmic sound, such as caused by loose bearings, will soon destroy an Engine if allowed to run for any considerable time. The operator, therefore, should always have a keen ear for such sounds, and should make adjustments as soon as possible when necessary. All bearings of importance are adjustable, making adjustment easy. The "big end" of the connecting rod requires careful and continuous attention. Any excessive wear is invariably due to lack of adequate and continuous lubrication (see special diagram, page 13, illustrating oiler on big end). When a “knock” is detected on any of the bearings it should be promptly taken up. Great care should be exercised when testing the bearings to make sure they do not bind on the shaft, and thus be unduly tight, and cause trouble from heated bearings.

Knocking.-Always be on the lookout for loose bolts, etc.; occasionally go over the whole Engine, tighten all loose nuts, etc., and make sure lock washers are bent over so as to lock the nut.

The working parts of the Engine require careful and intelligent attention. The constant knocking of a loose connecting rod on the crankshaft will eventually produce crystallisation of the steel, and result in a broken shaft and possibly other parts of the Engine being damaged.

For best results use only-

MACSDIESEL Cylinder Oil.

KONKING, LUBRICATION, ETC.

When the Engine knocks from any cause whatever, the matter should be promptly investigated and put right If you are unable to do so, get an experienced mechanic to immediately correct the difficulty.

Konking.-Pre-ignition or “konking,” when starting the Engine (indicated by a violent knocking), is generally caused by allowing too much fuel to fall into the fuel cup (862) (due to turning the fuel on for too long a period when starting, or else by pressing the fuel valve (863) open too often). After the operator has started the Engine several times he can generally gauge what fuel is required to enable the Engine to start without “konking.”

"Konking" not only places unnecessary strain on the working parts, but the chief objection to “konking”, is because it is invariably the cause of "blowing the gasket" (or joint) in the cylinder head; consequently “konking” must be avoided as much as possible.

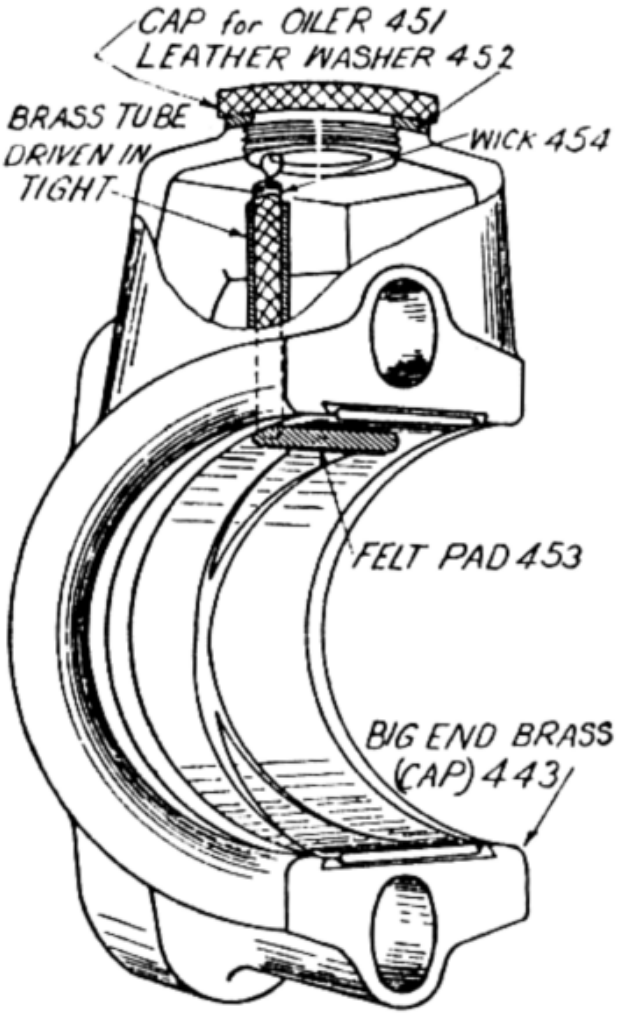
Flywheel Knock.-A knock which is sometimes difficult to locate will develop if the keys or key and clamp bolt securing the flywheels are allowed to become loose. The flywheels should be kept hard up against the shoulders, as this is their correct position.

Lubrication.-The proper amount of oil to be used cannot be exactly foretold, as it varies for different types, and even two Engines of the same type may require a different amount of lubrication. The operator should always try to use as little as possible, but, of course, without in any way to endanger the operation of the Engine. When starting a new Engine, or after having adjusted bearings necessitated by wear, be sure to feel over the Engine at frequent intervals, and if bearings run a little too hot, use more oil, provided the bearing in itself is not too tight; if so, it should be adjusted.

The statement “Oil is cheaper than Machinery” applies particularly to Engines, and neglect to sufficiently lubricate or the use of the wrong grade oil (whether cheap or expensive) will be certain to do serious damage to the Engine. On this account we supply a special lubricating oil termed **Macsdiesel Cylinder Oil**, which can be purchased

from our branches or agents in one or four gallon tins, and no other oil (however good it is for other purposes) possesses the high flash point, specific gravity. correct viscosity and boiling point suitable for use in our Engines.

"Big End" Oiler.-The Crankpin bearing (or “big end”) is lubricated by a felt pad (held tightly in a groove in the bronze cap of the Connecting Rod). The oil is fed from the lubricator by means of a wick (454) in the manner shown in the following illustration:-



The wick should not project out of the hole, as it will then syphon too much oil, and very rapidly empty the cup.

BIG END OILER, ETC. (*Continued*). **OIL PUMP.**

The Cap for Oiler (451C) must be firmly tightened into position, so that it will not become unscrewed or allow any oil to escape.

When properly adjusted, one lubricator-full of oil should last about 6 to 8 hours.

GIVE THIS OILER ATTENTION EACH TIME THE ENGINE IS STARTED.

Feel the "big end" bearing each time the Engine is stopped. It should be moderately cool, otherwise it indicates lack of sufficient lubricant. (See Instructions regarding “Care of Bearings, Loose Bearings, Knocking, etc,” on Page 11.)

OIL PUMP (Diagram Page 15.)

Should oil leak past plunger, screw gland nut (1022) up slightly so as to tighten packing washer.

Packing Gland (982) (See oil pump diagram).-These glands are used an the oil piping and also fuel piping. (Should a ferrule get damaged or last, you can make a temporary joint with string.)

To Set Oil Pump.-Remove lubricator from pump, draw plunger (990) partly out, and insert a piece of wire in hole where lubricator fits, then push plunger against the wire, turn flywheels until roller of push rad is on the top of Cam, loosen set screw in Arm (991) for operating oil pump, move arm along push rod till the bent portion of plunger will fall into the slot of arm (991), then tighten set screw`

Dirt on Ball Valve.-If Oil is blown out of the lower glass of the Sight Feed Lubricator it indicates that the ball valve in the pump (see diagram) is not seating properly, possibly due to some foreign matter being caught between the ball valve and seating. This can often be removed by removing the Sight Feed Lubricator and working the plunger by hand until the obstruction is washed away with the flow of oil; failing that, remove pump from Engine and wash in kerosene and replace.

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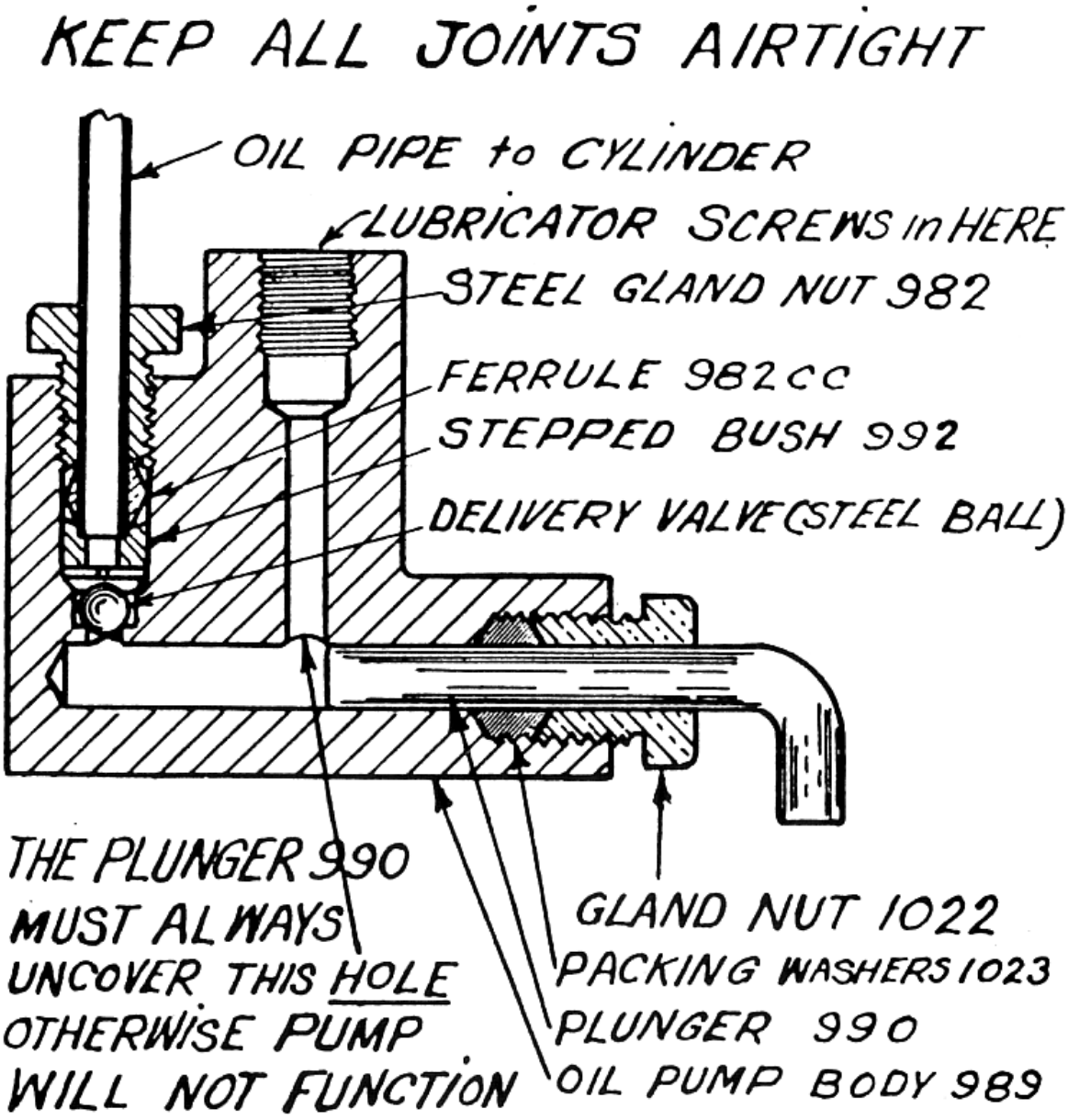
OIL PUMP.

INSUFFICIENT LUBRICATION IS DETRIMENTAL. AMPLE LUBRICATION IS ESSENTIAL.

ERR ON THE SIDE OF EXCESSIVE LUBRICATION.

SECTIONAL VIEW OF FORCE FEED OIL PUMP, AS FITTED TO IMPERIAL "SUPER-DIESEL" ENGINES.



You can't compress a liquid, so don't try to start your engine with an excess of fuel in the combustion chamber; it may cause a breakage.

LUBRICATION OF ENGINE.

Importance of Piston Lubrication.-Compression should not escape past the piston rings. The best fitted piston and piston rings, if allowed to run dry in the cylinder, would not be able to hold tight for any pressure. The illustration shows the section of farce feed pump for forcing oil between the piston and cylinder so as to maintain the oil film between the piston and cylinder walls. It is the oil film which makes the perfect air and gas tight joint; the piston rings merely perform the function of retaining the oil film. It will thus be understood that the proper lubrication of the piston is a point of vital importance.

To ensure good lubrication in the first place, use only Macsdiesel Cylinder Oil, supplied by us, and adjust the lubricator to feed continuously the right amount of oil. Do not apply excessive oil at times and at others let the Engine run dry.

Piston and Rings.-It is not advisable to disturb the piston and rings unless it is absolutely essential. Clients are warned against the common tendency of condemning piston rings for Engine troubles when the rings are not at fault at all. II the charge appears to be blowing past the piston it is advisable to draw the piston (it being only necessary to uncouple the big end). Carefully note the position of the rings (that is, the relation of the gaps in the rings), so that you can put them back the same way. Scrape off any carbon deposit on the head of piston, but do not remove any deposit from the working surfaces of the piston or between the rings, as such deposit will have become part of the bearing surface. It is not always necessary to remove the piston rings when cleaning the piston. The rings must be quite free to move (to free the rings, should they be stuck in the groove, pour kerosene over them and work them gently with the fingers or tap them with a piece of wood; do not use a hammer or any metal tool), but any carbon behind or at the side of the rings may remain there providing it is not excessive. Any badly worn or broken ring ought to be replaced with a new one. When the ring is a loose fit side-

ways it is advisable to get the sides of the groove (or grooves) in the piston machined out parallel to suit our standard oversize width ring. When replacing the ring at the head end it is advisable to remove the cylinder head (260), and carefully scrape or file away any carbon or ridge formed by wear upon the internal surface of the cylinder. New rings, standard and oversize, are available from stock. (A good deal of care is required in fitting new rings, and if the operator proposes doing this work himself it will be wise to communicate with the manufacturers, when full directions will be supplied). When replacing the piston make sure there is an abundance of oil on the working surface of the piston, cylinder and rings; also see that the gudgeon pin is properly secured, the white metal washers are in position, and the "big end" bearing is in perfect adjustment, and the “big end” nuts thoroughly tightened, and the lock washer is bent over so as to lock the nut.

Surplus Oil.-By means of the special drain plug provided occasionally draw off any surplus oil which may collect at the bottom of the crank pit.

GUDGEON PIN AND COMPRESSION.

Gudgeon Pin.-This is hardened and ground, and a tight driving fit in the piston. Originally it was held by two set screws, but in the later models provision is made, for two white metal washers to be inserted (one at either end of the gudgeon). There is, therefore, no chance of the gudgeon becoming loose and wearing a groove in the side of the cylinder. It is important, however, to make sure that the gudgeon pin is always a tight driving fit in the piston, and that both of the white metal washers are kept in their respective positions.

When removing Gudgeons from Pistons, the largest diameter part is always the end with two holes in it, and the Gudgeons must therefore be driven out from the opposite end.

Compression.-To have an Engine produce its rated horsepower, it is absolutely necessary to have good com-

pression. The Engine can readily be tested by closing all valves. When the Engine is 'on the compression stroke, it should not be easily turned over, and resistance should be sufficient to rebound the flywheels.

Altering Compression Space.-Provision is made for liners consisting of thin sheet metal, which are placed between the head of the connecting rod (440) and the base of the "big end" bearing (442). This is a common practice with many other types of Oil Engines. If the Engine should not start promptly, it may indicate the desirability of fitting one, two or three liners (1/32 in. thick), but if this is done the Engine may “konk” or “knock” when working; and if this should occur, it is obvious that one or more of the liners should be removed. Generally speaking, it is not advisable to fit any liners in order to increase the compression without writing fully consulting the manufacturers and obtaining their sanction.

LOSS OF COMPRESSION is sometimes due to lack of oil on piston, especially when starting up after the Engine has been standing. Adjust lubricator, and pump a supply of oil on to piston as explained previously. It may also be due to valve stems being gummy, or push rod binding in the guide and not allowing the valve to close. Put kerosene on exhaust valve stem, and work it backwards and forwards.

Cylinder Head Casket (261).-Always have one or two spare gaskets on hand. Keep these perfectly flat, and when not in use they should be kept between two flat surfaces, and never left about carelessly, curled up, or cracked, in which case they will become useless.

When fitting a new cylinder heat gasket, make sure no trace of the old gasket is left on either face of the joint, also be exceptionally careful not to burr or distort the faces on either the cylinder or cylinder head, otherwise it is impossible to make a good sound joint.

Valves.-Never allow any of the valves to leak, as it means a loss of compression, which in turn results in poor and uncertain combustion, loss of power, and perhaps

carbonising of the fuel valve and fuel cup, caused by improper combustion. If a valve leaks it should be turned on its seating; but if this fails to rectify matters, it should be removed and reground, and before assembling again it should be cleansed with kerosene as otherwise described, and all seats and joints should be free from grit and dirt.

Exhaust Valves.-If the exhaust valve (320) should shut sluggishly, it is probably due to a weak spring, or perhaps a gummy deposit is formed on the stem of the valve. This deposit can be temporarily cured by using a small quantity of kerosene on the valve guide, but ii may be desirable to remove the valve at the first opportunity; cleanse thoroughly with kerosene, regrind, and, if necessary, slightly polish the stem with fine emery cloth.

Lubricate exhaust valve regularly (with kerosene only) through oil hole provided in valve guide under spring.

Occasionally examine the lock nuts on the inlet and exhaust. valves. Always keep them locked tightly. Use two spanners (one on each nut), so that the nuts are positively tightened against each other by moving spanners in opposite directions.

Regrinding Valves.-The exhaust and inlet valves require to be reground occasionally. To do so, loosen the four large nuts on the cylinder head with the special spanner provided. Remove the cylinder head, clean and regrind valves with the special grinding tool provided. While the exhaust elbow is off clean out any carbon deposit in the exhaust port, elbow, piping or silencer. Carefully remove all particles of the old gasket from the cylinder head joints, insert new gasket and replace cylinder head. Tighten all four nuts evenly, finally tightening them securely.

Valve Grinding.-Too much stress cannot be laid on the necessity for effectively regrinding valves. It is a common occurrence to find less compression after “grinding in” valves than before, although the seatings appear good.

VALVES-*Continued*.

To regrind a valve satisfactorily, a rapid alternating rotation, with light pressure and frequent lifting of the valves during the operation, is essential. Heavy pressure on the valve head may cause distortion, and often creates a false seating, which is not gas-tight under working conditions. Neither does excessive pressure expedite the operations, as most of the abrasive powder is too quickly forced out from between the seatings. Particles of emery are also liable to become embedded in the seatings.

If the valve is “pitted,” it should be ground in on its seat with a paste of fine emery and engine oil. Smear this paste on the valve face, and place the valve on its seat. With the tool provided press the valve down and turn it round, backwards and forwards, occasionally lifting the valve off its seating to prevent the emery caking and cutting grooves on the faces.

When the valve has been "ground in," and the seat marking well all round, clean the parts to remove all traces of grinding material and replace in the usual manner.

Needle Feed Valve (866).-This controls the amount of fuel entering the fuel cup, and is operated by the governor.

Should it fail to function properly, it is probably due to one of the following causes:

Gland nut (871) screwed up too tightly.

Needle valve (which is made of silver-steel) may be distorted or bent, and requires straightening.

There must be 1/64 in. clearance between the forked end of the small lever (806) and the disc on top of the needle valve spindle (866) when the Engine is stationary, and when the speed regulator (807) is moved to the left as far down as it will go after slackening off stop screw. (See also page 24.)

This clearance is essential, so as to ensure the needle valve shutting off the supply of fuel to the Engine when the speed becomes excessive.

Fuel Valve Adjustment.-Occasionally the lock nut and adjusting screw of the double offset lever (921) may shake loose. This will cause the fuel valve (863) to remain open

for too short or too long a period. (It will, of course, depend on which way the screw turns after it gets loose.) If the screw turns downwards, it will keep the valve open for too long a period and allow too much fuel to enter the fuel cup (possibly producing a black coloured exhaust, or the Engine will blow fuel out of the air hole and konk). On the other hand, if the screw slackens upwards, not enough fuel will be allowed to enter the Engine; consequently it will lose power. It is very seldom that any adjustment to this part is required, the correct position being that at which only the minimum amount of fuel is taken into the cylinder to do the work required by the Engine.

This position can easily be ascertained by testing the set screw in various different positions while the Engine is working. In each case, however, it is important that the lock nut should be securely locked in position, otherwise the adjustment will vary and cause the Engine to work irregularly.

To ensure best results, the fuel valve should seat on its outer extreme bottom edge only (see diagram page 23) and not for the full depth of the seating.

The copper-asbestos washer makes the joint between the bottom flange of the fuel cup and the machine facing in the cavity of the cylinder head (see diagram, page 23).

Vapourising Housing.-(See diagram on page 23.)-The fuel valve (863) is mechanically operated, and it **is of the utmost importance that this valve should be kept tight and not allowed to leak**. If it leaks, it will be indicated by the kerosene vapour being blown out of the small air hole. (See diagram, page 23.) If this leakage be allowed to continue for any length of time, it will cause:

Loss of power.
Carbonisation of the fuel valve (863).
Finally resulting in stopping the Engine altogether.

The usual cause for this valve leaking is by dirt getting under the seat; hence the necessity for using clean fuel, thoroughly well strained. Or it may be due to the set screw on the double offset lever (921) holding the valve (863) open too long a period.

You can't compress a liquid, so don't. try to start your engine with an excess of fuel in the combustion chamber; it may cause a breakage.

VAPOURISING HOUSING.

Remedy for Leaky Fuel Valve.-If a leak should occur, turn the fuel valve (863) a few times on it's seating. This can be done while the Engine is working, or alternatively press the valve open momentarily while the Engine is working, and the probabilities are the grit will be dislodged from the valve seat. If either of these remedies fails to overcome the difficulty, it will be advisable to stop the Engine at the first opportunity, and then proceed as follows:-

Disconnect fuel pipe connections at tank.
Remove double offset lever (921).
Disconnect top end of governor control link (805).
Screw off the two nuts which hold the vapourising housing in position. The complete housing (860) and fuel cup (862) can now be lifted out of the cylinder head.

The fuel cup (862) sometimes remains in the cylinder head after the vapourising housing has been withdrawn. Should this occur, replace the housing, screw both of the ½ in. nuts about half way down, turn the Engine round against the compression, and the air pressure inside the cylinder will then lift the fuel cup off the C/A washer, enabling it to be lifted out in the usual manner.

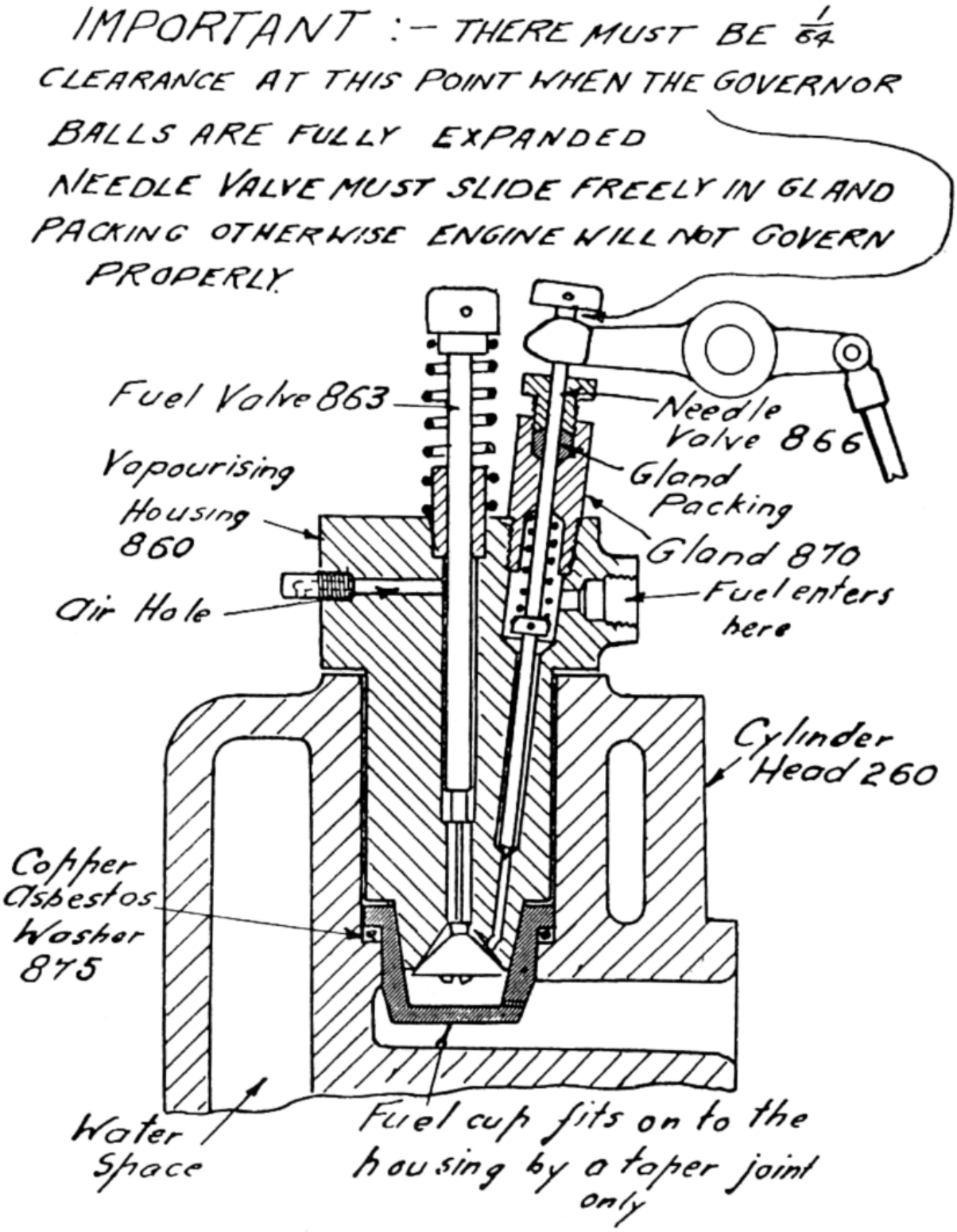
Occasionally the fuel cup (862) remains tightly fixed on the lower end of the vapourising housing (860). To remove the cup, hold the housing in one hand and gently hit the side of the fuel cup with a wooden hammer; it will then drop off easily without being marked, distorted, or damaged in any way.

Having now removed the complete housing and fuel cup, dissemble it (carefully noting the relation of the various parts), wash thoroughly in kerosene, remove all traces of carbon, also making sure that the small jet holes and passages are thoroughly clean and unobstructed. If necessary, lightly regrind the valve with ordinary knife polish-being very careful to thoroughly remove all traces of the emery before replacing the parts together.

The fuel cup makes a gas-tight joint to the housing by

VAPOURISING HOUSING-*Continued.*

Section View of the Vapourising Housing used on Imperial "Super-Diesel" Oil Engines.



The small holes in the fuel cup must always point towards the piston.

means of a tapered joint (see diagram, page 23). This joint may occasionally require to be reground.

Having all the parts thoroughly cleaned, assemble carefully, **making sure the marks on the housing and fuel cup come together, and the small holes in the fuel cup point towards the piston.**

The copper-asbestos washer (875) makes the joint between the bottom flange of the fuel cup (862) and the machined facing in the cavity of the cylinder head (see diagram, page 23).

It is most important that the flat seatings in the cylinder head, fuel cup, and the vapourising housing are thoroughly level and clean.

When replacing the vapourising housing, screw and tighten both nuts evenly.

Governor.-The Governor is of the flyball type mounted direct on the flywheel. It controls the fuel supply by opening or closing the needle valve (866) in the vapourising housing (860) through the medium of a grooved collar (745), levers (800 and 803), side rod (301), connecting link (805) and lever (806).

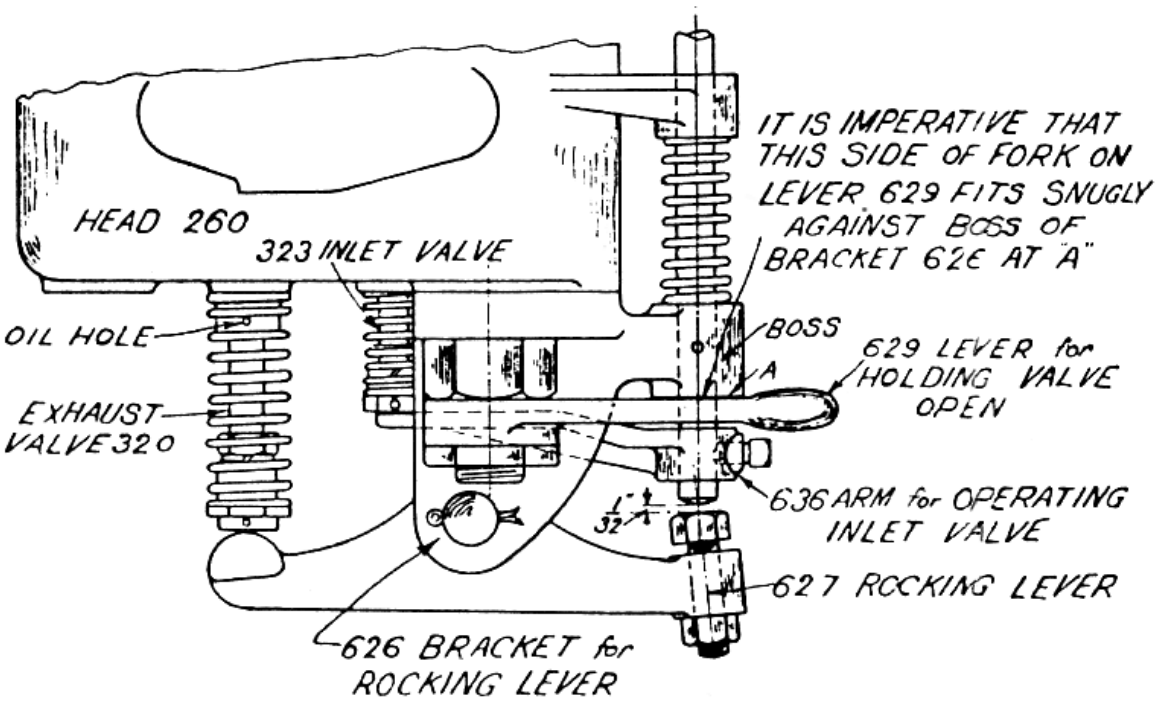
To Set Governor to Govern Properly.-For the Governor to govern properly there should be at least 1/64 in. (see arrow at right hand top corner of diagram, page 23) clearance between the top of the small forked lever (806) and the underneath face of the cap (868) which is fixed at the top of the needle valve (866) when the balls are fully expanded. To get this position with the engine stationary slacken off stop screw on brackets' (873) and push governor control lever (807) to the left as far as it will go. There should be 1/64 in. clearance showing between the lever (806) and cap of needle valve (866); if not, slacken off square head screw in lever (803) on side shaft (801), and shift lever (806) till it shows 1/64 in. clearance (**this clearance is positively essential so as to ensure the needle valve shutting on the supply of fuel to the Engine when the speed becomes excessive**), then securely tighten up screw (803).

GOVERNOR.

To set slow-running position, start engine in the usual manner, and then shift speed regulator lever (807) to the left slowly till the Engine will run slowly, then screw up stop screw to meet lever (807), and lock the nut against bracket.

To make the Engine run faster, tighten up both of the adjusting nuts which regulate the tension of the springs on both of the governor weights. If a slower speed is desired, decrease the tension on bath springs by unscrewing both nuts evenly.

Excessive Speed.-Excessive speed is distinctly **harmful, and the best Engine made will not long withstand the strain of unreasonable driving; fast running, in addition to shortening the life of the machine, is dangerous. Never allow the Engine to race; WHENEVER THE LOAD IS THROWN OFF. ALWAYS REDUCE THE ENGINE SPEED TO THE MINIMUM.**



To Adjust Arm 636 to Operate Inlet Valve (see above illustration).-Turn the Engine slowly in the usual running direction, until the Exhaust Valve just closes (i.e., when the piston is at the head end of the Engine), lift lever 636, and slide arm along pushrod till it just touches the end of the inlet valve, then tighten the square-headed set screw on arm 636.

DIFFICULT STARTING.

Timing Gear Wheel (680).-If this should be removed, it is most important it should be returned to its original position. To enable this to be done turn flywheels round till the crank pin is up. Place gear into position with the high part of the cam up also. (See illustration, page 26). Then insert stud 681 (do not forget lock washer), then tighten up nut and bend over the "L" washer, so as to stop the nut from coming loose. This nut must be kept tight, otherwise it may become loose and allow the stud to revolve, and possibly cause serious damage to the teeth of the timing wheels, etc.

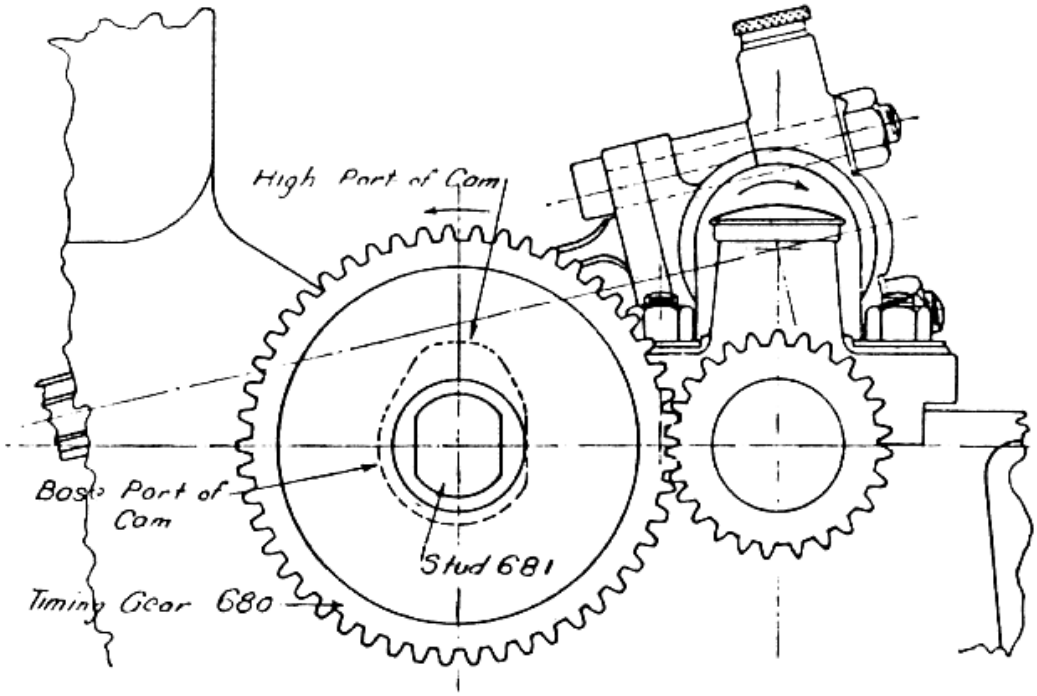


Diagram showing correct timing of S, CC and FF Engines.

Push Rod.-The clearance between the rocking lever and push rod (when the roller is on the base part of the cam) should be 1/32 in.

Springs.-See that all springs have sufficient strength to perform their respective duties. Examine often the inlet and exhaust valve springs, which are in direct contact with the heat of the Engine. Heat greatly lessens the strength of the springs.

General Working Hints.-Black smoke from the exhaust indicates imperfect combustion, and will cause the exhaust valve to "gum up." It is probably due to:

For best results use only-

MACSDIESEL Cylinder Oil.

DIFFICULT STARTING.

Poor compression. (See note re Piston and Lubrication).
Too much fuel (due to fuel valve opening too much).
(See note re fuel valve adjustment.)
Engine overloaded. (See note re pulleys)

Engine Will Not Pull or Pick Up Speed.-Set screw on double offset lever (921) may have slacked back, thus not letting enough fuel into the fuel cup.

Governor out of adjustment, and so not lifting needle valve.

Piston may lack oil.

Piston rings may be gummy.

Exhaust valve may be closing sluggishly clue to stem being gummy.

Exhaust elbow, pipe or silencer may be choked with carbon.

Difficult starting of the Engine is invariably due to lack of oil on the piston. This might occur through the Engine standing idle for some considerable time.

To rectify, proceed as follows:-

Adjust the oil so that it will flow quickly through the sight feed lubricator (or else remove the lubricator altogether and keep pouring a quantity of oil into the oil pump). Move the plunger backwards and forwards by hand for a few minutes, occasionally slightly revolving the flywheel of the Engine. This will then ensure a good film of oil covering the whole working surface of the piston.

The lubricator can then be replaced and the Engine started in the usual way (to enable Engine to start more readily).

Heated Bearings.-If the main bearings become heated, it indicates they may be too tightly adjusted, grit may have got into them, the lubrication may be insufficient, or lubricant is of inferior quality.

Never commence to do any work until you have attended to the lubrication and you have plenty of water and fuel in their respective tanks.

You can't compress a liquid. so don't try to start your engine with an excess of fuel in the combustion chamber; it may cause a breakage.

ORDERING PARTS.

Frequently inspect Engine and running gear. See that no unnecessary play exists, and that all bolts and nuts are tight.

Repairs.-Repairs should in every possible case be entrusted to the original manufacturers, as they have the best facilities for doing the work, and (after the owner) are the most interested in keeping the cost of repairs and maintenance at the lowest.

When ordering spare parts, always give:

The Engine No. (stamped on name plate).
Class of Engine (stamped on name plate).
Reference No. (as shown in the Spare Pats List).

All orders for spares and repairs to be sent direct to

A. H. MCDONALD & CO. PTY. LTD.,
566-574 BRIDGE ROAD, RICHMOND, E.1, VIC.,
or Nearest Interstate Branch Office.

Spare Parts.-It is advisable to have the following spare parts on hand:-

Gasket for cylinder head (261).
Asbestos copper washer for vapourising housing (875).
1 spring of each kind fitted.

For work where absolute reliability is desired, in addition to the above, the following should also be on hand in case of emergency:-

1 vapourising housing (Assembly 872).
1 inlet valve (Assembly 323).
1 exhaust valve (Assembly 320).

Always keep spare parts clean and available at a moment's notice. As soon as any spares are used, order others.

When writing to us respecting the Engine, or when ordering parts, kindly give:

ENGINE NUMBER AND CLASS (stamped on name plate on cylinder).
And the **REFERENCE NUMBER** (as shown in the Spare Parts Lists).

All orders for spares and repairs to be sent direct to-
A. H. MCDONALD & CO. PTY. LTD.,
570-4 BRIDGE ROAD, RICHMOND, E.1, VIC.
Or to Interstate Branch Office.

ORDERING PARTS.

When forwarding goods to us, please consign as follows:-

Small Packages (up to 11 lb.).-Send per Parcels Post to 570 Bridge Road, Richmond, E.1, Victoria.

Light Parcels per Passenger Train.-Consign to us at Spencer Street or Flinders Street Railway Station but for quick delivery to 570 Bridge Road, Richmond. E.1, Victoria, ex Suburban delivery from Spencer Street or Flinders Street (as the case may be). Prepay freight and suburban delivery charges. This will ensure prompt delivery to our works.

Heavy Packages per Goods Train.-Consign to us at Spencer Street Goods Yard.

In each instance it is IMPERATIVE TO PROMPTLY ADVISE US of the date of despatch of all packages, **HOW** and **WHERE** consigned.

When ordering goods, always indicate whether we are to despatch per:

Parcel Post

Passenger Train,

Goods Train.

A. H. McDONALD & CO. PTY. LTD..

IMPERIAL ENGINE WORKS.

566-74 BRIDGE ROAD, RICHMOND, E.1, MELB.

(Take Tram in Spencer or Flinders Streets),

And at Brisbane, Sydney, Adelaide, Perth.

When ordering spare parts, always give:-

THE ENGINE NUMBER (stamped on name plate).

CLASS OF ENGINE (stamped on name plate). '

REFERENCE NUMBER (as shown in spare parts list).

Reference Nos. of Component Parts used on S CC & FF types Imperial Super Diesel Engines

Name of Part.	No Used Per Eng.	Reference Nos. S	CC	FF
CYLINDER and BEDPLATE Assembly Includes next 7 items.		A200SA	A200CE	A200FF
Cylinder and Bedplate	1	200SA	200CE	200FF
Cap for Main Bearing	2	203SA	203CE	203FE
Fibre Packings, $\frac{1}{16}$ in. thick	4	217SA	217CB	217FB
Fibre Packings, $\frac{1}{32}$ in. thick	8	217SB	217CC	217FC
Water Tubes	4	262FA	262FA	262FA
Syphon Tube for Oil Well of Cap for Bearing	2	226CB	22603	226CB
Plug for Oil Hole; also used as hook for Spring	1	21OCA	210CA	210CA
Stud (long) for Cylinder Head	1	201SA	201CA	201FA
Stud (short) for Cylinder Head	2	202SA	202CA	202FA
Stud (extra long) for Cylinder Head	1	215SA	215CA	215FA
Splash Guard	1	A206SA	206CC	206FB
Spring Clip for Splash Guard		209SA	-	-
Nut for Centering Lever	1	212SA	212CA	212FA
Brasses for Main Bearings (2 halves)	2	213SA	213CB	20SFB
Faced Nut for Cylinder Head	1	218SA	2lSCA	218FA
Trimming for Oil Well	2	227CA	227CA	227CA
Cover for Oil Well	2	229CA	229CA	229CA
Drain Pipe for Crankcase	1	267DA	267DA	267DA
Cap for Drain Pipe	1	228CA	228CA	228CA
Lock Washer for Main Bearing Bolts	4	230CA	230CA	453CA
HEAD for CYLINDER Assembly, with Guides only Include next 4 items.		A26OSA	A260CD	A260FC
Head for Cylinder	1	260SA	260CD	260FC
Guide for Exhaust Valve	1	328CB	328CB	328CB
Guide for Inlet Valve	1	329CB	329CB	329CB
Sealing Disc	2	265PA	265CA	265CA
Gasket and Rubber Rings for Head	1	261SA	261CB	261FA
HEAD for CYLINDER Assembly, with Valves Includes items in this section marked thus *.	1	A264S	A264CD	A264FC

SPARE PARTS-*Continued*.

Name of Part.	No Used Per Eng.	Reference Nos. S	CC	FF
Head for Cylinder Assembly, with Guides only		A260SA*	A260CD*	A260FC*
EXHAUST VALVE Assembly Includes next 4 items, C. & F. only.	1	-	A320CB*	A320FB*
Exhaust Valve	1	320SA*	320CB	320FR
Exhaust Valve Spring	1	321CA*	321CA	321FA
Cap for end of Exhaust Valve	1	-	322CB	322CB
Lock Nut for Valve Stem	1	-	327CB	327CB
INLET VALVE Assembly includes next 4 items, C. & F. only.	1	-	A323CB*	A323FB*
Inlet Valve		323SA*	323CB	323FB
Spring for Inlet Valve	1	324SA*	324CA	324FA
Cap for end of Inlet Valve		325CB	325CB	
Lock Nut for Valve Stern	1	-	327CB	327CB
Cup for Valve Spring	2	322SA*	-	-
Cotter for Valve	2	338SA*	-	-
PISTON Assembly Includes next 4 items.	1	A38OSA	A38OCB	A38OFB
Piston	1	380SA	38OCB	380FB
Gudgeon Pin	1	381SA	381CB	381FB
Piston Rings (4 only on S. type)	5	382SA	382CA	382FA
Washer for end of Gudgeon Pin	2	385SA	385CA	385FA
Fibre Washer for Gudgeon Pin		386SA	386CA	386FA
CONNECTING ROD (Complete) Assembly Includes items in this section marked thus *.	1	A455SA	A455CB	A455FB
Connecting Rod with small end bush only Includes next item.	1	A440SA*	A440CA*	A440FA*
Bush for Small End	1	441SA	441CA	441FA
BIG END BRASSES Assembly Includes next s items	1	A442SA*	A442CB*	A442FB*
Big End Brasses (2 halves)	1	442SA	442CB	441FB
Cap for Oil Box on Big End Cap	1	451CA	451CA	451CA
Leather Washer for Cap	1	452CA	452CA	452CA
Felt Pad for Big End	1	453SA	453(JA	453CA
Wick tar Oiler	1	454CA	454CA	454CA
Syphon Tube for Oil Box	1	459CA	459CA	459CA
BOLT for BIG END Assembly Includes next 2 items.	2	A444SA*	A444CB*	A444FB*
Bolt for Big End		444SA	444CB	444FB
Lock Washer	2	230CA	458CA	458FA
Nut for Bolt	2	459SA	⅝ h.f. Nut	¾ h.f. Nut
Packing for Varying Compression	1to3	445SA*	445CA*	445FA*

SPARE PARTS-*Continued.*

Name of Part.	No Used Per Eng.	Reference Nos. S	CC	FF
CRANKSHAFT Assembly Includes next 3 items.	1	A500SA	A500CC	A500FC
Crankshaft	1	500SA	500FC	500FC
Crankshaft Pinion	1	501SA	501CB	501FB
Crankshaft Pinion Key	1	$\frac{7}{8}x\frac{3}{16}$	50AG	50AG
Flywheel Starting side	1	560SA	560CC	560FB
Flywheel, Pulley, and Governor side	1	564SA	564CC	564FC
Bolt for clamping Flywheel Boss	2	-	578CA	$\frac{3}{4}x8$ Eng Bolt.
Starting Handle (in rim of wheel)	1	562CA	562CA	-
Rivet for Handle (in rim of wheel)	1	576SA	576CA	-
STARTING HANDLE Assembly, loose Handle type Includes next 3 Items.	1	-	A588CA	A562FA
Lever for Starting Handle	1	-	574CA	562FA
Starting Handle Sleeve	1	-	563FA	563CA
Stud for Starting Handle Sleeve	1	-	565FA	565FA
Extension for Crankshaft for Starting Handle, to fit inside Pulley	1	-	573CA	586FA
Extension for Crankshaft for Starting Handle for Foot Path Roller	1	-	-	584FA
Key for Flywheel	2	$\frac{1}{2}x\frac{3}{8}x3\frac{1}{2}$	$\frac{1}{2}x\frac{3}{8}x3\frac{1}{2}$	$\frac{5}{8}x\frac{3}{8}x4$
Stud for Belt Pulley	2	$3-\frac{3}{8}x1\frac{1}{2}$	$3-\frac{3}{8}x1\frac{1}{2}$	$6-\frac{3}{8}x1\frac{1}{2}$
PUSH ROD FORK Assembly Includes next 2 items.	1	-	A620FC	A620FC
Push Rod Fork (circular type)	1	-	620FC	620FC
Roller for Fork	1	623SA	623FA	623FA
Rod for Push Rod	1	62ISA	621CC	621FC
Rod for Push Rad Key	1	-	777S	777S
Guide for Push Rod	1	622SB	622FC	622FC
Roller Pin	1	624SA	-	-
Spring for Push Rod	1	625SA	625CA	625FA
ROCKING LEVER BRACKET Assembly Include next 3 items.	1	A635SA	A635CB	A635FB
Rocking Lever Bracket	1	626SA	626CA	626FA
Rocking Lever Pin	1	628SA	628CA	628CA
ROCKING LEVER Assembly Includes next 2 items	1	A627SA	A627CB	A627FB
Rocking Lever	1	627SA	627CB	627FB

SPARE PARTS-*Continued.*

Name of Part.	No Used Per Eng.	Reference Nos. S	CC	FF
Rocking Lever Adjusting Screw	1	657CA	657CA	657CA
Lever for holding Valve open	1	629SA	629CB	629FB
Arm for operating Inlet Valve Assembly Includes next 2 items. S type only.	1	A636SA	636CA	636FA
Arm for operating Inlet Valve		636S	-	-
Boss		803CA	-	-
TIMING GEAR and CAM	1	680SA	680CC	680FC
STUD for TIMING GEAR Assembly Includes next 3 items.	1	A681SA	A681CC	A681FC
Stud for Timing Gear	1	681SA	681CC	681FC
Lock Washer	1	458FA	458FA	458FA
Nut for Stud	1	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
Guard for Timing Gear	1	682SB	682CB	682FB
GOVERNOR BRACKET and WEIGHT Assembly Includes items in this section marked thus *.	2	A746SA	A746CA	A746CA
Governor Bracket and Pin only Assembly Includes next 2 items.	2	A740CA*	A740CA*	A740CA*
Governor Bracket	1	740CA	740CA	740CA
Pin for Governor Weights	1	744CA	744CA	744CA
Governor Weight	1	741CA*	741CA*	741CA*
Adjusting Screw for Spring	1	743CA*	743CA*	743CA*
Spring for Governor Weight	1	528N*	151T*	151T*
GROOVED COLLAR on CRANKSHAFT Assembly Includes next 2 items.	1	745SA	A745CA	A745FA
Grooved Collar	1	-	745CA	'HSFA
Pin for Grooved Collar	2	-	755CA	755CA
Lever for Side Rod Crankshaft end	1	800CA	800CB	800CB
Shoe Piece for Lever Crankshaft end	1	-	800CC	800CC
Side Rod for Governor Control	1	801SA	801CB	BOIFB
Bearing Bracket for Side Rod	2	802SA	802CB	802CB
Spherical Bearing for 302	2	-	812CA	812CA
Lever for Side Rod (Head end)	1	803CA	803CB	803CB
Link for Governor Control Assembly Include next 4 items.	1	A805SA	A805CC	A805FC
Link for Governor Control	1	805SA	805CC	805FC
Jaw End for Link	2	826CB	826CB	826CB
Lock Nut for Jaw End	2	828CA	828CA	828CA
Pin for Jaw End	2	827CB	827CB	827(ZB

SPARE PARTS-*Continued.*

Name of Part.	No Used Per Eng.	Reference Nos. S	CC	FF
GOVERNOR REGULATOR BRACKET Assembly (Ratchet Type) Includes next 8 Items.	1	-	A810CB	A810CB
Bracket on Vapourising Housing for Levers with Ratchet	1	-	873CA	873CA
Forked Lever for lifting Needle Valve	1	-	806FA	806FA
Lever for altering speed of Engine (plain hole)	1	-	807FB	807FB
Stud for Levers	1	808FA	808FA	808FA
Plunger for Lever for altering speed	1	-	809FB	809FB
Spring for Plunger	1	-	812FA	812FA
Double Offset Lever	1	-	921CB	921CB
Stud for Double Offset Lever	1	-	922CB	922CB
GOVERNOR REGULATOR BRACKET Assembly, without Ratchet Includes next 7 Items.	1	A810CC	A810CC	A810CC
Bracket on Vapourising Housing for Levers without Ratchet	1	873CB	873CB	873CB
Forked Lever for lifting Needle Valve	1	806FA	806FA	806FA
Lever for altering speed (tapped hole)	1	807FC	807FC	807FC
Stud for Levers	1	808FA	808FA	808FA
Adjusting Screw for Lever 807FC	1	809FC	809FC	809FC
Double Offset Lever	1	921CB	921CB	921CB
Stud for Double Offset Lever	1	922CB	922CB	922CB
Arm on Push Rod for Offset Lever	1	920CA	920CA	920CA
VAPOURISING HOUSING Assembly Includes items in this section marked thus *.	1	A872CB	A872CB	A872FB
FUEL VALVE Assembly Includes next 3 items.	1	A863CA*	A363CA*	A863CA*
Fuel Valve	1	863CA	863CA	863CA
Cap for Fuel Valve	1	865CA	865CA	865CA
Spring for Fuel Valve	1	864CA	864CA	864CA
NEEDLE VALVE Assembly Includes next 6 items.	1	A866CA*	A866CA*	A866CA*
Needle Valve	1	866CA	866CA	866CA
Collar for Needle Valve	1	867CA	867CA	867CA

SPARE PARTS-*Continued.*

Name of Part.	No Used Per Eng.	Reference Nos. S	CC	FF
Cap for Needle Valve	1	868CA	868CA	868CA
Spring for Needle Valve	1	869CA	869CA	869CA
Gland for Needle Valve	1	870CA	870CA	870CA
Nut for Gland	1	871CA	871CA	871CA
Vapourising Housing	1	860CB*	860CB*	860CB*
Guide Collar for Fuel Valve	1	861CA*	861CA*	861CA*
Fuel Cup	1	862CA*	862CA*	862CA*
Elbow for Air Hole	1	876CA*	876CA*	876CA*
Copper Asbestos Washer	1	875CA*	875CA*	875CA*
FUKL TANK (SINGLE) Complete Assembly Includes items in this section marked thus *	1	A980SR	A980CB	A980FB
Fuel Tank Assembly with fixed fittings Includes next 5 items	1	A980SA*	A980CA*	A980FA*
Fuel Tank	1	980S	980C	980F
Ring for Filler Cap	1	986FC	986FC	986FC
Fuel Cock Single	1	998FA	998FA	998FA
Guide Tube	1	997FA	997FA	997FA
Tank Brackets	2	893SA	-	-
NEEDLE VALVE Assembly Includes next 2 items	1	A1007CA*	A1007CA*	A993FA*
Needle Valve	1	1007SA	1007CA	1007FA
Cap for Needle Valve	1	994FA	994FA	994FA
Spring for Needle	1	995FA*	995FA*	995FA*
Washer for Screw in Fuel Cock	1	1033FA*	1033FA*	1033FA*
Filler Cap (Push-on type)	1	229CA*	229CA*	229CA*
Strainer	1	987FB*	987FB*	987FB*
FUEL TANK (DOUBLE) Complete Assembly Includes items in this section marked thus *.	1	A987SB	A987CB	A982FB
Fuel Tank Assembly with fixed fittings Includes next 5 items	1	A987SA*	A987CA*	A982FA
Fuel Tank	1	987S	987C	987F
Ring for Filler Cap	2	986FC	986FC	986FC
Double Fuel Cock	1	992FA	992FA	992FA
Guide Tube	2	997FA	997FA	997FA
Tank Brackets	2	983SB	-	-
NEEDLE VAVLE Assembly Includes next 2 items	2	A1007SA*	A1007CA*	A1007FA*
Needle Valve	2	1007SA	1007CA	993FA
Cap for Needle	2	994FA	994FA	994FA
Spring for Needle Valve	2	995FA*	995FA*	995FA*
Washer for Screw in Fuel Cock	1	1033FA*	1033FA*	1033FA*

SPARE PARTS-*Continued.*

Name of Part.	No Used Per Eng.	Reference Nos. S	CC	FF
Filler Cap	2	229CA*	229CA*	229CA*
Strainer	2	987FB*	987FB*	987F8*
Band for Fuel Tank	2	-	983CB	983FB
FUEL PIPING Assembly Includes next 3 items.	1	A981SA	A981CB	981FB
Fuel Pipe	1	981SA	981CB	981FB
Gland Nut	2	982CA	982CA	982CA
Ferrule	2	982CC	982CC	982CC
OIL PUMP Assembly Includes next 5 items.	1	A995CD	A995CD	A995CD
Body for Oil Pump	1	989CD	989CD	989CD
Plunger for Pump	1	990CC	99OCC	990CC
Gland Nut for Pump	1	1022CB	1022CB	1022CB
Packing Washers for Pump	1	1023CA	1023CA	1023CA
Stepped Bush	1	992C	992C	992C
Sight Feed Lubricator	1	No. 2	NO. 2	No 3
OIL PIPE Assembly Includes next 3 items.	1	A996SA	A996CA	A996FA
Oil Pipe	1	996SA	996CA	996FA
Gland Nut	2	982CA	982CA	982CA
Ferrule	2	982CC	982CC	982CC
Arm on Push Rod for Oil Pump	1	991CB	991CB	991CB
Box Spanner for Nuts holding Cylinder Head	1	999S	999CB	999FB
Tommy Bar for Box Spanner	1	-	999CC	999CC
$\frac{1}{2}$ Open End and $\frac{3}{8}$ Box Spanner	1	577C	577C	577C
Valve Grinding Tool	1	1004C	1004C	1004C
SILENCER (without Flange) Assembly Includes next 2 items.	1	A1044SA	A163AA	A1044FA
Main Casting of Silencer	1	1044SA	163AA	1044FA
Cover for Silencer	1	163AB	163AB	1043FA
Elbow for Exhaust Pipe	1	1041SA	1042CA	1041FA
Flange for Exhaust Pipe	1	-	1043CA	1053JA
Gasket for Elbow or Flange	1	-	1045CA	1045FA
Pipe for Air Intake	1	1042SA	1042CA	1042FA
Stay for Exhaust Pipe off Hopper	1	1047SA	1047CA	1047FA
Exhaust Pipe, 6' long (Supplied In 2 pieces when Engine is cased)	1	1122SA	1122CA	1122FA

INSTRUCTIONS for Fitting PISTON RINGS

As Manufacturers, we are surprised at the lack of knowledge displayed by so-called “experts” and “mechanics” in not understanding the fundamental principles necessary to ensure maximum efficiency in the fitting and renewal of Piston Rings.

To enable the Makers to supply slightly “oversize” PISTON RINGS for Cylinders of Engines, which have been in use for some considerable time, it is desirable that a “PIN GAUGE” be made which will measure the exact diameter of the cylinder (at THE CRANKSHAFT END).

Also the “gluts” will be worn tapered and the piston will require to be put in a lathe, and the gluts “trued up” to uniform width, in which case RINGS of “OVERSIZE” WIDTH WILL BE REQUIRED.

In some instances, we have known the gluts to be worn tapered but INSTEAD OF CHUCKING the Piston in a LATHE, and re-turning the gluts, so as to make the SIDES PERFECTLY PARALLEL, and thus enable the new Piston ring to make a proper “gas-tight” joint, the mechanic has just fitted the new Rings into the old “worn” gluts, and there is no possible chance of the Rings functioning Properly, or being of any value WHATEVER.

To make a PIN GAUGE, take a short piece of straight fencing wire, slightly longer than the diameter of the cylinder. Sharpen it at EACH end (the same as you would sharpen a lead pencil), then FILE it to the exact length and nicely rounded on the extreme ends, so that it represents the diameter of the Cylinder, nearest the crankshaft. If, in the process, the Gauge is made too short, it can be lengthened slightly by placing it on a hard metal surface, and hammering it in the centre portion of the wire.

TO MAKE A WIDTH GAUGE.- Take a piece of Sheet Iron, or Tin about 1 inch long and a little

wider than the ring. File it to Fat tightly into the widest part of the glut. This, together with the pin gauge should be posted to us and we will send the nearest over size rings.

On receipt of the rings, the WORK OF WIDENING the GLUTS to suit the Rings can be proceeded with.

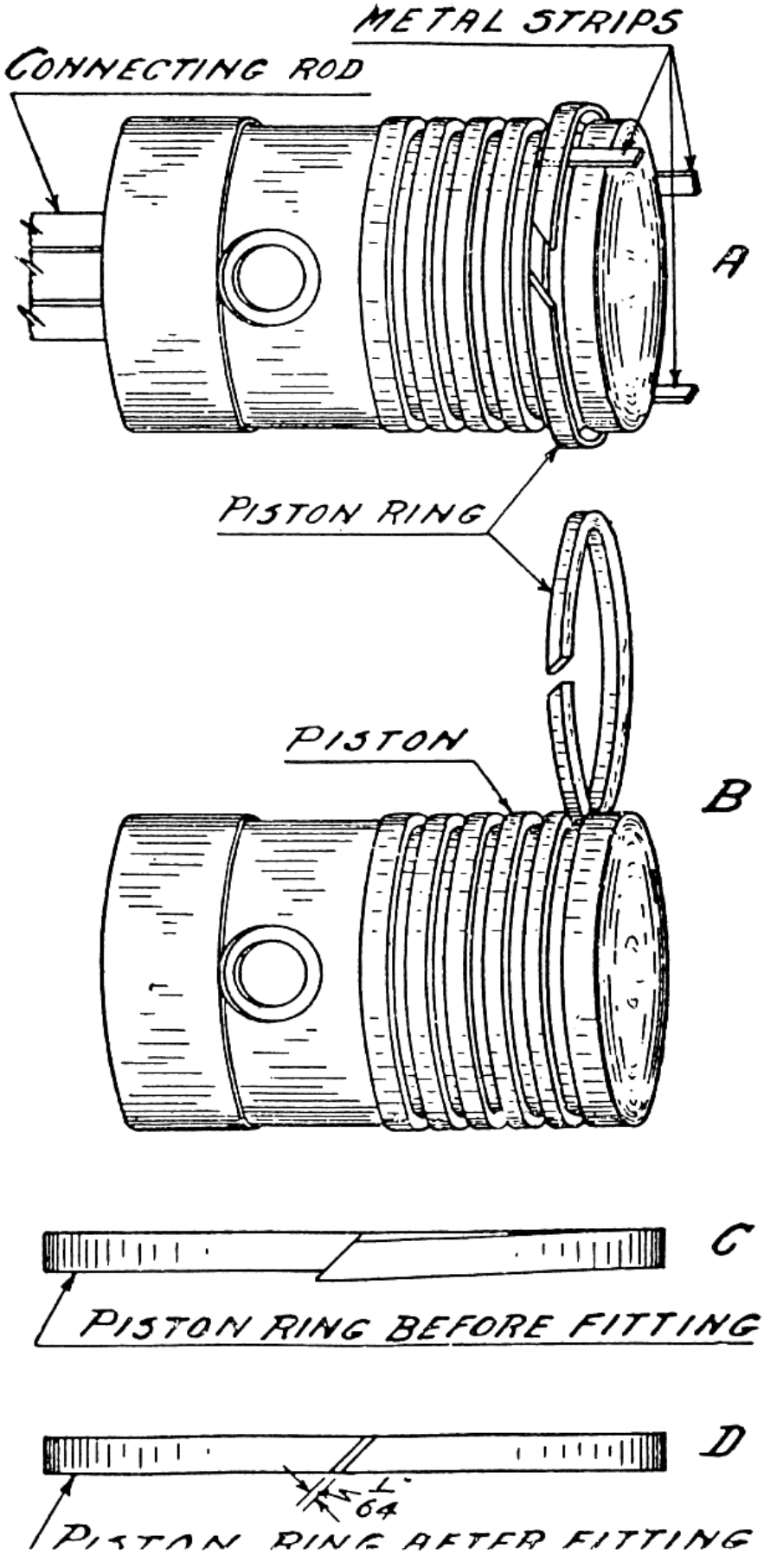
l. The ring you decide to replace should be taken out of the groove and all carbon deposits removed. (Do not remove the other rings or remove the carbon deposits).

2. To remove the ring, procure 3 strips of thin sheet iron about $\frac{1}{4}$ in. wide by 6 in. long. Expand the top ring at the joint and insert the strips at equal distant points around the piston, so that the strips come between the underneath side of the ring and the outside of the piston. The ring can then be easily and safely slid off the piston. See illustration “A.”

3. It is also wise to carefully scrape away the shoulder at the head of the cylinder (formed by wear), in the bare of the cylinder walls, and it this wear is excessive, always fit the new ring from this end of the cylinder, because this is the portion of the cylinder which becomes enlarge through the natural wear of the Piston and rings on the cylinder walls.

4. The ring must be the exact width so that it will be a neat fit and yet free to expand. If the ring is “tight” in the groove, it can easily be reduced by rubbing it on a sheet of emery cloth placed on a perfectly flat surface. (It is just as well to mention that there is no need to slip the ring over the piston, as the width of the ring can be tested by inserting it in the slot and revolving both Piston and ring so as to ensure that there are no tight spots either in the groove or through the width of the ring varying at different points). See illustration “B.”

5. Having thus fitted the ring to t:.e groove in the piston, take the ring and push it into the mouth at the Cylinder a distance of about 2 inches, making sure


METAL STRIPS
CONNECTING ROD
A
PISTON RING
PISTON
B
C
PISTON RING BEFORE FITTING
D
1/64
PISTON RING AFTER FITTING

that the outside of the ring lies flat against the cylinder. If the ring is not the correct dia, but slightly larger, it will be shown by the sides of the ring at the joint not being EXACTLY PARALLEL with each other. See illustration “C.” Remove the ring, place it in a vise, carefully file off sufficient metal so that when the ring is again tried in the cylinder both ends of the ring will be exactly parallel, and the space between the slots will allow just sufficient room for expansion by heat, viz., l-64th inch. See illustration “D.”

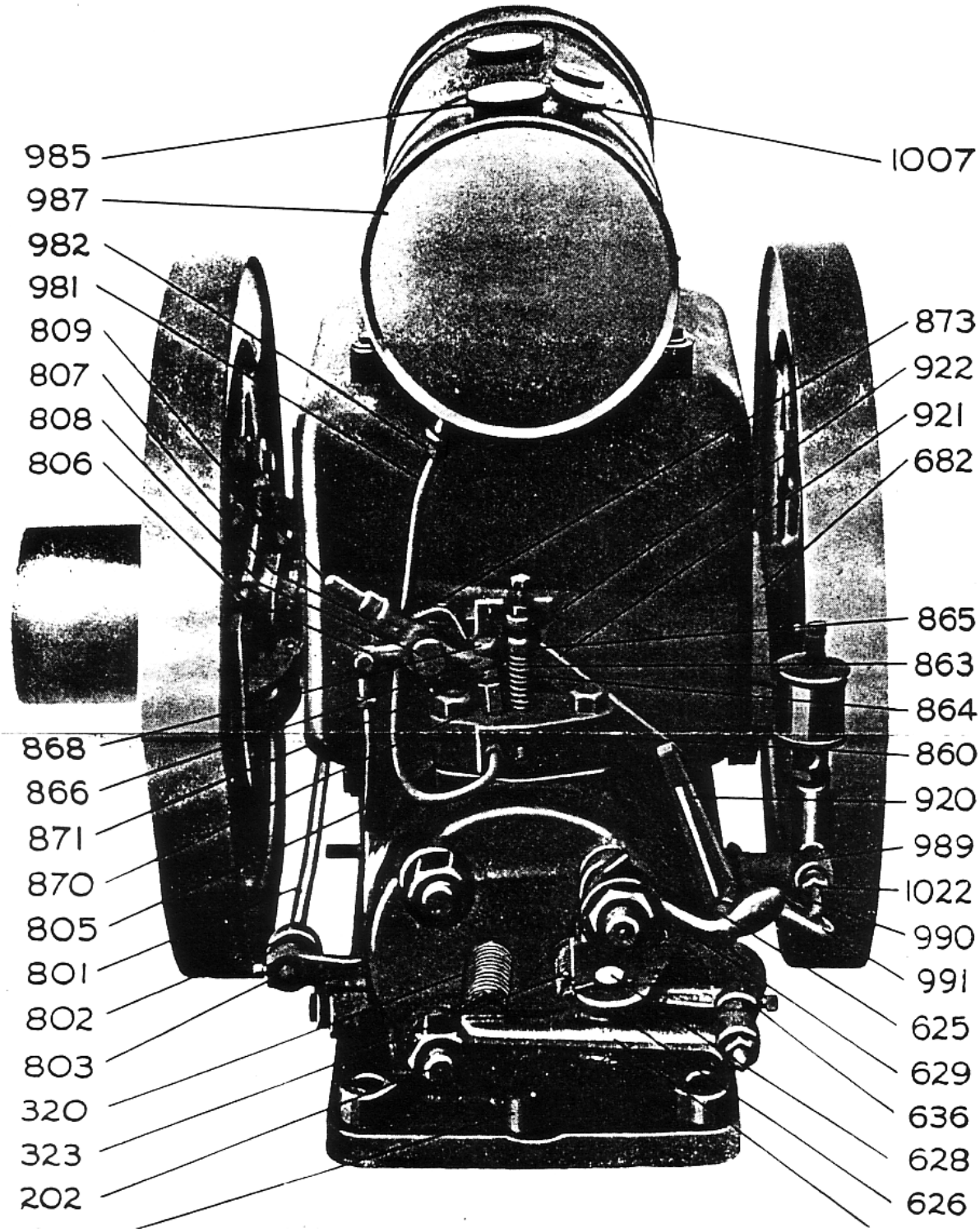
6. All the parts should then be well oiled and the piston replaced. Great care must be exercised when inserting the piston into the cylinder as it is very easy for the rings to be inadvertently warped or broken. Hold the piston dead square with the cylinder and use very gentle pressure, slightly rocking the piston very gently from side to side-the rings will then slip into their places quite comfortably. It is almost unnecessary to add that the Inlet Valve should be open when replacing the piston, also make sure the “big end” bearing is in perfect adjustment and the “big end” nuts are thoroughly tightened. The first nut must be pulled up tight against the brass and the second nut locked against the first nut using two spanners, or, if L washers are fitted, lock the nut by bending one corner of the L washer.

7. When running the engine after having fitted a new piston ring give more than the ordinary amount of lubricant for several days, as it takes from seven to ten days continuous work for a NEW RING TO BECOME THOROUGHLY POLISHED AND ADAPT ITSELF TO THE CYLINDER.

PISTON RINGS ARE FRAGILE and, therefore, require to be handled very carefully.

The gaps of Piston Rings should be EQUALLY SPACED AROUND THE BOTTOM HALF OF THE PISTON. All parts should be well oiled, including the Cylinder.

Also read directions in Instruction Book, page 15.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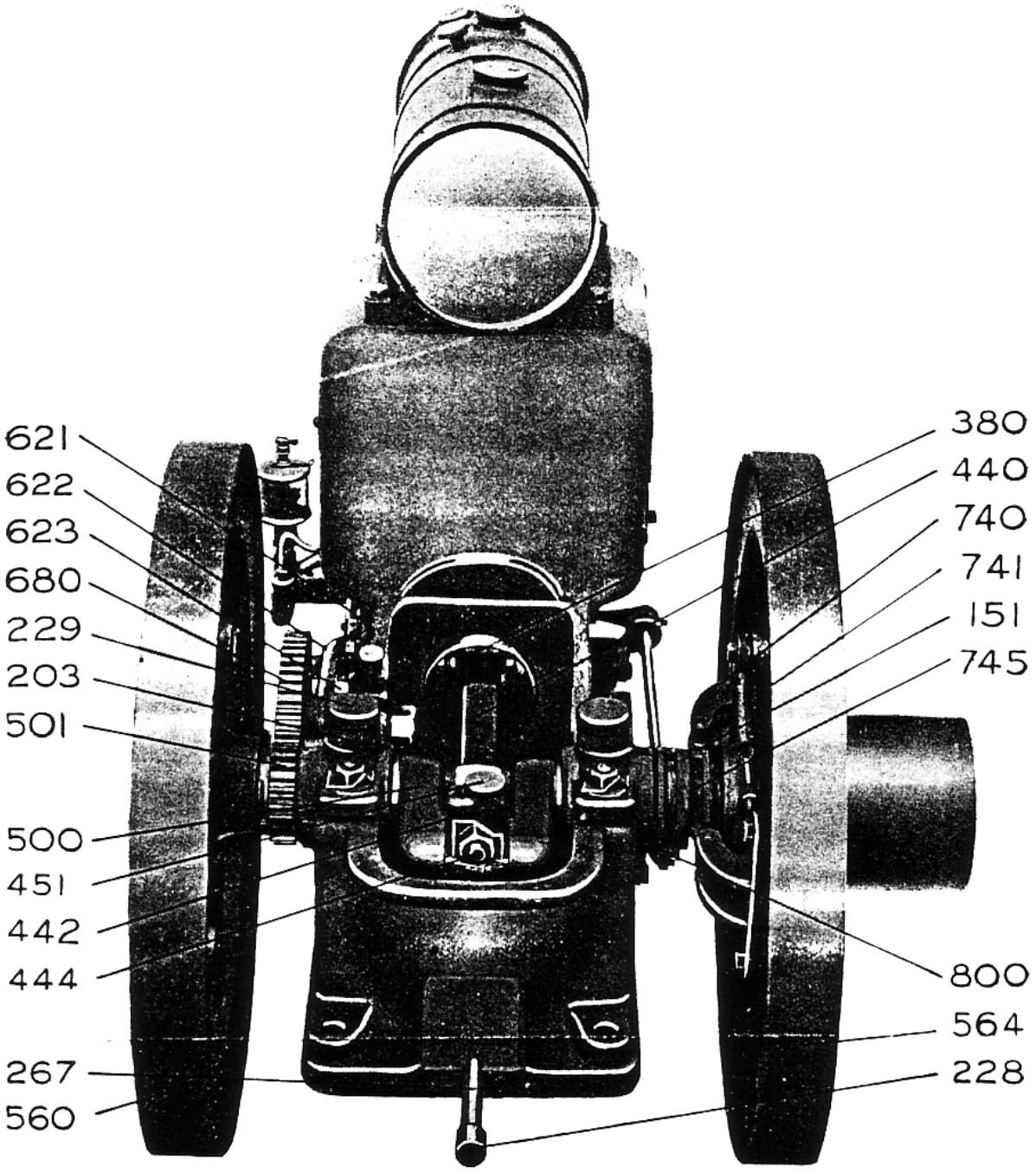
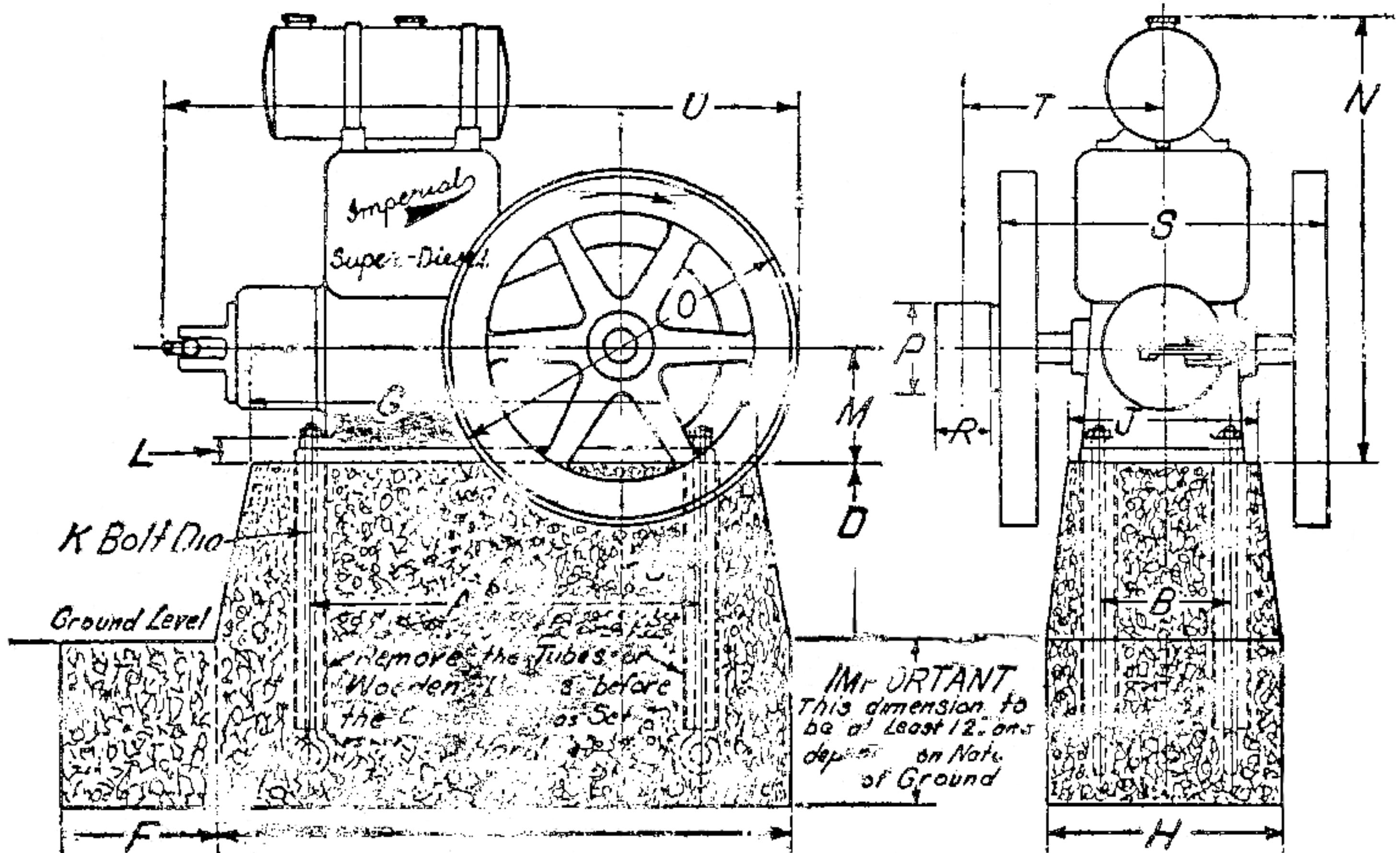


CRANK END VIEW

IMPORTANT NOTE.-These illustrations serve only as a general guide. After finding illustration of a part wanted, order only the corresponding part, giving reference number as shown on pages Nos. 31 to 36. Always give Engine No. and Type (viz., S, CC or FF) when ordering Spare Parts.



TYPE	A	B	C	D	E	[illegible]	G	H	J	K	L	M	N	O	P	R	S	T	U
S	21¼	8"	[illegible]	12"	[illegible]	[illegible]	25¼	15½	12"	½"	1½"	6"	19"	18"	5	3"	18½"	12¼"	34"
C	26¼	9"	5¼	12	30½	18	30¾	16½	13"	½"	2"	7½"	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F	33	[illegible]	2¼	12	45½	18	37½"	19½"	[illegible]	⅝"	2¼	9½	37½"	30"	8"	3½"	25½"	16½"	50¾

Foundation Dimensions for S, CC and FF Engines