INSTRUCTION BOOK

No. 32A-2

FOR

INSTALLING AND OPERATING

ATLAS IMPERIAL

FOUR CYCLE

MECHANICAL INJECTION

DIESEL ENGINES

DUST PROOF TYPE

PRICE $1.00

ATLAS IMPERIAL DIESEL ENGINE CO.

MAIN OFFICE AND FACTORY

OAKLAND, CALIFORNIA, U. S. A.

Printed in U. S. A.

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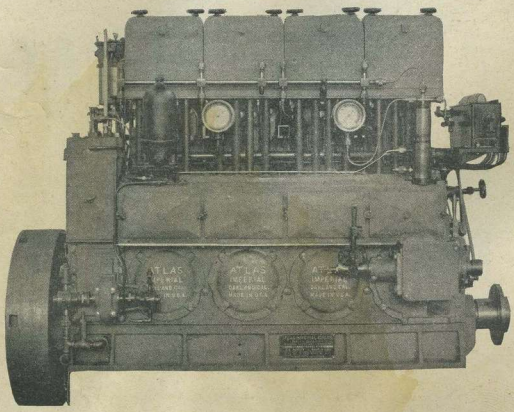


ATLAS IMPERIAL, THE PROVEN DIESEL ENGINE

Some of the Characteristics of Atlas Imperial Mechanical Injection Diesel Engines

TYPE OF FUEL USED:
Diesel Fuel Oil.

INJECTION OF FUEL:
By pressure without the aid of compressed air.

IGNITION:
Accomplished by heat of compression only.

FUEL CONSUMPTION:
Four-tenths pounds per horse-power hour, or about 20 horse-power hours per gallon.

COST OF LUBRICATING OIL FOR 100 H. P., PER HOUR:
Approximately 6c.

COMPRESSION:
375 pounds per square inch.

STARTS:
By compressed air (maximum pressure is 200 pounds) in 20 seconds from stone cold to full load. No priming or pre-heating is required.

SLOW SPEED:
Heavy duty.

APPROXIMATE WEIGHT PER RATED HORSE-POWER:
150 to 170 pounds.

LUBRICATION:
Is by force feed system.

CYLINDERS ARE LUBRICATED:
By means of a mechanical force feed cylinder oiler. Quantity of lubricating oil required, about one gallon in ten hours for each 100 horse-power.

CIRCULATING WATER REQUIRED:
Only one-half of the amount necessary for a heavy duty gas engine of the same power.

GOVERNOR:
The engines govern closely from full load to no load. Governor controls the amount of fuel injected into the cylinder. The speed of the engine can be increased or decreased by use of the control handle.

PRACTICAL CONSTRUCTION:

Simple in construction, all parts easily accessible and all parts as far as possible, interchangeable. Engine can be operated by any ordinary intelligent individual. All parts where practical, are hardened and ground to precision gauges.

ENGINE SPEEDS:

The speed of the engine may be varied from slow to fast and vice versa, to suit the work that is to be performed, in the same manner as an automobile engine is slowed down or speeded up, but the engine should NEVER be allowed to run at an excessive speed as it is essentially a heavy duty engine with heavy reciprocal parts which are not adapted to high speeds, therefore should not be operated above its normal running speed.

ENGINE FUEL:

Is pumped through a small steel tube that leads to the spray valves in the cylinder heads. This pump is a simple plunger pump driven from off of the cam shaft. The excessive amount of fuel which is pumped into the fuel line is by-passed back to the supply tank through a relief valve set at the proper pressure adjustment.

GOVERNING:

Is by regulating the length of time the spray valve is kept open. This is accomplished by a sensitive gear-driven flyball governor which functions by regulating the duration of the spray valve opening, as well as the amount which the spray valve is being lifed. Attached to the governor is a speed regulating device whereby the speed of the engine may be altered by the operator to suit requirements. This governor is very quick in action and responds immediately when loads are suddenly applied or released.

Explanation of the Diesel Principle

FACTS:

1. Air becomes hot by being compressed. The degree of heat depends on the amount of compression.
2. Three hundred and seventy-five pounds compression creates sufficient heat to ignite fuel oil when properly sprayed into the compression chamber at the proper time.
3. Fuel oil, if sufficiently atomized, will ignite when injected into a cylinder of compressed air, the temperature of which has been raised above the fire test of the fuel by means of compression.
4. The expansion of the burning fuel oil is the power-creating force within the cylinder of the engine.

The Diesel engine differs from a gas engine from the fact that it is a constant pressure engine. That is, the injection of fuel into the cylinder is timed and controlled to maintain constant pressure during its introduction, while in a gas engine a constant volume of mixture is taken into the cylinder and after compressing same to a safe limit (about 50 pounds) the mixture is ignited by some auxiliary mechanism and the pressure instantly rises in the nature of an exploson to a degree depending on the volume of the mixture.

While the terminal pressures are about the same in both types of engines, the efficiency of the Diesel is twice that of the gas engine, due to compressing the air to a high temperature before injecting the fuel, then controlling this injection so that combustion continues for a predetermined time, varying with the load.

This process enables the Diesel engine to maintain a much higher mean effective pressure with a corresponding greater horse-power for the same cylinder dimensions.

In order to obtain perfect combustion within the cylinder it is necessary to inject the fuel oil in the form of a very fine spray which is done by the specially designed spray nozzle.

By understanding these fundamental requirements of a Diesel engine it is readily seen that the mechanical injection Diesel engine is very simple and not a complicated mass of machinery.

CYCLE:

Atlas-Imperial Diesel engines operate on the four-cycle principle. The four cycle implies that the work in the cylinder is accomplished in four strokes of the piston, or two revolutions of the engine.

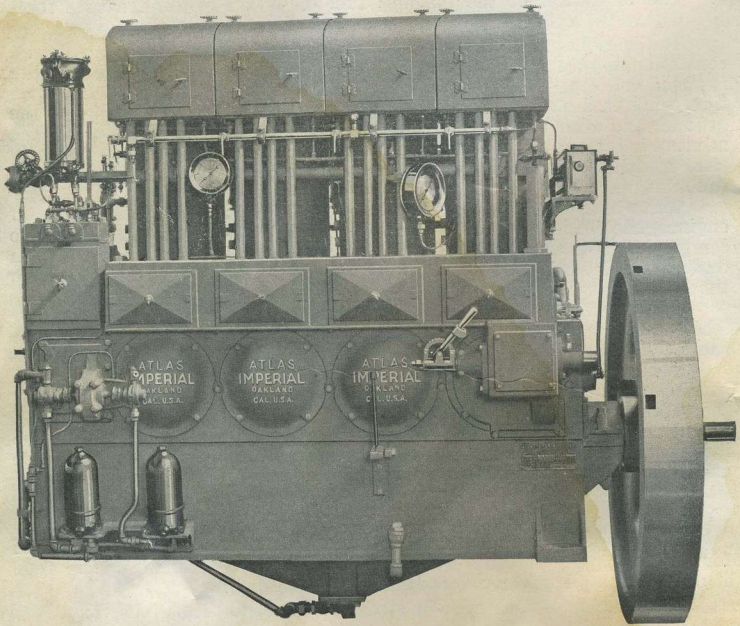
The function of each cycle or stroke of the piston is as follows:

1. INTAKE:

When the piston goes down on the intake stroke, the intake valve being open, the cylinder becomes filled with air from the atmosphere.

2. COMPRESSION STROKE:

On the upward stroke of the piston, the inlet valve is closed and the air in the cylinder is compressed to about 375 pounds pressure per square inch. At this pressure (as explained before) the temperature of the compressed air is raised sufficiently to ignite the fuel. A few degrees before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the piston reaches the top of the compression stroke the fuel spray valve is opened by a cam and the fuel sprayed into the heated air. A constant pressure of fuel oil is maintained in the spray nozzles at all times by means of small plunger pumps which are more fully described later in the book.

3. **EXPANSION STROKE:**

The fuel oil burning and expanding in the cylinder maintains pressure on the piston during the downward stroke. Near the end of the power stroke the exhaust valve opens and allows the burned gases to escape.

4. **SCAVENGING STROKE:**

As the piston returns to the top of the cylinder with the exhaust valve open, the piston pushes all the burned gases out of the cylinder through the exhaust valve. When the piston has reached the top the exhaust valve is closed and the intake valve again is opened.

This completes the four cycles or four strokes of the MECHANICAL INJECTION DIESEL engine and describes the method of its functioning.

COMMENT:

It will be noted that while the sequence of the strokes forming this cycle is similar to that of the gas engine, the functions performed during the cycle (except on the exhaust stroke) are materially different.

On the first stroke, by taking into the cylinder pure air only, we are enabled to compress this charge sufficiently to secure a very high temperature, which would be impossible with a charge of gas mixture, because of liability to preignition.

This high temperature secured allows the use of a cheap, low grade fuel oil of high fire test which is safe to handle and increases both the thermal and commercial efficiency of the engine.

On the third stroke the fuel is introduced under absolute control, as to timing and quantity, the constant pressure in the column of fuel oil being sufficient so that when the valve opens the fuel is completely atomized and ready for instant firing at the moment it reaches the heated interior of the cylinder, and we reiterate, no high pressure air is used to force this fuel oil into the cylinder.

With some methods (not the true solid injection type) fuel is introduced under low pressure into a recessed casting projection into the firing chamber while there is no pressure, and on the up stroke of the piston the pressure increases until sufficient heat is developed to ignite the little cartridge of fuel (previously injected under no pressure) and when it ignites it blows the fuel oil out through small holes provided for that purpose. No control of the exact moment of firing is possible, as in our method where the fuel is mechanically injected into the cylinder at the proper time.

As stated above, this combustion is not in any sense an explosion, but takes place during a well defined, predetermined portion of the power stroke and at constant pressure, and because of the nature of its introduction into the cylinder and the large volume of pure air into which it is forced, the combustion is perfect within the range of cylinder power rating, hence the high thermal efficiency of the Diesel engine on low grade fuel oils.

The foregoing description of the engine is, of course, general in character, intended to cover only the principles around which the physical construction is assembled.

In General

IN issuing this instruction book we have tried to present to the reader the principal points to be observed in the care, operation and maintenance of the Atlas Imperial Diesel engine in a clear and concise manner.

This information is extended not only for use by the operator but also for those responsible for the performance of the engine. It is impractical to cover the exceptional conditions which might occur and therefore we have only covered those with which each operator should be thoroughly familiar.

Along these lines we offer as a satisfactory suggestion: WHEN THE ENGINE IS RUNNING SATISFACTORILY AND SMOOTHLY LEAVE IT ALONE, DO NOT BE CONTINUALLY TRYING TO BETTER THE OPERATION WITH MINOR ADJUSTMENTS.

FIRST: NEVER ALLOW YOUR ENGINE TO SMOKE:

A Diesel engine, oil engine, gas engine, kerosene lamp or a candle perform the same operation, namely: Each burns a certain amount of fuel when mixed with proper proportions of air, and when the proportions are such that there is not enough air for the fuel to burn clean, in other words, too much fuel for the amount of available air—you will have smoke. Whether it be a candle, kerosene lamp, gas engine, oil engine, or diesel engine, smoke indicates that the proportions of air and fuel are not correct. These proportions must be adjusted to a point at which smoke is eliminated—combustion perfect, and the exhaust clear.

In a Diesel engine there are two things that will cause the engine to smoke; first, as above stated, too much fuel for the amount of air; and secondly, not the right distribution of broken up fuel in the combustion chamber. If the spray nozzle should be out of order or partly clogged, the fuel may enter the combustion chamber in a solid liquid form, in which case it does not properly mix with the air in the cylinders and consequently will cause smoke, even if the amount of fuel is not in excess of the amount required to properly mix with the air in the cylinders. When the exhaust from an engine is smoky it clearly indicates that combustion is not perfect and that the residue, in shape of smoke, is clinging to the oily surfaces of the cylinders, pistons, piston rings, valves, etc., and when this happens you are creating trouble for yourself and doing an injustice to the engine. Therefore, the first thing in consideration of the operation of a diesel engine is, NOT TO ALLOW YOUR ENGINE TO SMOKE.

SECOND: DO NOT OVERLOAD YOUR ENGINE:

A Diesel engine is unlike a gas engine in that it can be overloaded. You can continue increasing the power of a Diesel engine to a great extent by admitting too much fuel which increases the heat within the cylinders and increases the pressure in the cylinder. One cannot continually overload an engine any more than you can continually overload any other thing, thinking that you can go on successfully carrying the overload without bad results. Atlas Imperial Diesel engines are of such liberal dimensions that they will pull a considerable overload without smoking; but if one attempts to overload his engine too much it will naturally smoke, and smoke means trouble.

There is no harm in running the engine continually up to its full power as long as its exhaust is clear and combustion perfect. Do not allow spray valves, air starting valves, inlet or exhaust valves to be leaky. If an engine has been allowed to smoke for some time, carbon will be deposited on the valve seats in spots and allow the valves to leak. As soon as a valve is leaky a blast of fire will pass through the leaky valve and start to cut the valve seats or valves, thereby causing much trouble.

THIRD: LUBRICATION:

Any piece of machinery needs proper lubrication and a Diesel engine is not an exception. Always see that lubricating systems are always in proper working order. We have attempted to make the lubricating systems in our engines as near fool proof as possible, but it still remains for human intelligence to watch it from time to time to ascertain that it functions in the way that it should.

Atlas Imperial Diesel engines are lubricated by a dual system; a primary and secondary system. The primary system consists of a mechanical force feed oiler, ratchet drive. New oil is used in this mechanical oiler at all times. There is always a small amount of waste oil from the cylinder lubrication, which after being caught up in the oil tight base, becomes part of the "make up" of the secondary system.

The secondary system supplies oil under pressure to all main bearings, crank bearings and wrist pins. The pressure of the oil is maintained by a lubricating rotary pump, located on the rotary pump door attached to centerframe on the operating side of the engine.

The lubricating oil consumption is a variable factor, depending somewhat on the grade of oil used, but principally on the care given the engine in its operation, ordinarily about 1500 to 2000 horse-power hours per gallon.

CYLINDERS:

Oil is supplied to the cylinder walls by means of the force feed lubricator oiler, through a small pipe connected to the inlet and exhaust side of the cylinder wall. It requires not more than three or four drops of oil to the cylinder wall per minute. It is very important that this lubrication be constant and not vary in any way. This may be detected very readily by counting the drops as they drop past the sight glasses located on top of the oiler and should be checked at regular intervals.

BEARINGS:

The lubrication of the main bearings is accomplished by means of a force feed system, so arranged that the oil is being forced, by means of a pump at a pressure varying from five to ten pounds, according to that which has been regulated by the pressure lubricating oil relief valve. The oil is pumped from the oil reservoir or supply tank through oil pipes in the base to the bottom of the main bearings. This is not done through the top of the bearing caps, thus permitting a simple arrangement of the oil piping and obviating the necessity of breaking the pipe connections, etc. The crank shaft revolving in the main bearing is provided with a hole drilled angular through to the crank pin, through which the oil is forced (by centrifugal force) thereby lubricating the connecting rod bearings or crank pins.

It is important that sufficient oil is always maintained in the oil reservoir to insure the proper function of the pumps so that the oil will circu-

late freely, unhampered by air bubbles and the like. A pressure gauge is connected to the lubricating oil pipe line, which indicates the oil pressure on the bearings at all times. If no pressure is registered on this gauge, it will indicate one of three things: ONE—that there is not sufficient oil in the reservoir; TWO—that the lubricating oil pumps are not functioning properly. THIRD—That some bearing has become sufficiently loose to allow the lubricating oil to flow out too freely.

All the oil pumped through these bearings is collected in the crank pits, flows to a sump through a strainer, is pumped from the sump through to a filtering tank and back to the main bearings.

WRIST PINS:

In the top half of the crank bearing at the center of the groove is a hole for the oil to leave the crank bearing and enter the connecting rod. The connecting rod is drilled hollow and is fitted with a check valve at its lower end, (which checks any attempt of the oil to return back to the crank) so that the oil which is forced through the crankshaft and through the hole in the bearing will pass through the check valve and then up through the hollow connecting rod to lubricate the wrist pin in the piston.

OIL RETURN:

During its course the oil is being gradually squeezed out, partly through the main bearings, partly through the crank bearings, and the balance out through the wrist pin bearings, from where the oil returns by gravity to the sump in the bottom of the base.

The lubricating oil distributing pipe is provided with a spring loaded relief valve, so arranged as to allow the surplus oil to be delivered back into the lubricating oil reservoir, and thereby preventing the pressure from becoming too excessive.

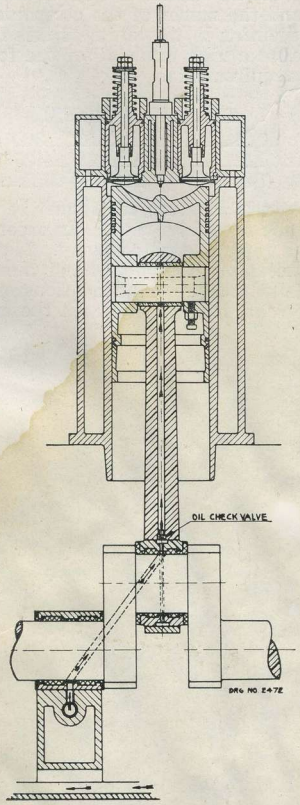
CHOICE OF OIL:

When the engine warms up after running for some time, the oil pressure may not register as high as when the engine was first started, due to the fact that the oil becomes thin with heat, and therefore flows more freely out through the sides of the bearings.

The choice of lubricating oil for the power cylinders and bearings of a Diesel engine is a matter involving many operating factors of which the most important are the temperature and pressures within the power cylinders, the thoroughness of oil distribution over the working surfaces, the amount of carbon formation and the method of lubrication.

Fairly high temperatures and pressures are to be contended with in a Diesel engine. The oil film formed, therefore, must have sufficient body to support the piston and piston rings, preventing metallic contact with the cylinder. Heat will naturally thin out the oil and therefore in the selection of the lubricant the body of the oil at the operating temperatures must be considered. High quality, correctly refined Diesel engine cylinder oils retain their body better than the low grade, inferior oils.

Unsuitable or inferior oil fails to provide satisfactory lubrication. It chars freely, combines easily with fuel impurities, the products of incomplete combustion and dust or dirt in the intake air, forming a hard crust-like deposit In an attempt to supply lubrication with such an oil excessive



METHOD OF LUBRICATING CRANK AND PISTON PIN BEARINGS, BY FORCE FEED

feeds to the cylinders are generally employed. This aggravates the difficulties. The oil then works itself in between and behind the piston rings where it gradually bakes and decomposes forming deposits that cause the rings to stick in their grooves.

The trade names of oils suitable for lubricating ATLAS IMPERIAL DIESEL ENGINES and the names of the companies marketing them are far too numerous to mention in the limits of this book. We have found from our experience that a high grade oil of the following characteristics usually meets all the requirements.

SPECIFICATIONS

Flash Point	360°F or over
Fire Point	425°F or over
Viscosity (Saybolt) @ 210°F	65 Secs. or over

In the selection of a lubricating oil it must be remembered that only oils of the highest grade should be used. In order to assure yourself on this point, deal with a reputable oil company. Most oil companies maintain lubricating engineers on their staffs and these men should be consulted freely as they can make recommendations on the ground with the full knowledge of the conditions under which the engine is to work.

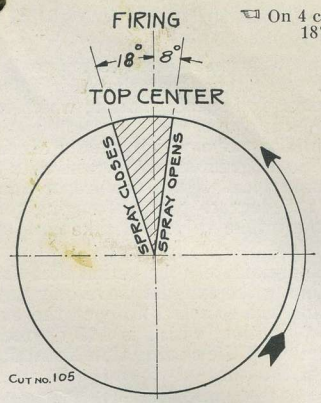


DIAGRAM A

On 4 cyl. 6½x8½ only
18° and 6°

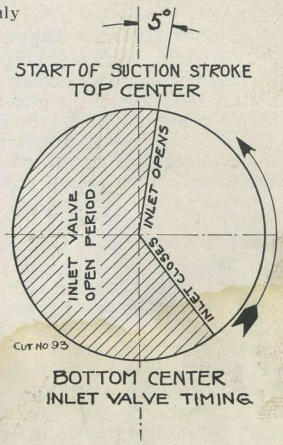


DIAGRAM B

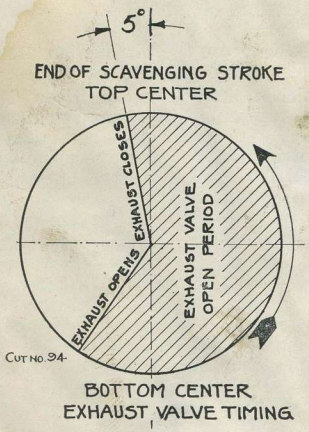


DIAGRAM C

VALVE SETTING DIAGRAMS

VALVE TIMING:

Referring to the diagrams:

Diagram A shows the portion of the revolution relative to top center for the opening and closing of spray valves. Remember that this valve setting is based on the governor being set at full speed position, which in turn will permit the maximum lift of the spray valve.

Diagram B—Has reference to the intake valve which admits air to the cylinders during the intake stroke. This diagram shows approximately the time that the intake valve should remain open. When the proper time for closing has been adjusted, which is 215 degrees past scavenging top center then the time of the opening of the intake valve will take care of itself, the same as the exhaust valve.

Diagram C—Exhaust valve—shows approximately the period that the exhaust valve should remain open. In timing the exhaust valve only pay attention to the opening time. If the cams are so set as to open the exhaust valve at approximately the correct position, which is 145 degrees past top firing center as shown on diagram, then the closing time will take care of itself, due to the size of the lobe of the cam.

It is not essential that the air intake and exhaust valve settings should be exactly on the degree as they may vary two or three degrees either way without interfering with either power, economy or running condition of the engine.

In adjusting the valve setting at any time do so by lengthening or shortening the valve lifter rods by screwing them in or out of the rocker fork which is attached to the outer end of the rockers.

TIMING OF AIR STARTING VALVE:

See that the Globe valve on the air line is closed.

Place the air starting lever No. 570 (See page 40) over to the front side of the engine which is the starting position. Then turn the flywheel around until 5° before top center on compression stroke of the particular cylinder being adjusted. Then adjust the air starting pushrod by screwing the pushrod socket in or out so that the valve will just begin to open. Then tighten jam nut on pushrod to insure against the valve adjustment's changing. The time of closing of the air starting valve will take care of itself, as it is determined by the lobe of the cam.

ADJUSTMENT AND TIMING OF ALL THE VALVES:

When an engine is shipped from the factory all valve timings are adjusted properly for running. If, however, for any reason the engine has been partly dismantled during installation or shipment, or if some one has interfered with the valve settings (while crating and shipping) then it may become necessary to retime the valves before starting the engine. The most important valve to have correctly timed is the spray or fuel valve, located in the center of the cylinder head.

FIRING ORDER OF THE ENGINES:

Number ONE cylinder is the one located next to the flywheel, or the governor end of the center frame. The firing order for the three cylinder engine is 1-2-3, and for the four cylinder engine is 1-2-4-3.

Turning the engine "towards you" means turning the flywheel counter clockwise, the flywheel being viewed from the flywheel end of the engine looking towards the rear of fan spindle end of the engine.

SPRAY VALVE NOZZLE OR TIP:

The spray valve nozzle or tip is an important factor in the proper running of the Atlas-Imperial Diesel engines. The correct size tip used on the various engines is of great importance, as it regulates the spray of the injected fuel oil or vapor into the cylinder. To insure proper functioning of the spray valve it is paramount that the holes of the tip be kept clean at all times. It is very important that the spray valve be tight and does not leak.

The size tips used on the engines according to their bore and stroke is shown in the table below:

	SIZE OF HOLE	NO. OF HOLES	STAMPED
4 Cyl. 6½" x8½"	8	5	8
3 and 4 Cyl. 7½" x10½"	8	5	8
4 Cyl. 9" x12"	10	5	10

SPRAY VALVE:

The function of the spray valve is to admit the fuel to the cylinders at the proper time and at the same time deliver the fuel oil in the form of a very finely atomized spray so that the fuel is readily ignited and properly burned within the cylinder. The spray valve is located in the center of the cylinder head and extends clear through the head, with the spray valve tip projecting slightly below the bottom of the cylinder head. It is provided with a needle valve held in position by a strong spring, the tension of which is slightly adjustable. The fuel oil is admitted below the stuffing box at a pressure anywhere from 1000 to 3500 pounds per square inch (depending on the adjustment of the pressure regulating valve). This spray valve is held in position by a clamp arrangement having a single stud thus making it easily removable for inspection or cleaning. It is operated by a lifting rocker arm which lifts the valve approximately 2/100 of an inch when the engine is pulling its full load. The governor controls the lift of these valves so that when the engine is running idle the lift is very little and only sufficient to admit enough fuel to turn over the engine. As the load increases the engine governor causes these valves to raise slightly more and consequently admit additional fuel in direct proportion to the power developed.

CARE AND MAINTENANCE:

To insure proper functioning of the spray valve it is paramount that

it be kept clean and the holes in the tips be absolutely clear of any impurities. The packing on the stem should be screwed up just tight enough to hold the pressure, for if too tight it will cause excessive wear on the valve stem, thereby causing the valve to work in a very sluggish manner or to remain open allowing too much fuel to enter the cylinder. When such a condition exists the cylinder relief valve will begin to blow off due to the excessive pressure which arises in the cylinder under such conditions.

If any of the tips become clogged with dirt or any other matter, the fuel is thereby unable to enter the combustion chamber in its usual manner and will cause a reduction in the revolutions of the engine, also its power, for the lack of enough fuel. This condition is more apt to occur in a new installation due to dirt and the likes that is in the piping and the tips will have to be cleaned until this disappears or is worked out. If clean pure fuel is used the tips will only have to be cleaned on very few occasions.

When the valves have been disassembled to be cleaned care must be taken to readjust them properly when placing them back in the cylinder heads. The maximum lift of the spray valve spindle should never be more than 2/100 of an inch in any case. Excessive lift will only be an unnecessary waste of the fuel, while not sufficient lift will cause the lifters and cams to make excessive and unnecessary noise. The screw strainer in the side of the spray valve should be checked to see that it is not striking the spray valve stem and is also screwed in the strainer far enough to miss the nipple part of the union.

ADJUSTING AND TIMING OF SPRAY VALVES:

Put the governor control handle in full speed position, place the engine starting lever in running position. Close all isolating valves on the fuel rail. Open all cylinder relief or snifter valves. Bar over flywheel in running direction until pointer on engine frame corresponds to a few degrees before mark on flywheel showing opening of spray valves. Then open isolating valve corresponding to cylinder you are timing. Be sure that the piston in that particular cylinder is nearing the top of its compression stroke, which is easily ascertained by the fact that both the inlet and exhaust valves remain closed during that stroke. CAUTION: NEVER ATTEMPT TO TURN THE FLYWHEEL WITH THE BAR UNLESS ALL CYLINDER SNIFTER VALVES ARE ENTIRELY OPENED.

Pump up fuel pressure by hand fuel pump to about two thousand (2000) pounds pressure. Then continue barring the flywheel over SLOWLY until the pointer on the engine frame registers with mark on flywheel, showing opening of the spray valve. (Referring to Diagram A, on Page 15.) If at that point the fuel pressure on gauge does not release, then loosen jam nut under push rod fork for that particular spray valve, and adjust the push rod by screwing it in or out as the case may be until the pressure is released at that particular point. If the pressure is released before the flywheel is turned to the proper point indicated on the flywheel, then the rod is too long and must be shortened by screwing it into the fork slightly; and if the pressure does not release when the flywheel has been turned to the proper point as above referred to, then the rod should be unscrewed and thereby lengthened until it releases at the exact point.

When this has been accomplished lock the jam nut tight under the fork, turn the flywheel back again to see if the tightening of the jam nut has slightly altered the timing, in which case it must be loosened again,

and the rod screwed into the fork slightly farther, and the jam nut tightened again. Turn the flywheel backwards again a few degrees, then turn ahead very slowly to see that the pressure releases exactly at the desired point.

It will be necessary to pump up pressure with the hand pump each time.

In order to ascertain the time of closing of the spray valve, turn the engine ahead until the mark on flywheel showing closing of spray valve is past the point. Then pump up pressure, bar the flywheel backwards again until the pressure is released. This will determine the exact point of the flywheel where the spray valve closes.

If this varies a little from 18 degrees DO NOT change push rod, as time of opening of the valve is most important. If it closes earlier than 15 degrees or later than 20 degrees then the cam on the cam shaft must be turned away from you to make the closing come later and toward you to make the closing come earlier. After moving the cam the push rod must again be adjusted. Changing the location of the cam should only be necessary at very infrequent intervals.

After timing of the spray valves it is good practice to open all snifter valves, and turn engine over a few times by air, this will remove any excess fuel oil that may have accumulated in the cylinders.

Once a week the timing should be checked over and the valve corrected.

Proceed in this same manner with the spray valves on each cylinder in which timing needs checking up. It is important that the valve timing in the spray valves be correct on all cylinders in order that they all may be working equal when the engine is running.

If black smoke issues from the exhaust pipe ascertain which cylinder is smoking, the cause of the smoke being either due to too much fuel entering that cylinder, or that some of the spray tips are partly plugged up, spreading the fuel unequally into the cylinder, or admitting so little fuel to some of the cylinders that an excessive load is put on some one individual cylinder; or, that the spray valve may be leaking either at the valve seat or at the joint between spray tip and spray valve body. It is of utmost importance that the spray valve be absolutely tight so that no fuel can enter the cylinder at any other time excepting during the period when the valve is opened by the spray cam, which should be at all times kept in proper adjustment.

Whenever a spray valve is removed from the head for the purpose of cleaning, grinding, or adjusting, then upon replacing the spray valve the timing of that valve must be checked up again as a slight alteration may be caused by the replacement.

INSTRUCTIONS FOR REMOVING AND CLEANING SPRAY VALVE:

Take out cotter pin and pin No. 873 from spray rocker fulcrum. Slip out horseshoe collar from under spray valve stem nut. Unscrew high pressure fuel union nut and pull tube away a little from spray valve. Loosen spray valve clamp nut enough to slide spray valve clamp back and remove spray valve. In case spray valve gasket remains on spray valve in removing, make sure it is replaced in cylinder head.

REMOVING SPRAY VALVE TIP:

Unscrew spray valve seat nut and, if tip remains in seat nut, a small

brass punch is provided for removing and a few light taps are sufficient to loosen tip. In doing this care should be taken not to mar the tip.

CLEANING SPRAY TIP:

A wire spray valve tip cleaning needle, is provided, to be used when the spray tip is plugged or clogged with any foreign substance. This needle should be inserted into the small holes at the proper angle which is about 30° from horizontal. Do not twist or turn needle in holes as this may cause reaming and would make an uneven spray. Clean tip with gasoline and a small plunger is also provided to be used to force gasoline through the small holes to determine if all the holes are entirely free and open. Assemble tip and place in testing clamp.

SPRAY VALVE TEST CLAMP:

There is a connection located on the high pressure fuel rail for the purpose of testing out the spray valves after cleaning them, to see that the spray holes are clean.

A bracket located on the base directly beneath this connection to which a stand is attached for holding the spray valve and also has a lever for lifting the valve in the same manner as the rocker on the head does.

HOW TO USE THE TEST CLAMP:

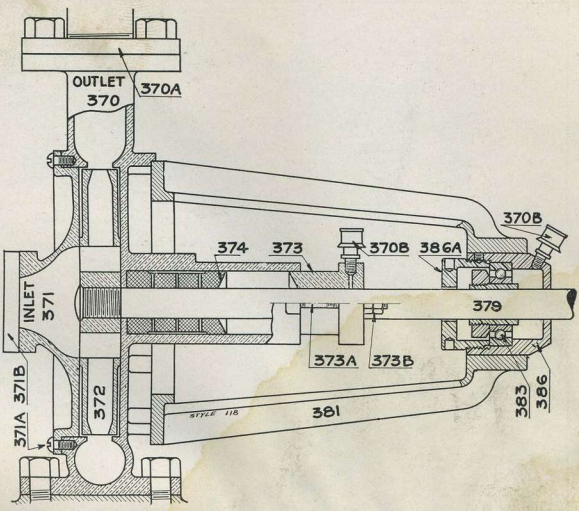
First close all the isolating valves on the fuel rail. Then after spray valve has been fastened in the stand attached to the base, connect the spray valve with its connection to the connection on the fuel rail. After all connections have been inspected and tight, pump up the fuel pressure by the hand priming pump. Then open the valve by hitting the end of the test stand handle with a quick short tap, watch closely to ascertain if a fine spray of fuel comes out of EACH separate hole in the tip.

When assembling the spray valve make sure that all of the parts have been put together tight and do not leak, for a leaky spray valve is one of the greatest reasons why the engine will not run properly.

Care should be taken not to forget to close the isolating valves on all of the cylinder heads for if they are left open a large amount of oil will gather on the top of the piston head, and when the engine is started there is liable to be lots of trouble, due to the excessive amount of oil being compressed in the cylinder.

GRINDING THE SPRAY TIP AND STEM:

Loosen spray valve spring plug No. 857 until spring tension is released. Pull spray valve stem back a little and not beyond the end of spray valve body as this may disturb packing. Apply a little fine grinding compound on shoulder of tip and grind seat on spray valve body. Apply a little fine grinding compound on tip of stem and grind seat in tip. Wash tip in gasoline using plunger to clear holes. If occasion arises to pull stem from body the packing should be removed and the body cleaned to prevent small particles of packing working down and clogging tip. Repack stem. After final test of spray valve the lift should not be more than 1/16 of an inch. This is adjusted by either loosening or tightening the spray valve spring plug.



CENTRIFUGAL PUMP

G370 Centrifugal pump, complete: Part Nos. 370, 370B, 370C, 370D, 370E, 371, 371A, 371B, 371F, 372, 373, 373A, 373B, 374, 374A, 379, 381, 381A, 381C, 383, 386, 386A.

370 Cent. pump body
Cent. pump body pipe plug

370A Cent. pump inlet or outlet flange

370B Cent. pump grease cup

370C Cent. pump inlet or outlet flange gasket

370D Cent. pump holding down cap screw

370E Cent. pump body drain cock nipple

370F Cent. pump body drain cock

370G Cent. pump flange cap screw

371 Cent. pump cover

371A Cent. pump cover screw

371C Cent. pump cover gasket

372 Cent. pump runner with shaft No. 379

373 Cent. pump shaft gland

373A Cent. pump shaft gland stud

373B Cent. pump shaft gland stud nut

374 Cent. pump shaft bushing

374A Cent. pump shaft flax packing

379 Cent. pump runner shaft

381 Cent. pump steady bearing

381A Cent. pump steady bearing cap screw

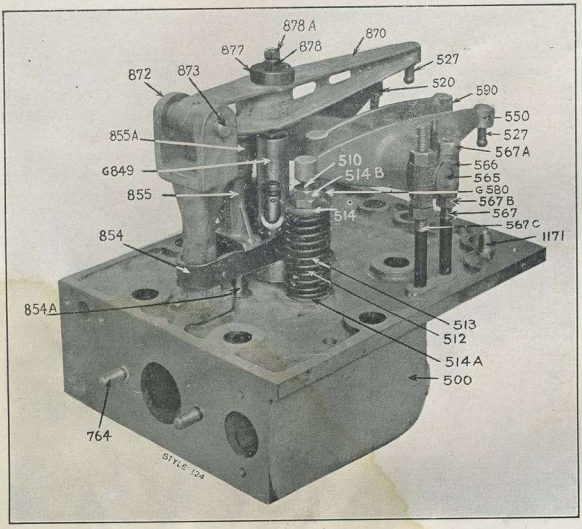
381C Cent. pump steady bearing clamp screw

383 Cent. pump radial thrust ball bearing

384 Cent. pump shaft coupling

386 Cent. pump ball bearing housing
Cent. pump ball bearing housing clamp screw

386A Cent. pump ball bearing retainer
Cent. pump ball bearing retainer lock set screw
Cent. pump shaft guard
Cent. pump shaft guard bracket
Cent. pump shaft guard bracket screw
Cent. pump shaft guard bracket cap screw

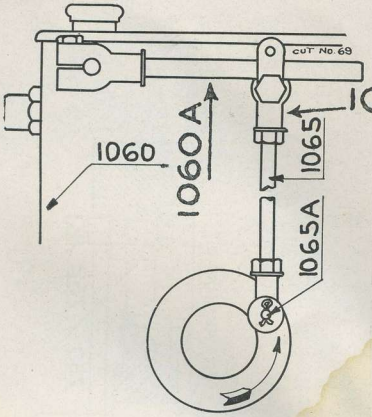


CYLINDER HEAD

G500	Cylinder head complete; except spray valve
GA500	Cylinder head, with valves and springs only
500	Cylinder head
501	Cylinder head stud
501A	Cylinder head stud, special for lifting head
501B	Cylinder head stud nut
502	Cylinder head gasket
505	Cylinder head cover
505A	Cylinder head cover stud with handle
510	Valve and stem, inlet or exhaust
512	Valve stem bushing, inlet or exhaust
513	Valve spring, inlet or exhaust
514	Valve spring bushing, inlet or exhaust—top
514A	Valve spring bushing, inlet or exhaust—bottom
514B	Valve stem nut
520	Inlet rocker, with buttons
520A	Inlet rocker bushings (set of 2)
526	Push rod socket, inlet, exhaust, air, or fuel
527	Push rod button, inlet, exhaust, air and fuel
550	Exhaust rocker with buttons
550A	Exhaust rocker bushings (set of 2)
565	Rocker shaft
566	Rocker shaft bearing
567	Rocker shaft bearing stud
567A	Rocker shaft bearing stud nut; top
567B	Rocker shaft bearing stud lock nut
567C	Rocker shaft bearing stud, long
G580	Air starting valve, complete; Part Nos. 579, 580, 582, 583, 584, 585, 586, 588
590	Air starting rocker, with roller and pins
590A	Air starting rocker bushings (set of 2)
764	Exhaust elbow stud
G849	Spray valve complete
854	Spray valve clamp
854A	Spray valve clamp stud
855	Spray valve clamp bridge
855A	Spray valve clamp bridge nut
870	Spray valve rocker and pins
872	Spray valve rocker fulcrum
873	Spray valve rocker pin
877	Spray valve horse shoe collar
1171	H. P. fitting through head

Always Give Part Name, Part Number and ENGINE NUMBER

FORCE FEED OILER

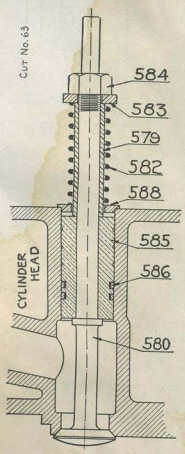


The force feed oiler used for oiling the cylinder walls of the engine is driven off of the cam shaft by means of a crank disc.

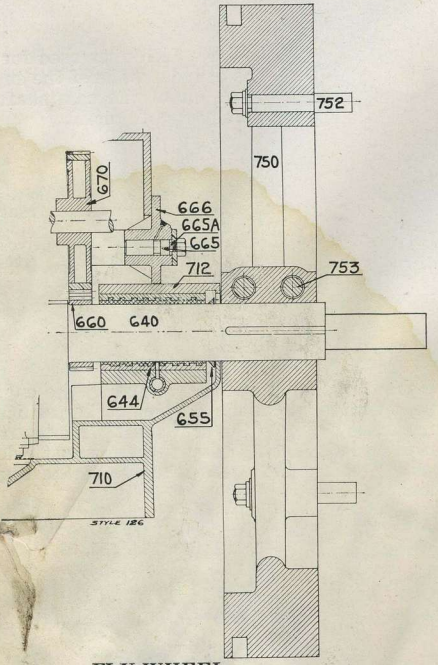
1060	Force feed lubricator
1060A	Force feed lubricator drive arm
1060B	Force feed lubricator connecting rod eye
1065	Force feed lubricator drive rod.
1065A	Force feed lubricator drive rod pin.

Air Starting Valve

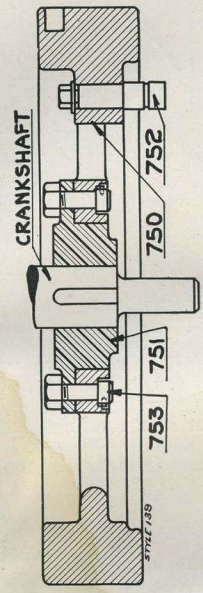
THE air starting valve shown below is used for starting the engine. It is of the 4 cycle type, operated by the air starting rocker, which in turn is actuated by air starting cam on the cam shaft. The starting lever is in running position when it is leaning toward the exhaust side of the engine. When it is leaning toward the operator's side of the engine then it is in starting position.



579	Spring bushing
G580	Valve, complete; Part Nos. 579, 580, 582, 583, 584, 585, 586, 588.
580	Valve
582	Spring
583	Spring washer, top
584	Nut
585	Balance bushing
586	Balance bushing ring
588	Spring washer, lower



FLY WHEEL
Used on 8½ " and 9 " Bore

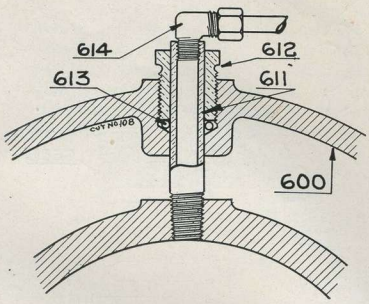


FLY WHEEL
Used on 6½ " and 7½ " Bore

750 Flywheel
751 Flywheel coupling
752 Flywheel friction bolt (special).
753 Flywheel clamp bolt
753 Flywheel clamp stud
753A Flywheel clamp stud washer
753B Flywheel clamp stud nut

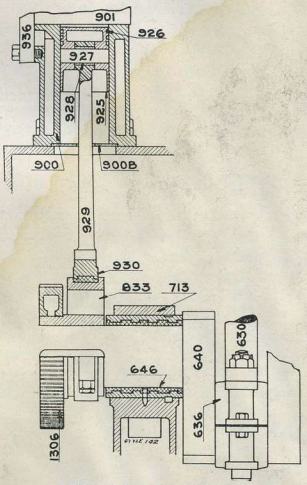
Always Give Part Name, Part Number and ENGINE NUMBER

Cylinder Lubricating Pipe



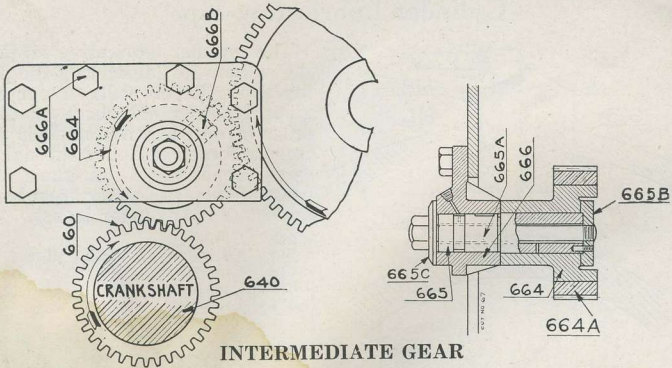
The cylinder lubricating oil pipe shown here for lubricating the piston and cylinder walls of our engines requires but three or four drops of oil per minute. It is fed from a force feed oiler through a small copper pipe. A gland and packing keep the water from leaking out of the cylinder jacket.

600 Cylinder
611 Cylinder lubricating pipe
612 Gland
613 Packing
614 Elbow



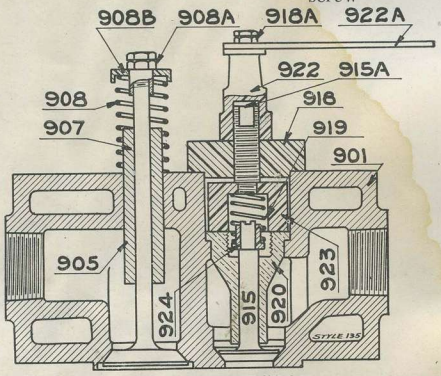
AIR COMPRESSOR

630 Engine connecting rod
636 Crank pin box
640 Crank shaft
646 Crank shaft bushing, center
713 Base cap, center
900 Air compressor cylinder
900B Air compressor splash plate
901 Air compressor head
925 Air compressor piston
926 Air compressor piston ring
927 Air compressor piston pin
928 Air compressor connecting rod bushing
929 Air compressor connecting rod
930 Air compressor eccentric strap
932 Air compressor eccentric strap bolt
933 Air compressor eccentric
935 Air compressor relief valve
936 Air compressor pass over pipe to head
937 Air compressor gauge (300 lbs.)
1306 Centrifugal pump chain sprocket, driver



INTERMEDIATE GEAR

640 Crankshaft
660 Crankshaft pinion
664 Intermediate gear
664A Intermediate gear ring
665 Intermediate gear pin
665A Intermediate gear pin bolt
665B Intermediate gear pin bolt washer
665C Intermediate gear bearing pin bolt washer
665D Intermediate gear pin bolt nut
666 Intermediate gear bearing
666A Intermediate gear bearing cap screws
666B Intermediate gear bearing lock screw



AIR COMPRESSOR

G901 Head, complete; Part Nos. 901, 905, 907, 908, 908A, 915, 915A, 918, 918A, 919, 920, 922, 922A, 923, 924
901 Head
902 Stud
905 Inlet valve
906 Grid
907 Inlet valve bushing
908 Inlet valve spring
908A Inlet valve nut
908B Air compressor inlet valve washer
915 Discharge valve
915A Discharge valve adjusting screw
918 Discharge valve flange
918A Discharge valve relief handle nut
918C Air compressor discharge valve flange stud
919 Discharge valve spring
920 Discharge valve guide
922 Discharge valve cap nut
922A Discharge valve relief handle
923 Discharge valve guide cap
924 Discharge valve spring bushing

Fuel Oil

Theoretically, a Diesel engine should burn any petroleum product if properly prepared. However, there are certain impurities in almost all fuel oils which determine to a large extent the suitability of those oils for operation in a Diesel engine. The following brief description of the various impurities, with their effect upon the engine, is given to guide the purchaser and the oil supplier in the selection of a proper fuel oil.

GRAVITY

Specific gravity is in itself no indication of the suitability of a Diesel fuel oil.

VISCOSITY

The viscosity of a fuel oil will determine its suitability by the effect that it has on the flow of the fuel oil through the pipes, valves and so forth. An oil of high viscosity that may be in all other respects satisfactory will require heating to enable it to flow satisfactorily through the fuel lines, valves and so forth. Another effect of high viscosity is the resistance that it offers to vaporization, requiring variation in the size of the burner tips.

MECHANICAL IMPURITIES

Under this heading come such elements as dirt, grit, fiber and water. The small holes in the spray valve tips, strainers and so forth are liable to become clogged if there is too large an amount of mechanical impurities. Besides this, they have the effect of cutting out the seats of the valves.

CARBON RESIDUE

This is a characteristic of fuel oil which has only recently received attention, at least in Diesel fuel oil specifications, and one which has quite an effect on the operation of an engine. This carbon residue (Conradson carbon) is a measure of the proportion of carbon deposits that are likely to occur on the piston, cylinder head, valves and so forth. A high percentage of Conradson carbon is usually associated with carbon formation within the cylinders, as well as gumming up of the valves and stems.

LUBRICATING VALUE

All petroleum products have a certain amount of oiliness and the higher this oiliness is in a fuel oil the less wear will be noticed on the pump plungers, spray valve stems and such similar parts. Very light oils, such as kerosene, contain little or no lubricating value and therefore their use will usually result in excessive wear on the pump plungers, spray valve stems and so forth.

The following are the general characteristics of a suitable Diesel fuel:

Viscosity (Saybolt Universal) at 100° F.	35 to 60 seconds
Sulphur content	1.5% maximum
Conradson carbon	1% maximum
Moisture and sediment	.5% maximum
Ash	.05% maximum

Legal regulations usually limit the flash to a minimum of 150° F.

Diesel fuels from California crudes are readily obtainable, meeting the above specifications in gravities between 24 and 30° API. Midcontinent fields produce so-called gas oils with gravities ranging from 32 to 35° API. European oils likewise come within this same range.

We cannot place too much emphasis upon the importance of getting oil which is free from impurities to avoid the clogging of valves, strainers, spray valve tips and so forth and upon the desirability of securing an oil with as much oiliness as possible to avoid wear on some of the vital parts of the engine.

DO NOT CONFUSE DIESEL FUEL WITH ORDINARY BOILER OIL. THE LATTER CONTAIN DIRT AND SEDIMENT WHICH MAKE THEM UNSUITABLE FOR A DIESEL ENGINE.

A heavy fuel oil thinned down by the addition of a lighter oil is not a satisfactory fuel, as the lighter oils in such a mixture burn off rapidly and leave the heavier oil to gum up piston rings and valves and cause excessive cylinder wear. Insist on getting a straight run distillate for your fuel.

CARE OF FUEL OIL

The best fuel oil can be ruined if not properly handled. Store and transport your fuel in clean container and use your containers for fuel oil only. Flush out the container frequently to remove any dirt, rust or scale that may accumulate.

Keep your containers closed to prevent dust, dirt and water getting in the fuel oil, as these impurities in the fuel are bound to cause you more trouble and annoyance than required to keep your fuel clean. Provide means in your storage tanks for draining off any water that may be present.

Draw fuel from storage tank through a pipe inserted in top of tank. Be sure the lower end of suction pipe is 3 or 4 inches above the bottom of tank. This allows dirt and water to settle to bottom of tank where they can be occasionally drawn off.

An engine supply tank should be provided big enough to hold at least a day's supply of fuel.

Strain the fuel oil when transferring it from storage tanks to engine supply tank. A good strainer can be made from a five-gallon can by cutting off the top and inserting therein a conical strainer made from 150-inch bronze gauze. Cut the gauze into 4 triangles and solder the upper edges to the top of the can. Have the lower point of the gauze about 2 inches above the bottom of the can. Punch a hole in the bottom of the can and solder on a piece of 1½" brass pipe, which can be inserted in engine supply tank filling hole. Be sure to use a new bright clean can free from rust or dirt. Keep the strainer away from dust and dirt when not in use and wash out frequently.

Fuel Oils

TO assist in obtaining the proper oil to be used as fuel in this engine, we transmit herewith our recommendations. These recommendations are the results of past experiments which have been conducted by us.

In purchasing the fuel oil to be used for this engine, you should advise the oil company that it will be used in a full type mechanical injection Diesel engine. We recommend that your first purchase be only a few hundred gallons rather than a large supply, in order to be sure that you obtain the proper kind of oil.

There are two characteristics of oil which are of **EQUAL IMPORTANCE.** First, its **GRAVITY;** and second, its **VISCOSITY.**

It has been found that low Gravity oils are not satisfactory for all year service as they congeal in cold weather. Similarly it has been found that high Gravity oils, or oils about 38° or higher do not function satisfactorily at all times. especially in the warmer temperatures.

Therefore, the results of the various tests conducted reveal the following:

1. It has been found that any oil of less than 24° Gravity Baume must be filtered and heated. While this oil may be satisfactorily used in certain localities, generally speaking it is unsatisfactory for the average installation where cold weather is encountered, on account of the difficulty in heating the oil.

2. That 24° to 28° Gravity Baume oil is usually clean and needs no heating or straining before reaching the filter provided on the engine except in extremely cold weather providing the oil has the proper Viscosity.

3. The conclusions reached with regard to engines that must be operated at zero temperatures are that during cold weather periods oils from 32° to 38° Gravity Baume should be used, but that at all other times the 24° to 28° Gravity Baume oil should be used.

The Viscosity should be from 40 to 50 seconds with a Saybolt test 100° Fahrenheit. If the Viscosity runs to any great degree higher than 50 seconds, you will find that the oil is too thick for use as it is liable to clog the strainers and pumps.

"Do not confuse Diesel fuel oil with ordinary boiler or furnace oil. The latter contain dirt and sediment, which make them unsuitable for operation in a Diesel engine."

Therefore, specifications for the oil best suited for this engine are as follows:

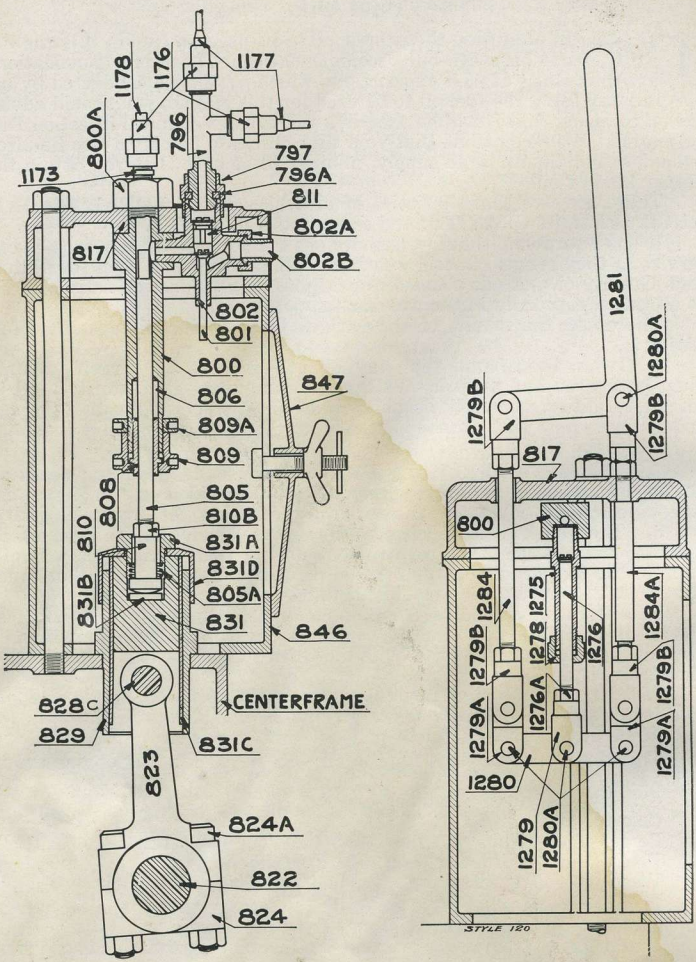
Gravity—24° to 28° Baume.
Caloric value—18,500 B. T. U's.
Percentage of Sulphur—Less than ½ of one per cent.
Flash Point—Not lower than 150° Fahrenheit.
Viscosity—40 to 50 seconds, Saybolt test 100° Fahrenheit.

Irrespective of what oil is used, it is necessary that the oil be refined to the extent that all water, sand and grit be removed.

You will note from the above that the fuel oil most suitable is one from 24 to 28 degrees gravity.

This is the oil which we ordinarily use to test the engine at our plant. It is known as Fuel Oil or Diesel Fuel Oil and it is sometimes incorrectly called Crude Oil.

For temperatures from zero to 15° Fahrenheit above zero it would probably be best to use 32° Baume Gravity Oil, but for sub-zero temperatures you would have to use a 36° Baume to 38° Baume Gravity Oil.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831A
831B
805A
831B
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CENTERFRAME
828C
829
831C
823
824A
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1281
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817
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1284
1279B
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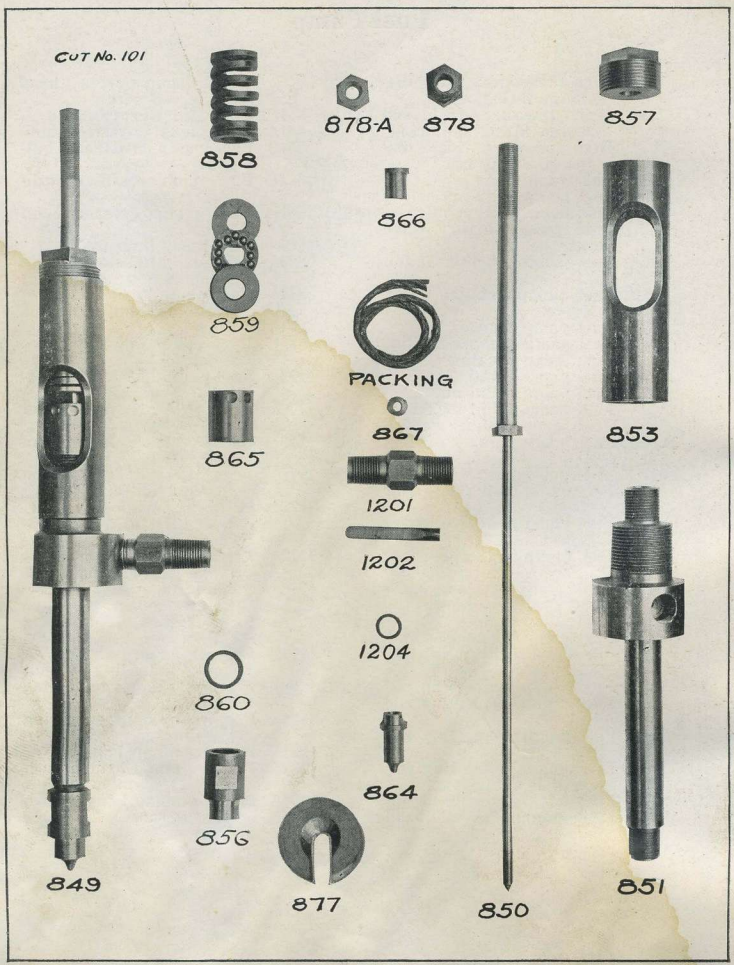
1278
1276
1284A
1279A
1279B
1276A
1279A
1279B
1280
1279
1280A
STYLE 120

FUEL PUMP

Fuel Pump

796 High pressure fuel discharge fitting
796A High pressure fuel discharge fitting split ring
797 High pressure fuel discharge fitting nut
800 Fuel pump body
800A Fuel pump body nut
801 Fuel pump suction valve
802 Fuel pump suction valve cage
802A Fuel pump suction union nut
802B Fuel pump suction union sleeve
805 Fuel pump plunger
805A Fuel pump plunger spring
806 Fuel pump packing
808 Fuel pump gland
809 Fuel pump gland nut
809A Fuel pump gland lock nut
810 Fuel pump plunger head
810B Fuel pump plunger nut
811 Fuel pump discharge valve
817 Fuel pump plate
Fuel pump plate steel cover (front)
Fuel pump plate steel cover (top)
Fuel pump plate steel cover screw (large or small)
Fuel pump plate and housing slotted cap screw
822 Fuel pump crank
G823 Fuel pump connecting rod, assembled, Part Nos. 823, 824, 824A.
823 Fuel pump connecting rod
824 Fuel pump connecting rod cap
824A Fuel pump connecting rod cap bolt
Fuel pump connecting rod cap bolt nut
828C Fuel pump cross head pin
829 Fuel pump cross head guide
Fuel pump cross head guide cap screw
831 Fuel pump crosshead
831A Fuel pump crosshead nut
831B Fuel pump crosshead button
831C Fuel pump crosshead bushing
831D Fuel pump crosshead oil guard
846 Fuel pump housing
846A Fuel pump housing stud
Fuel pump housing stud nut
847 Fuel pump housing cover
Fuel pump housing cover hinge
Fuel pump housing cover hinge screw
1173 Fuel pump bleeder connection
1176 High pressure fuel union nut
1178 High pressure fuel union sleeve
1178 High pressure fuel union sleeve, blind end
G1274 Priming pump only; Part Nos. 1275, 1276.
1275 Priming pump cylinder
1276 Priming pump plunger
1276A Priming pump plunger nut
1278 Priming pump cap
1279 Priming pump plunger eye
1279A Priming pump connecting rod link
1279B Priming pump link eye
Priming pump link eye nut
1280 Priming pump connecting rod
1280A Priming pump connecting rod pin
1281 Priming pump handle
1284 Priming pump handle push rod
1284A Priming pump handle push rod fulcrum



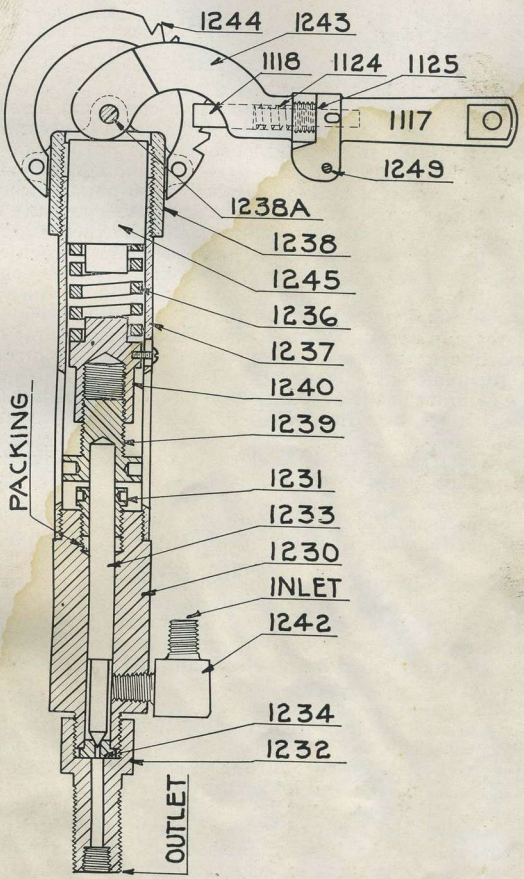
SPRAY VALVE

G849	Spray valve, complete; Part Nos. 850, 851, 853, 856, 857, 858, 859, 860, 864, 865, 866, 867, 878, 878A, 1201, 1202, 1204	865	Spray valve gland nut
850	Spray valve stem	866	Spray valve gland
851	Spray valve body	867	Spray valve packing seat
853	Spray valve spring casing	877	Spray valve horseshoe collar
856	Spray valve seat nut	878	Spray valve stem nut
857	Spray valve spring plug	878A	Spray valve stem lock nut
858	Spray valve spring	895	Spray valve testing outfit
859	Spray valve spring ball bearing	896	Spray valve cleaning needles
860	Spray valve gasket	897	Spray valve tip or nozzle remover
864	Spray valve nozzle or tip	898	Spray valve tip cleaner plunger
		1201	Fuel strainer body
		1202	Fuel strainer stem
		1204	Fuel strainer gasket

Always Give Part Name, Part Number and ENGINE NUMBER

Fuel oils lighter than distillate, such as kerosene, etc., are not suitable for this engine. It is possible that you may be able to adjust the engine so it will function satisfactorily for a short period, but the engine is not intended for such oils and if used trouble probably must be expected later, as such fuels will damage the valves and pumps. This is equally true of any other Diesel or Semi-Diesel engine.

Fuel and lubricating oils are filtered by means of a strainer located on the base or on the fuel lifter housing, and fastened by brackets which are made suitable for the different sizes of engines.



FUEL RELIEF VALVE, REMOTE CONTROL

Fuel Relief Valve

1117	Handle
1118	Pawl
1124	Pawl spring
1125	Pawl spring screw
G1230	Valve, complete Part Nos. 1117, 1118, 1124, 1125, 1230, 1231, 1232, 1233, 1234, 1236, 1237, 1238, 1238A, 1239, 1240, 1242, 1243, 1244, 1245, 1249.
1230	Body
1231	Gland
1231A	Gland packing ring
1232	Stud
1233	Stem
1234	Seat
1236	Spring
1237	Spring cage
1238	Handle bearing
1238A	Handle bearing pin
1239	Handle adjusting screw
1240	Handle plug, lower
1242	Fuel fitting
G1243	Handle, complete; Part Nos. 1117, 1118, 1124, 1125, 1243, 1249.
1243	Handle
1244	Handle section
1245	Spring plug, top
1249	Handle screw

THE fuel relief, is a spring loaded valve connected directly to the high pressure fuel pumps by means of steel tubing, and is equipped with an adjustable spring tension. The purpose of this valve is to regulate the pressure of fuel delivered to the spray nozzles. It is essential that the pressure be kept to about 3500 pounds when the engine is working under normal loads. An increased pressure causes an excess amount of oil to enter the cylinder, thereby increasing the heat. The normal initial temperature at the time of ignition when the engine is developing its rated horse-power is approximately 1200 degrees Fahrenheit. Additional fuel pressure makes it possible to raise this temperature up to 2400 degrees Fahrenheit.

The increase in pressure will increase the power to some extent but not in proportion to the increase in pressure or heat produced.

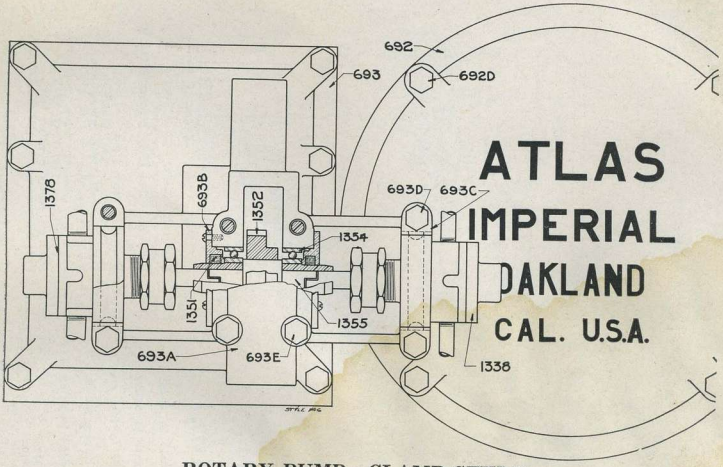
The high momentary temperature has a tendency to destroy the metal in the cylinder heads as well as in the top of the piston. The quick changing of temperature from high flash to cold intake period will eventually start minute surface cracks which in time increases in depth as well as in area. This is likely to cause cracked piston heads and cylinder heads. This clings to the cylinder head and valves causing the valves to leak.

With the increased pressure on the fuel line, more oil is injected into the cylinder than can be used, and consequently it will leave a carbon deposit.

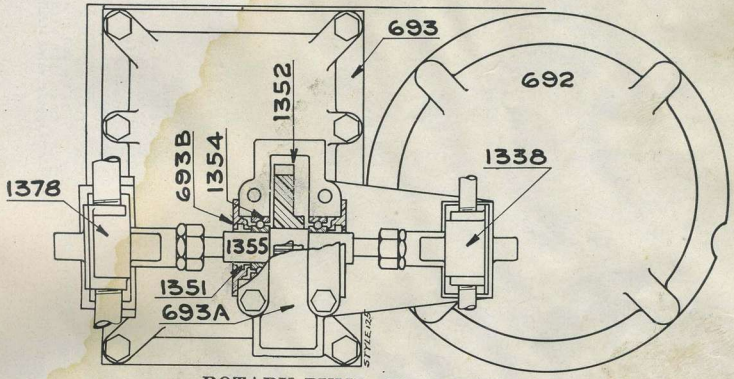
It will be readily understood that the higher the pressure on the fuel line the greater will be the quantity of fuel admitted to the cylinders during a given period of spray valve opening. If the engine is idling, the pressure should be reduced to about 1000 pounds. The altering of pressure is accomplished by manipulating the handle on top of the fuel relief valve.

When the engine has been adjusted to a certain pressure of fuel suitable for a fixed load, then it is essential that this pressure be maintained uniformly. This valve is so constructed that any quantity of oil over and above that which goes through the spray nozzles at the fixed pressure will be by-passed and let back into the fuel tank. In this way this fuel relief valve automatically maintains the pressure and takes care of the surplus fuel pumped by the high pressure fuel pumps.

If the fuel relief valve leaks, make sure that valve stem is working freely and not stuck or sluggish in packing; if this is found to be all right then the valve is leaking at seat and should be reground with a very fine abrasive.

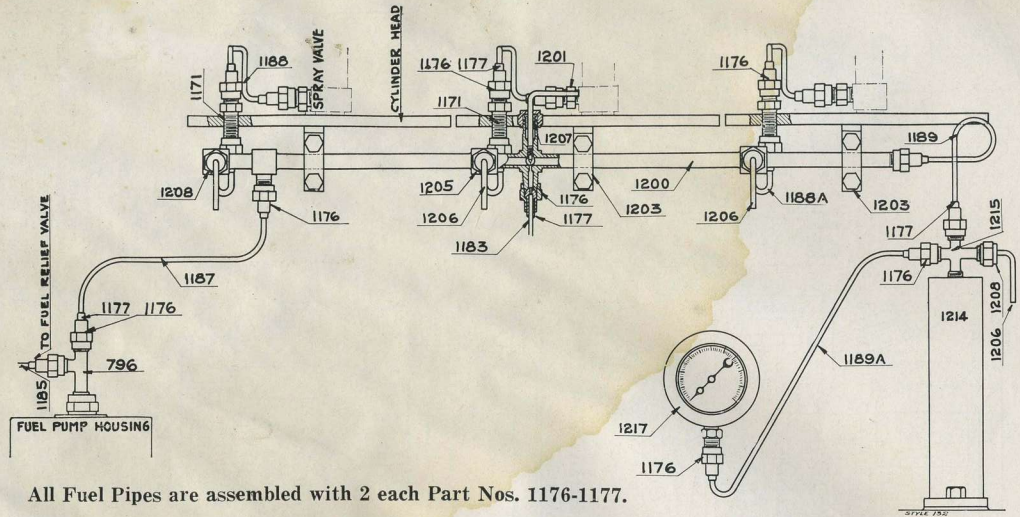


ROTARY PUMP—CLAMP STYLE



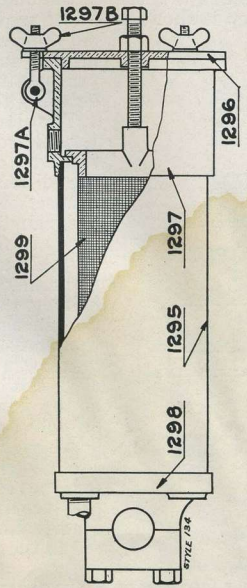
ROTARY PUMP—FOOT STYLE

692 Centerframe door (round)
692A Centerframe door gasket
692D Centerframe cover cap screw
693 Rotary pump door
Rotary pump door cap screw
Rotary pump door gasket
693A Rotary pump door bearing cap
693B Rotary pump door ball bearing retainer
Rotary pump door ball bearing retainer screw
693C Rotary pump door clamp cap
693D Rotary pump door clamp cap screw
693E Rotary pump door cap—cap screw
1338 Rotary pump, complete; ¼" outlet
1341 Rotary pump gear and shaft driver for ¼" outlet pump
1342 Rotary pump gear and shaft driven for ¼" outlet pump
1351 Rotary pump felt washer
1352 Rotary pump gear, driven
1353 Rotary pump gear driver on cam shaft coupling
1354 Rotary pump ball bearing
1355 Rotary pump drive shaft
1371 Rotary pump gear and shaft for ½" outlet pump. Driver
1372 Rotary pump gear and shaft driven for ½" outlet pump
1378 Rotary pump, complete; ½" outlet
Rotary pump holding down cap screw



All Fuel Pipes are assembled with 2 each Part Nos. 1176-1177.

796 High pressure fuel discharge fitting
1171 High pressure fuel pipe connection through head
1173 Fuel pump top connection
1174 Fuel oil receiver drain connection
1176 High pressure fuel union nut
1177 High pressure fuel union sleeve
1178 High pressure fuel union sleeve, blind end
1183 Testing pipe—fuel rail to spray valve test clamp
1187 Fuel pump to fuel rail
1188 Fuel pipe from fuel rail to spray valve
1188A Fuel pipe from fuel rail to spray valve connection
1189 Fuel pipe from fuel rail to fuel oil receiver
1189A Fuel pipe from fuel oil receiver to fuel pressure gauge
1200 Fuel rail complete with isolating valves and fittings
1201 Spray valve strainer body
1202 Spray valve strainer stem
1203 Fuel rail clamp
1204 Spray valve strainer gasket
1205 Isolating valve body, always fitted to fuel rail
1206 Isolating valve stem
1207 Isolating valve stem gland
1208 Isolating valve stem gland nut
1214 Fuel oil receiver
G1215 Fuel oil receiver valve, complete; Part Nos. 1206, 1208, 1215
1215 Fuel oil receiver valve body
1217 Fuel oil pressure gauge—10,000 lbs.



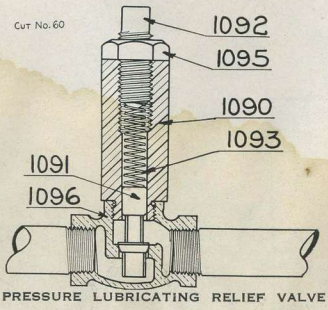
DAY TANK

G1295 Day tank, complete, Part Nos. 1295, 1296, 1297, 1297A, 1297B, 1298, 1299
1295 Day tank casing
1296 Day tank cover
Day tank cover pipe plug
Day tank cover holding down cap screw
1297 Day tank casing collar
1297A Day tank casing collar eye bolt
1297B Day tank casing collar wing nut
Day tank casing collar eye bolt pin
1298 Day tank casing collar bottom
Day tank casing collar bottom clamp cap screw
1299 Day tank strainer

Always Give Part Name, Part Number and ENGINE NUMBER

Lubricating Oil Sump Pump

THE lubricating oil sump is located at the center of the engine underneath the base, and is provided with angular draining trough from all of the crank pits so that the circulating oil finds its way to the bottom of the crank pits and drains into the sump. The proper level of lubricating oil in the sump is shown in cut of engine and indicated by dotted line marked "Oil Level." Within this sump is a strainer which prevents the carbon deposits from entering the lubricating oil pump.



PRESSURE LUBRICATING RELIEF VALVE

G1090	Valve, complete; Part Nos. 1090, 1091, 1092, 1093, 1095.
1090	Body
1091	Plunger
1092	Adjusting screw
1093	Spring
1095	Adjusting screw nut
1096	Check valve

The lubricating oil pump receives the oil from the bottom of the oil reservoir or sump and delivers it to the distributing manifold, which connects to the bottom of each of the main bearings. The main bearings are fitted with bearing shell, very closely fitted around the entire crank shaft for the purpose of holding the lubricating oil. The clearance between the bearings and the shaft should only be sufficient to allow a good film of lubricating oil. If the bearings are scraped free at the joints, then the lubricating oil, which is pumped through the bearings, finds too ready an outlet and thereby makes it impossible for the oil pump to maintain a pressure on the oil sufficient to send it up through the connecting rod to the wrist pin bearings.

PRESSURE LUBRICATING RELIEF VALVE

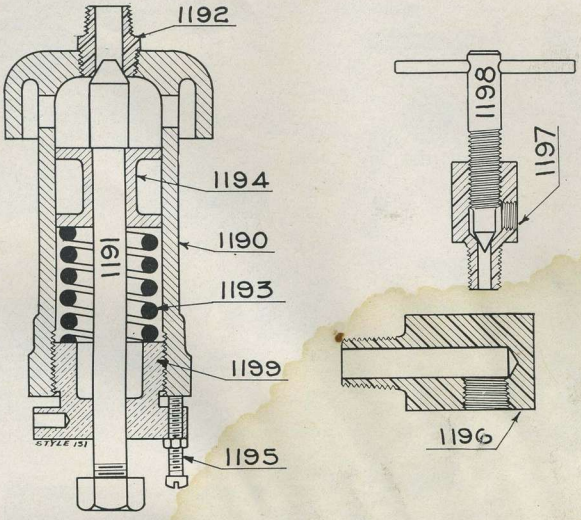
A pressure lubricating relief valve, used in connection with the lubricating oil sump and pressure pump, is used to maintain a constant and determined pressure of the lubricating oil on its course through the engine. To adjust the valve, first loosen the adjusting screw nut and then tighten or loosen the adjusting screw to suit requirements desired. Then tighten the adjusting screw nut back again.

ADJUSTMENT OF SAFETY VALVE:

If while the engine is running the saftey valve should blow off (at ordinary running speed) and the spray valve is known to be tight, then it indicates that the safety valve spring is weak or seat of valve is pitted.

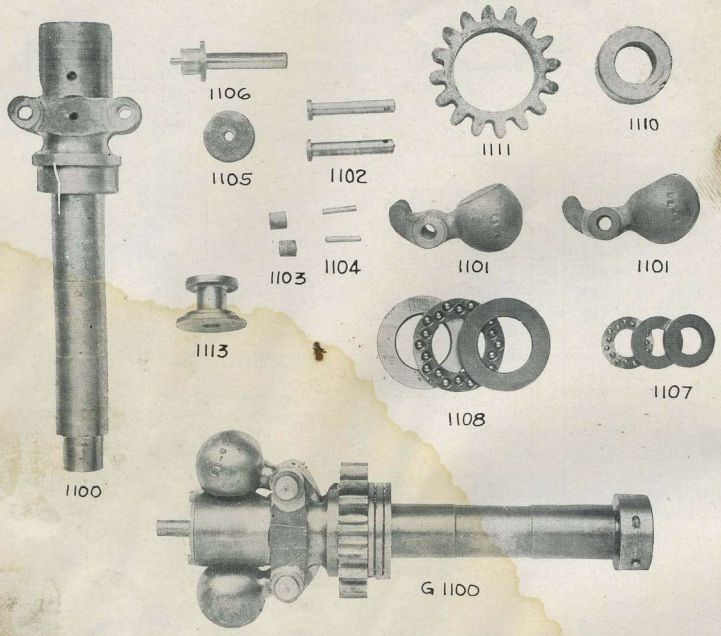
To remedy this, tap very lightly the end of the valve stem with a hammer and with a wrench on valve nut turn valve slowly while tapping. This will cause the valve to reseat itself; if blowing still continues increase tension of the valve spring by turning the adjusting nut until sufficient tension has been exerted on the the valve spring to cause the valve to cease from blowing.

Cylinder Relief Valve or Safety Valve



G1190	Valve, complete; Part Nos. 1190, 1191, 1192, 1193, 1194, 1195, 1199.	1195	Adjusting screw lock
1190	Body	1196	Cylinder plug
1191	Stem	G1197	Snifter valve, complete; Part Nos. 1197, 1198.
1192	Seat	1197	Snifter valve body
1193	Spring	1198	Snifter valve stem
1194	Spring collar	1199	Adjusting screw

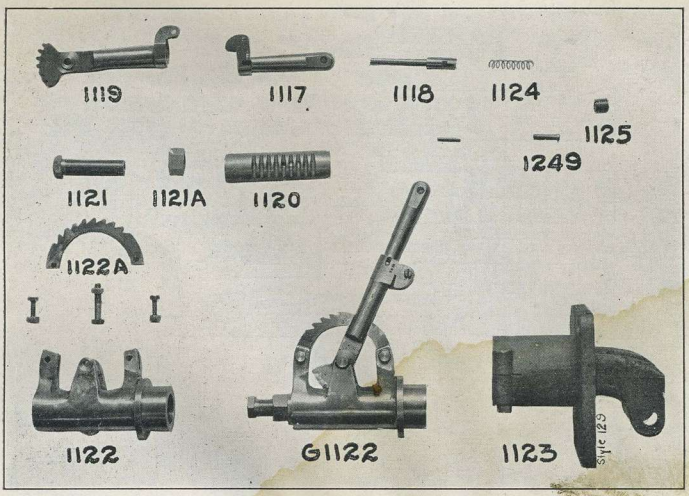
THE function of the cylinder relief valve is to safeguard against excessive pressure in case too much fuel has been admitted to any one cylinder or in case fuel is admitted and ignited before the engine obtains sufficient speed, in which case the pressure may rise excessively. Excess pressure escapes through these relief valves. It is just as essential to acertain from time to time that these valves are in working order as it would be to ascertain at regular intervals that a safety valve on a boiler is in working order. At least once a week they should be tried out. By inserting a screw driver or some such instrument between the nut on the end of the valve stem and the spring tension gland you can raise the valve from its seat while the engine is running allowing a blast of air or fire to blow from the valve for one or two strokes only. If the valve appears to leak, tap the end of the valve stem lightly with the wrench which will make the valve seat itself again. Care must be taken not to allow these valves to leak as the heat would soon destroy the valve seat and make them useless. A small needle valve called the snifter valve, located on the cylinders, on the operating side of the engine, for the purpose of opening up, to see if the cyinders are functioning properly.



GOVERNOR

G1100	Governor, complete; Part Nos. 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1113
1100	Governor body (always supplied with No. 1111 fitted on)
1101	Governor weight
1102	Governor weight pin
1103	Governor weight roller
1104	Governor weight roller pin
1105	Governor weight roller plate
1106	Governor thrust quill
1107	Governor thrust quill ball bearing, small
1108	Governor body ball bearing, large
1109	Governor shaft
1110	Governor body collar
1111	Governor pinion
1113	Governor thrust quill bushing

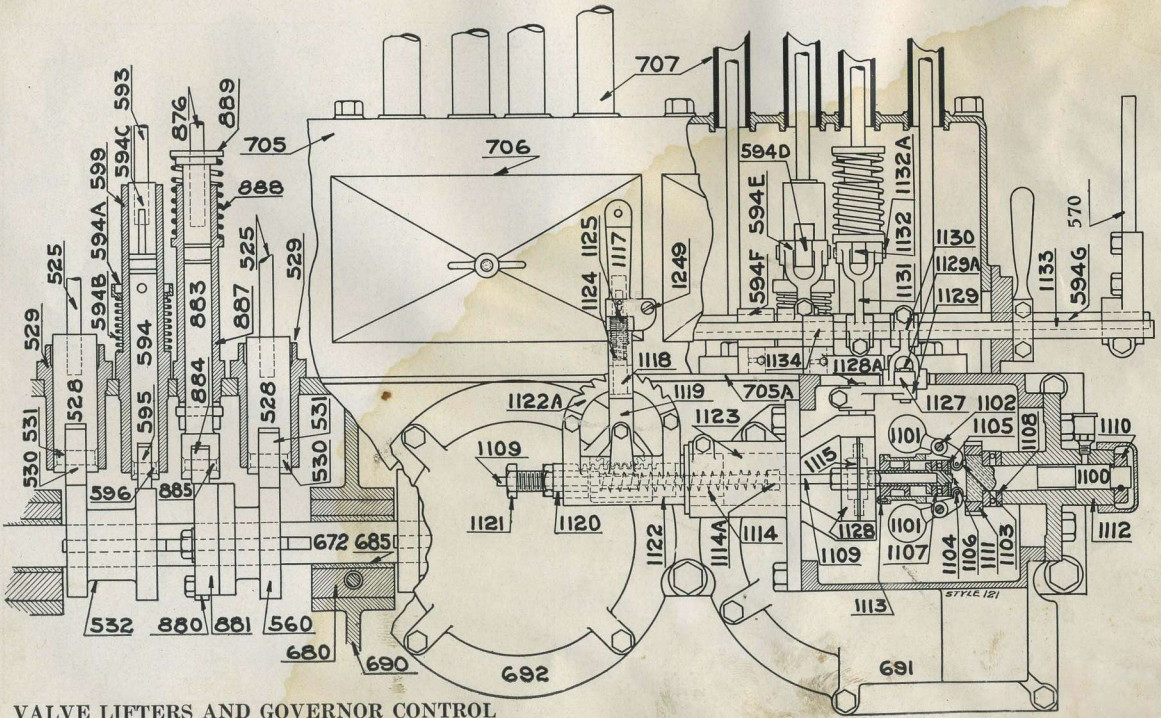
Always Give Part Name, Part Number and ENGINE NUMBER



GOVERNOR SPEED CONTROL

1114 Compression spring
G1117 Control handle, complete; Part Nos. 1117, 1118, 1119, 1124, 1125, 1249.
1117 Control handle
1118 Control handle pawl
1119 Control handle sector
1120 Rack for compression spring
1121 Rack adjusting screw
1122 Speed control socket with sector
1122A Speed control socket sector
G1122 Governor speed control handle, compete; Part Nos. 1117, 1118, 1119, 1120, 1121, 1122, 1122A, 1124, 1125, 1249.
1123 Governor control socket bearing
1124 Control handle pawl spring
1125 Control handle pawl spring screw
1249 Control handle screw

Always Give Part Name, Part Number and ENGINE NUMBER



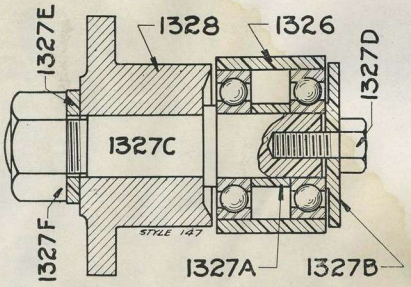
VALVE LIFTERS AND GOVERNOR CONTROL

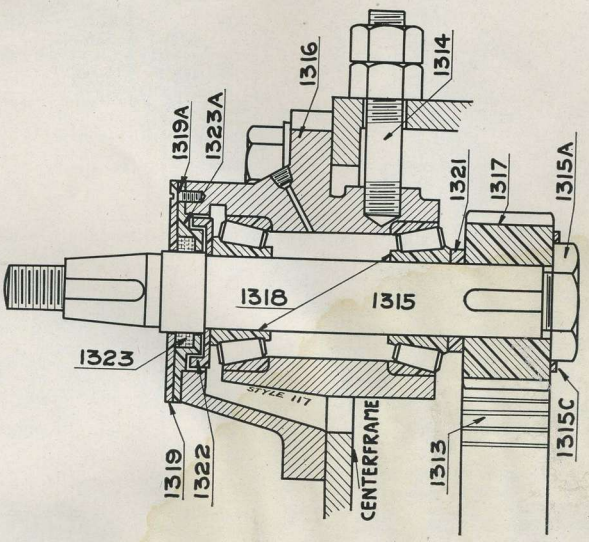
VALVE LIFTERS AND GOVERNOR CONTROL

525 Push rod, inlet or exhaust valve
528 Lifter with roller and pin, inlet or exhaust valve
529 Lifter guide, inlet or exhaust valve
Lifter guide cap screw
530 Lifter roller
531 Lifter roller pin
532 Inlet and air starting cam
Inlet and air starting cam key
560 Exhaust cam
Exhaust cam key
G570 Air starting handle, complete
570 Air starting handle
Air starting handle top
Air starting handle clamp cap screw
593 Air starting valve push rod
594 Air starting valve lifter with roller and pin
Air starting valve lifter pin
594A Air starting valve lifter collar
594B Air starting valve lifter spring
594C Air starting valve lifter rod socket
594D Air starting valve lifter wedge
Air starting valve lifter wedge pin
594E Air starting valve wedge fork
Air starting valve wedge fork pin
594F Air starting valve wedge fork bearing
Air starting valve wedge fork bearing set screw
594G Air starting valve wedge shaft
595 Air starting valve lifter roller
596 Air starting valve lifter roller pin
599 Air starting valve lifter guide
Air starting valve lifter guide cap screw
672 Cam shaft
680 Cam shaft bearing
685 Cam shaft bushing
690 Centerframe
691 Governor door
Governor door cap screw
692 Centerframe door (round)
Centerframe door cap screw
705 Valve lifter guide housing
Valve lifter guide housing stud
Valve lifter guide housing stud nut
705A Valve lifter guide housing flat cover
705B Valve lifter housing end plate
706 Valve lifter guide housing cover
707 Valve lifter guide housing push rod tube
876 Spray valve push rod
880 Spray valve cam toe
Spray valve cam toe cap screw
Spray valve cam toe cap screw washer
881 Spray valve cam disc
883 Spray valve lifter with roller and pin
884 Spray valve lifter roller
885 Spray valve lifter roller pin
887 Spray valve lifter guide
Spray valve lifter guide cap screw
888 Spray valve lifter guide spring
889 Spray valve lifter push rod socket
1112 Governor bearing
1114 Governor compression spring
1114A Governor compression spring collar
1114B Governor compression spring quill
Governor compression spring quill bushing screw
1115 Governor compression spring block
1117 Governor control handle
1122 Speed control socket
1122A Speed control socket sector
1122B Speed control socket handle pin
Governor control socket bearing cap screw
Governor control socket bearing clamp cap screw
1123 Governor control socket bearing
Governor control socket bearing cap screw
1127 Connecting rod between forks
1128 Governor fork
1128A Governor fork shaft
Governor fork shaft clamp cap screw
1129 Lever on vertical shaft
1129A Vertical shaft lever pin
1130 Fork on wedge shaft
Fork cap screw
1131 Governor wedge fork
1132 Fuel control wedge
1132A Fuel control wedge pin
1133 Fuel control shaft
1134 Fuel control shaft bearing
1134A Fuel control shaft bearing nut
1135 Governor fuel shaft tension spring
1136 Governor fuel shaft tension spring clamp
1138 Governor fuel shaft handle

CHAIN IDLER ROLLER

1326 Chain idler roller
1327 Chain idler roller ball bearing
1327A Chain idler roller ball bearing spacer
1327B Chain idler roller ball bearing collar
1327C Chain idler roller shaft
1327D Chain idler roller shaft cap screw
1327E Chain idler roller shaft washer
1327F Chain idler roller shaft nut
1328 Chain idler roller bearing

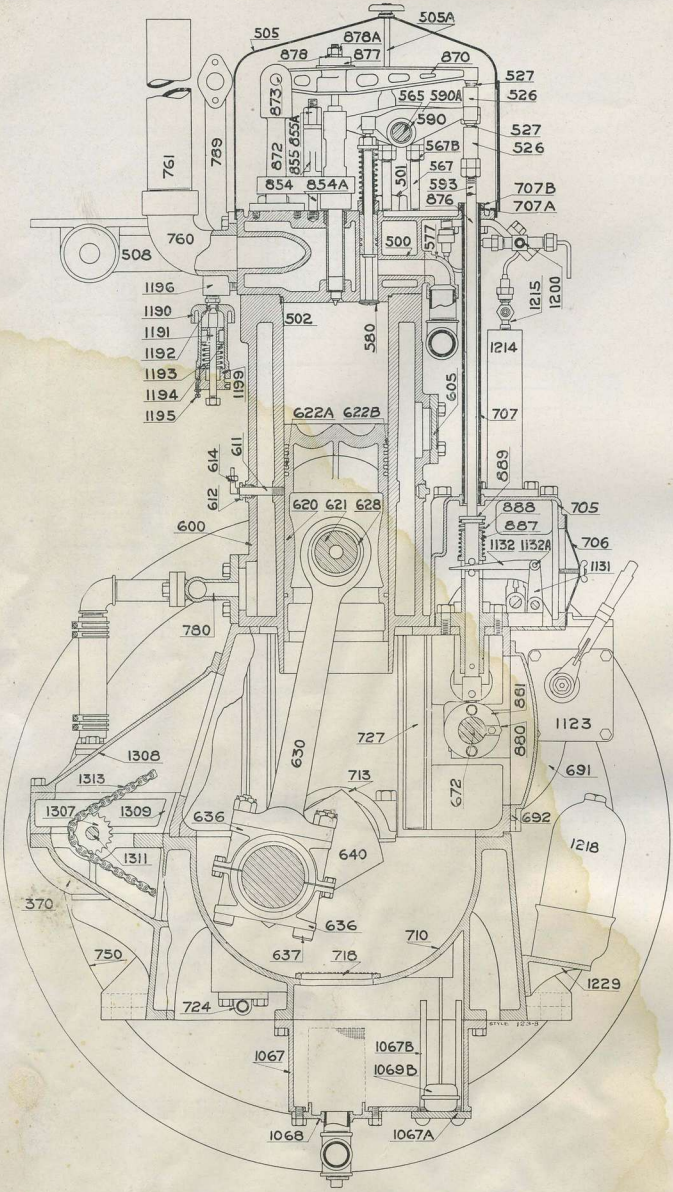




FAN SPINDLE AND BEARING

G1316 Fan spindle bearing, complete; Part Nos. 1314, 1315, 1315A, 1315C, 1316, 1317, 1318, 1319, 1319A, 1321, 1322, 1323, 1323A.
1313 Silent chain
1314 Fan spindle silent chain adjusting screw
Fan spindle silent chain adjusting screw nut
1315 Fan spindle
1315A Fan spindle nut
1315C Fan spindle nut lock washer
1316 Fan spindle bearing
1317 Fan spindle chain sprocket
1318 Fan spindle roller bearing
1319 Fan spindle steel cover
1319A Fan spindle steel cover screw
1321 Fan spindle spacer
1322 Fan spindle spacer washer
1323 Fan spindle felt washer
1323A Fan spindle felt washer retainer ring
Fan spindle bearing stud
Fan spindle bearing stud nut
Fan spindle bearing stud washer
Fan spindle sprocket key
Fan spindle nut lock washer screw

Always Give Part Name, Part Number and ENGINE NUMBER

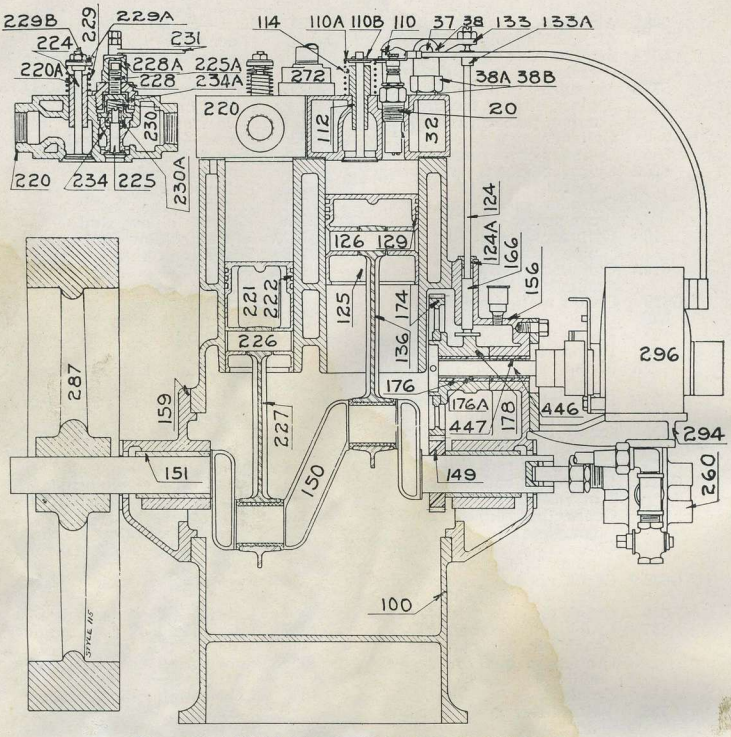


SECTIONAL VIEW OF DUST PROOF TYPE ENGINE

Dustproof Type

508 Air suction pipe
577 Air starting pipe elbow
577A Air starting pipe elbow gasket
577B Air starting pipe, including pipes, elbows, tee, flanged union, petcock, gaskets
600 Cylinder
605 Cylinder clean out cover
605A Cylinder clean out cover gasket
Cylinder clean out cover cap screw
610 Cylinder water by pass pipe
610A Cylinder water by pass pipe gasket
G620 Piston with rings and pin
620 Piston
621 Piston pin
622 Piston ring (double ring)
622A Piston ring, ¼" double seal
622B Piston ring, ¼" step cut
628 Piston pin bushing
G630 Connecting rod with ball check and bushing
630 Connecting rod, drilled
G632 Connecting rod ball check, assembled
632 Connecting rod ball check, complete
634 Connecting rod foot shims (state thickness)
G636 Crank pin box, assembled; Part Nos. 636, 637
636 Crank pin box, 2 halves
637 Crank pin box bolt
Crank pin box bolt nut
Crank pin box cap screw and nut
640 Crank shaft
706 Valve lifter guide housing door
710 Base
712 Base cap, flywheel end
713 Base cap, center
717 Base cap stud
Base cap stud nut
718 Base lubricating oil strainer
719A Base cap shim, flywheel end
720A Base cap shim, center
722A Base cap shim, opposite flywheel end
724 Base oil pipe flange with pipes fitted in
Base oil pipe flange cap screw
727 Base—centerframe cylinder stud
727A Base centerframe cylinder stud washer
727B Base centerframe cylinder stud nut
729 Base frame stud
730 Frame—cylinder stud
731 Base frame, stud, air compressor end
760 Exhaust elbow
761 Exhaust pipe
764 Exhaust elbow stud
764A Exhaust elbow stud nut
780 Water inlet pipe
780A Water inlet pipe gasket
Water inlet pipe flange to compressor
Water inlet drain cock
Water inlet drain cock nipple
Water inlet pipe cap screw
789 Water outlet pipe
Water outlet pipe cap screw
789A Water outlet pipe gasket
854 Spray valve clamp
854A Spray valve clamp stud
855 Spray valve clamp bridge
855A Spray valve clamp stud nut
870 Spray valve rocker
872 Spray valve rocker stand
873 Spray valve rocker stand pin
876 Spray valve rocker push rod
1067 Lubricating oil sump
1067A Lubricating oil float guide flange
1067B Lubricating oil float guide stud
1068 Lubricating oil strainer cage
1087 Pressure lubricating oil gauge—30 lbs.
1218 Fuel oil purolator
1229 Purolator bracket
1287 Lubricating oil purolator
1306 Chain sprocket, driver
1307 Chain sprocket, driven
1308 Chain shield
Chain shield cap screw
1309 Chain shield cap
1310 Ball bearing container
1311 Chain sprocket shaft
1312 Chain sprocket shaft ball bearing
1313 Silent chain

Always Give Part Name, Part Number and ENGINE NUMBER



NO. "0" AUXILIARY AIR COMPRESSOR

Always Give Part Name, Part Number and ENGINE NUMBER

AUXILIARY COMPRESSOR

In ordering all repair parts for compressor BE SURE and give BOTH the part name and number, also ENGINE NUMBER of auxiliary.

20 Spark plug
32 Engine cylinder head
33 Engine and pump cylinder head stud
33A Engine and pump cylinder head stud, long
33B Engine and pump cylinder head stud nut
37 Rocker pin
38 Rocker pin fork
38A Rocker pin fork stud
38B Rocker pin fork stud nut
100 Cylinder and frame
110 Inlet or exhaust valve
110A Valve stem cup
110B Valve stem cup lock
112 Valve stem bushing
114 Inlet valve spring
114A Exhaust valve spring
124 Exhaust rocker push rod
124A Exhaust rocker push rod bushing
125 Engine piston
126 Engine piston pin
129 Engine piston ring
133 Exhaust rocker with adjusting screw
133A Exhaust rocker ball socket
136 Engine connecting rod
149 Crankshaft pinion
150 Crank shaft
151 Crankshaft bushing
156 Crankshaft bearing
159 Crankshaft bearing, flywheel end
160 Crankshaft bearing cap screw
163 Frame cover door
163A Frame cover door clamp
163B Frame cover door clamp wing nut
163C Frame cover door clamp stud
166 Cam lifter
174 Cam gear
176 Cam gear pin
176A Cam gear pin bushing
178 Exhaust cam and gear hub
202 Breather pipe
220 Air pump head
220A Air pump head valve stem bushing
221 Air pump piston
222 Air pump piston ring
224 Air pump inlet valve
225 Air pump outlet valve
225A Air pump outlet valve adjusting screw
226 Air pump piston pin
227 Air pump connecting rod
228 Air pump valve nut
228A Air pump outlet valve cap
229 Air pump inlet valve spring
229A Air pump inlet valve spring guide
229B Air pump inlet valve spring guide nut
230 Air pump outlet valve spring
230A Air pump outlet valve spring guide
231 Air pump relief handle
234 Air pump outlet valve bushing
234A Air pump outlet valve bushing cap
240 Carburetor
260 Rotary pump
260A Rotary pump cap screw
272 Water outlet flange
287 Flywheel
294 Magneto bracket
296 Magneto
446 Magneto drive shaft
447 Magneto drive shaft bushing
G2441 Lubricator assembled
2441 Lubricator bottom with air pipe
2441A Lubricator valve
2441B Lubricator spring
2441C Lubricator washer and nut
2442 Lubricator top with stem
2442A Lubricator clamp stud
2442B Lubricator clamp stud nut
2443 Lubricator plug with stem
2443A Lubricator glass

Always Give Part Name, Part Number and ENGINE NUMBER

METHOD OF CLEANING PUROLATORS

Stop engine and drain purolator.

Remove case of element, this is done by taking out nut on top of purolator.

Wash element thoroughly in gasoline or kerosene.

Drain element and replace.

Place shell over element, and push down over stand pit.

Replace nut and gasket and tighten.

High Pressure Fuel Pumps

THE fuel pumps are of the plunger type with ½-inch diameter, hardened and ground plungers. These pumps are required to pump the fuel up to the required pressure of 3500 pounds, and for that reason are very closely fitted. It is necessary to use care in packing these plungers. The packing glands should never be screwed down so hard as to make the gland absolutely tight. It is essential that a small amount of fuel oil be allowed to work up through the packing, and thereby lubricate the plunger.

A quantity of packing is furnished with each engine. If the packing gland is screwed down too tight the packing will become dry and hard, and thereby cause the plunger to wear. The lower ends of the suction valves extend sufficiently below the valve bodies so that they can be reached by hand, turned around and moved with the fingers, if they stick. If a valve should be too tight at the stem it can be polished off with fine emery cloth, care being observed not to take off too much. In most cases it can be loosened by moving it up and down and twisting it around with the fingers.

Radiator

USE only clean water in radiator. If necessary haul the water. Avoid water which when boiled will leave a hard deposit or scale as it will clog up and decrease the efficiency of the radiator and cooling jackets. Do not use fuel oil barrels or oily or greasy tanks to haul water in. Grease or oil, even in a very small quantity in the radiator water, decreases the efficiency and results in trouble.

For full efficiency of radiator it is also essential that the outside should be kept clean and free from oil and dirt as any foreign matter on the outside surfaces of the radiator seriously effects its efficiency. Keep the front of the radiator clean at all times so as to have no obstruction to hinder or block the fan. It is a good practice to clean the outside of the radiator at times by using a hose with compressed air.

Pure water should be used in the radiator in the summer time and in countries where the temperature does not drop below freezing.

In cold weather where the system is apt to freeze up a quantity of denatured alcohol should be added to the water to prevent freezing. The percentage of alcohol should be increased in accordance with the degree of temperature below freezing as indicated in table below.

DENATURED ALCOHOL	WATER	BEGINS TO FREEZE AT DEGREES FAHRNHEIT
10%	90%	17 above zero
20%	80%	19 above zero
30%	70%	10 above zero
40%	60%	—2 below zero
50%	50%	—18 below zero

TAKE SPECIAL NOTICE

1. **A SMOKY ENGINE OR LOSS OF POWER IS DUE TO:**

Fuel Valve: Leaks, stem is clogged, nozzle is worn out, tension on spring too close, or not timed properly, or all of the cylinders are not firing properly.

Exhaust Valves: Leaks, stem stuck in guide or not timed properly.

Intake Valve: Leaks, stem stuck in guide or not timed properly.

Loss of Compression: Leaky cylinder relief valve, cylinder head gasket leaking, too low a piston (extra clearance due to wear and adjustment of connecting rod brasses and main bearings, change to a higher altitude or piston rings stuck in their grooves.

Too low fuel oil pressure. Engine running at too slow a speed.

Too much lost motion in governor parts. Wrong kind of fuel oil.

2. **BE SURE TO:**

Oil all moving parts with regularity. Watch lubricating oil pressure.

Squirt a little coal oil (kerosene) on each exhaust and intake valve stem previous to each time engine is started. This is not necessary if the engine has just been stopped and is started soon again.

Always slow engine down while you are idling.

Keep correct amount of lubricating oil in sump or supply tank.

Change lubricating oil when necessary (usually from 250 to 300 hours engine running time). Clean oil strainer every two weeks—oftener if required.

Draw water off bottom fuel oil tank and strainers as often as required to keep water out of engine. Always keep the engine clean.

Be sure to examine various parts of the engine while it is running to make sure that none of the parts have become overheated. This is also a good test to see if the circulating water is circulating properly and the lubricating oil is o. k.

Stationary Plant Installation

INSTALLING of Diesel engines must be carefully done in order to obtain the best results; and our suggestion is, to begin with, that

AIR TANKS:

Should be made very strong, and should be tested at least 100 per cent above the ordinary working pressure. Tanks should be as near the engine as possible. Tanks should be so placed that the pipes leading in and out be connected above the center of the tank, so that the tank itself will form a settling chamber in which water and oil carried in the air will be deposited in the bottom of the tank. A reasonable size, say one inch (1 ″), clean out plug should be placed in the bottom of the tank at the lowest point and a drain valve of about ½-inch size screwed into the plug. This valve should be opened to allow water and oil to be drained from the tank at frequent intervals of at least twice a week when engine is running steadily.

AIR PIPING:

All air piping should be good grade iron pipe and should never be of smaller diameter than the opening in the air tanks, use heavy malleable fittings (no cast iron fittings). The piping should be done so that there is no trap or depression to the pipe which can fill up with oil or water.

The pipe should have a slight pitch either towards the tank or towards the compressor, preferably towards the tank. If pipe has a pitch toward compressor put in a drain at lowest point. After the pipes are cut to lengths, they should be thoroughly cleaned from cuttings, and ends of pipes reamed so as to remove all sharp edges and chips from ends of pipe. Pipes should be screwed together with shellac (use no white lead or red lead in air connections).

The air tank must be securely fastened so that it cannot move and thereby break the pipe connection. The pipes should be so connected as to allow a reasonable amount of spring without the possibility of pipes breaking. It must be remembered that the weakest part of the pipe is always where the threads are cut. All pipes should be securely fastened with pipe straps to prevent excessive vibration. The interior of air tanks should also be coated with shellac before installing; which is done in the following manner: Plug all holes except one. Pour a quantity of shellac into the tank and plug the last hole. Roll the tank around and stand the tank on one end, then on the other, until the shellac has thoroughly covered all interior surfaces of the tank. Then open one plug and allow the surplus shellac to be drained out thoroughly before tank is placed. A substantial heavy duty valve should be placed in the pipe line close to the tank. When the engine is shut down for the night this valve should be shut tight so as to hold air pressure for the next time the engine is to be started. This will eliminate using the auxiliary engine every day when starting.

TESTING AIR PIPING AND AIR TANKS:

After the tank and piping are in place, pump up air pressure with the auxiliary compressor; and see that all joints are positively tight. On stationary installations a good grade globe valve should also be placed on the air line between the hand air starting valve on the engine and the tank, so that when the engine is started no air can pass by the hand air starting valve, which being of the quick opening gate valve type is never to be relied upon as being exactly tight. It is impossible to maintain quick opening gate valves in absolute tight conditions.

INSTALLING OF FUEL TANK AND FUEL PIPING:

It is a well known fact that grit, scale and dirt in the fuel piping is one of the most annoying things that can happen to the Diesel engine; hence, the fuel tank and fuel piping should be made with as much care as we have recommended with the air piping. The fuel tank must be thoroughly cleaned, after which it must be shellaced on the inside in the same manner as the air tank. It must be remembered that the fuel carries a great deal of sulphur and for that reason it will attack the walls of the tank and cause scale to get into the piping.

The fuel tank must have a liberal size drain opening at the bottom for cleaning out, with valve or stop-cock. The feed pipe leading from tank to fuel pump on engine should be connected an inch or so above the bottom of the tank to prevent sediment from entering the feed pipe. A good globe valve should be placed right close to the tank so that the pipe may be disconnected for cleaning out without having to drain the tank. Ends of all pipes should be carefully reamed and all piping shellaced inside. All joints should be made with shellac (no white lead or red lead will do); and pipes should be carefully cleaned out before final connection.

On larger installations it is advantageous to install a trap at the extreme lower end of the fuel piping so that any sediment reaching there can be cleaned out. This can be made with a tee, and short drop pipe with plug in the bottom of the drop pipe.

LUBRICATING OIL TANKS AND PIPES:

Where a lubricating oil tank is being installed, same must also be clean and free from dirt, scale, etc. Piping for lubricating oil should be made preferably of brass or copper to prevent scale from peeling off the pipe and getting into the bearings. Connect up all lubricating oil piping with shellac.

CIRCULATING WATER PIPES:

Circulating water pipes should be carefully made to see that there are no leaks. Make pipe of ample size to avoid friction, and make provisions at the lowest point of pipes for drainage of the entire circulating system, both for the auxiliary engine, and for the main engine. This prevents freezing in cold weather and makes it possible to wash out any mud or sediment that may enter the circulating system.

ALIGNING ENGINE AND FLYWHEEL MAINTENANCE:

It is of vital importance to have the engine carefully lined up to its work, in order to have it run smoothly. When the engine is properly fastened to its foundations and lined up to its work and all pipe connections made and tested to see that they are tight, then see to it that the flywheel is tight on the shaft. It is very important that the flywheel be securely tightened to shaft. In order to accomplish this, the hub is split on one side, and massive bolts used to clamp the hub together with. These bolts must be tightened up as tight as it is possible to make them without stripping the threads.

It is a good practice to try the nuts on these bolts at regular intervals, say once a month, to make sure that they have not slackened in any way. If a flywheel should be slightly loose on the shaft it may sound as if every connecting rod is loose or the sound may be transferred to the gearing or other machinery attached to the engine. If a flywheel is allowed to be loose serious trouble may be encountered as it will soon become sufficiently loose to do great damage to the crankshaft, flywheel, and other parts of the engine.

STARTING LEVER:

The starting lever is located on the end of the centerframe on the flywheel end on the operating side. When the lever is leaning toward the exhaust side it is in running position. When the lever is leaning toward the operating side it is in starting position. The starting valve should be used only long enough to give engine a good start, that is just enough to turn engine over a few revolutions, and then released from action.

Preparing For Starting New Engine First Time After Installing

WHEN the engine has been installed and all pipe connections made and tested to see that they are tight and in order, the next thing is to pump up air pressure in the air starting tanks. To do this, start the little auxiliary engine and pump up the air pressure to approximately 200 pounds. Test the safety valve on the auxiliary engine to see that the safety valve on the main engine compressor is in order and will blow off at about the same pressure. (The time required to charge these air tanks depends on the size of the tanks but will average about 15 minutes to each tank.) See that the inside of the engine base is clean and free from foreign substances.

Fill lubricating oil sump with good Diesel engine cylinder oil up to its normal oil level.

Put fuel oil in fuel tank. Care should be taken that no grit or dirt enters the tank, and the fuel should be strained through a very fine gauze strainer, preferably using a large funnel with a fine gauze strainer in it. After enough fuel oil has been put in the tank drain small quantity off and fill small gravity tank with fuel oil. Open valve leading to fuel strainer on engine and see that the fuel oil flows freely to the strainer and to the high pressure fuel pumps.

See that there is sufficient oil in the cylinder force feed lubricator.

Oil all rockers and pins and see that everything is well oiled and free from dirt or grit. See that all oil holes are clean and free from dirt. Move governor speed control handle to half speed position. Bar flywheel over until pointer on engine corresponds to about 45 degrees past top center of any cylinder. (Flywheel is marked to indicate top center on any cylinder as well as marked for valve settings.)

It may be necessary to disconnect blind union on top of the fuel pump in order to eject all the air in the lines, then pump up the fuel pressure with hand pump until fuel gauge registers about 2000 pounds. See that all isolating valves on fuel manifold are open. See that everything is clear and free from obstruction.

See that the air starting lever is in running position. Open the globe valve in the air line near the tank. Then open the air globe valve on air starting manifold on engine and when ready to start the engine, merely pull the starting lever over from running position to air starting position. The engine will then start to run. As soon as the engine has made a couple of revolutions and has picked up speed enough, place the starting lever back into running position. It is important to do this as quickly as possible in order to save air. The globe valve on the air manifold should then be shut off tight and the small drain cock in air manifold should be opened to drain off any residue that might be in the pipe between the globe valve and air starting valves. It is important that this globe valve be shut off, as it will relieve any undue pressure on the air starting valves and also in case the air starting valve should leak slightly it would blow into the cylinders and cause loss of power.

When first starting a new engine there are many little things that may hinder the machine from starting readily, such as dirt from the pipes getting into the valves, etc.

Regulate the governor to the proper speed by speed control handle, No. 1117. Next adjust the fuel relief valve to the proper pressure which for normal load should be 3500 pounds, for light load a lesser pressure can be used, and for idling 1000 pounds pressure is quite sufficient.

On a cold morning when the lubricating oil is stiff and for that reason engine hard to turn over, it may be advisable to prime engine before starting. To do this, proceed as follows:

Pump up fuel pressure to about 1000 pounds pressure, then lift spray valve rocker by hand until oil pressure is relieved, thus allowing a small amount of fuel oil to enter the cylinder. Pump up fuel pressure again and lift the next spray rocker in the same manner and repeat until all cylinders are primed.

See that the engine is working on all cylinders. If one is not firing open up the small snifter valves (1198) one at a time and close them again to ascertain which cylinder is not firing. In order to start the missing cylinders to fire it may be necessary to raise the spray valve rockers slightly and quickly by means of a small pry, thus allowing an additional amount of fuel to the point of that particular nozzle. This gives it a chance to get rid of any air that may be lodged in the spray nozzle. As soon as engine is started see that the circulating water is running freely through the engine and that all cylinders and cylinder heads are maintained at a uniform temperature. In making this first start it is necessary to investigate and see that every part is functioning properly and that the fuel positively reaches each spray nozzle, that all valves are seating properly and do not allow any pipe connections to be leaky. It is advisable to run the engine at first idle for a short time until everything gets in good running order before applying the load.

When the main engine is running the main air compressor should be started so as to pump up pressure in the air tanks for the next time the engine is to be started. When the engine is cold it will require approximately 150 to 200 pounds pressure on the air in order to give the engine sufficient speed to start properly. If the engine has been shut down only for a short period and is still warm it will start on considerably less air. It is possible to start it on air as low as 30 pounds per square inch. If the operator is careful with his air and uses it economically in starting there should be no occasion to ever use the auxiliary engine again unless after piping had been taken apart for some reason or other or the air lost by valves being left open, as the air tanks are tight and when the engine is shut down the valves properly closed off, air pressure should remain in the tanks from one day to another sufficient to start the engine again without having to use the auxiliary engine. In many instances the auxiliary engine is not used oftener than once a month unless it is used for other purposes than compressing air for starting.

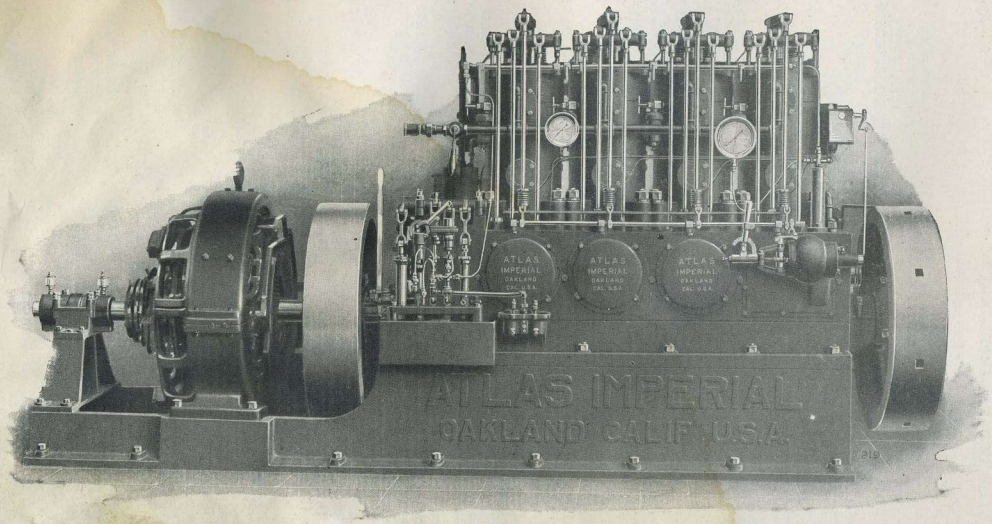
All engines are properly tested at the factory before shipping and all valves adjusted to the proper setting; this may become altered, however, in installing and if the engine does not run correctly when first started it may be that the valve setting should be gone over especially the opening and closing time of the spray valves which is very important. When the engine is running at normal load and all valves timed properly the exhaust should be almost clear. Black smoke indicates that either too much fuel is admitted into the cylinders or that the spray nozzle is not functioning properly. When starting a new engine it is possible that the holes in the

spray nozzles become clogged or partly clogged by particles of metal from the piping. When this happens the fuel oil is unequally distributed in the cylinder which causes smoky exhaust and vibration.

When starting a new engine use every precaution to see that the lubricating oil is flowing freely through the pumps and that the lubricating pump is maintaining at least 5 pounds pressure on the lubricating oil gauge.

After all adjustments are made and the engine runs smoothly and all parts functioning properly then it is a simple matter after that to operate the engine, start, stop, etc. When stopping the engine, first release the governor control handle to slow speed. Then pull fuel wedge lever which is located on the end of the fuel lifter housing on the flywheel end toward the operating side which cuts off the fuel to the engine, be sure to hold lever out till engine comes to dead stop. Quick stopping of the engine will come about due to the compression in the cylinders without fuel. Then shut off the fuel oil valve between the gravity (day) tank and the high pressure fuel pumps and close the valves on the air tanks tight to prevent loss of air pressure.

When starting the engine after they have been fully adjusted open the air valves on the tanks, turn on fuel from gravity tank and also from main tank to supply tank. Pump up about 200 pounds pressure with the small priming hand pump. Oil all rockers, etc., see that the flywheel is in proper position for starting, open gate valve on the air line, pull the starting lever over from running to starting position and as soon as the engine starts to turn over throw the starting lever back into running position. See that all cylinders start properly, shut gate valve off again, let air compressor on main engine pump up air pressure again so as to be prepared for the next start, see that circulating water is running properly and that lubricating oil pressure shows the proper amount on gauge. When the engine is first started it is possible that the exhaust will show smoky for a short time but after the engine has run from 10 to 15 minutes the exhaust should be nearly clear.



DIESEL GENERATOR SETS ARE MADE IN THREE, FOUR, AND SIX CYLINDER TYPE, EITHER DIRECT CONNECTED AS SHOWN ABOVE OR BELTED. IN HORSE POWERS RANGING FROM 30 H. P. TO 750 H. P.

PARTS LIST

Atlas Imperial Diesel Engine—Dust Proof Type.

INSTRUCTIONS

In ordering parts **BE SURE** to give the following information:

First—Name of Part Wanted.

Second—Number of Part Wanted.

Third—Engine Number (found on name plate on centerframe).

Fourth—Shop Number of machine on which Engine is mounted.

Fifth—Give Bore and Stroke of Engine.

IMPORTANT—RECHECK ALL NAMES AND NUMBERS TO BE SURE THAT THE CORRECT INFORMATION IS GIVEN.

The letter "G" in front of any number in the list indicates that that certain part comes in group or assembled form and contains **ONLY** those parts which are given.

Part No.	Part Name
G370	Centrifugal pump, complete; Part Nos. 370, 370B, 371, 371A, 371B, 372, 373, 373A, 373B, 374, 374A, 379, 381, 381A, 383, 386, 386A
370	Centrifugal pump body
	Centrifugal pump body pipe plug
370F	Centrifugal pump body drain cock
370E	Centrifugal pump body drain cock nipple
370A	Centrifugal pump inlet or outlet flange
370C	Centrifugal pump inlet or outlet flange gasket
370B	Centrifugal pump grease cup
370C	Centrifugal pump flange cap screw
370D	Centrifugal pump holding down cap screw
371	Centrifugal pump cover
371A	Centrifugal pump cover screw
371B	Centrifugal pump inlet flange
371C	Centrifugal pump cover gasket
	Centrifugal pump flange cap screw
372	Centrifugal pump runner with shaft No. 379
373	Centrifugal pump shaft gland
373A	Centrifugal pump shaft gland stud
373B	Centrifugal pump shaft gland stud nut
374	Centrifugal pump shaft bushing
374A	Centrifugal pump shaft flax packing
379	Centrifugal pump runner shaft
381	Centrifugal pump steady bearing
381A	Centrifugal pump steady bearing cap screw
381C	Centrifugal pump steady bearing clamp screw
383	Centrifugal pump radial thrust ball bearing
384	Centrifugal pump shaft coupling
386	Centrifugal pump ball bearing housing
	Centrifugal pump ball bearing housing clamp screw
386A	Centrifugal pump ball bearing retainer
	Centrifugal pump ball bearing retainer lock set screw
	Centrifugal pump shaft guard
	Centrifugal pump shaft guard bracket
	Centrifugal pump shaft guard racket screw
	Centrifugal pump shaft guard bracket cap screw
G500	Cylinder head, complete; except spray valve
GA500	Cylinder head, with valves and springs only (no spray valve)
500	Cylinder head
501	Cylinder head stud
501A	Cylinder head stud, special for lifting head
501B	Cylinder head stud nut

See Instructions for Ordering on Page 56

Part No.	Part Name
502	Cylinder head gasket
505	Cylinder head dust proof cover
505A	Cylinder head dust proof cover stud and handle
509	Air suction pipe
510	Valve and stem, inlet or exhaust
512	Valve stem bushing
513	Valve spring, inlet or exhaust
514	Valve spring bushing, inlet or exhaust; top
514A	Valve spring bushing, inlet or exhaust; bottom
514B	Valve stem nut
520	Inlet rocker with bushing
520A	Inlet rocker bushings (set of 2)
525	Push rod, inlet or exhaust
526	Pushrod socket
526A	Pushrod socket nut
527	Push rod button—Inlet, exhaust, air and fuel
528	Valve lifter, with roller and pin; inlet or exhaust
529	Valve lifter guide, inlet or exhaust
530	Valve lifter roller, inlet or exhaust
531	Valve lifter roller pin, inlet or exhaust
532	Inlet and air starting cam
550	Exhaust rocker with roller, pins and bushings
550A	Exhaust rocker bushings (set of 2)
560	Exhaust cam
565	Rocker shaft
565A	Rocker shaft oil cup
566	Rocker shaft bearing
567	Rocker shaft bearing stud
567A	Rocker shaft bearing stud nut. top
567B	Rocker shaft bearing stud lock nut
567C	Rocker shaft bearing stud, long
577	Air starting elbow
577A	Air starting elbow gasket
577B	Air starting manifold
578	Air starting globe valve
579	Air starting valve spring bushing
G580	Air starting valve, complete: Part Nos. 579, 580, 582, 583, 584, 585, 586, 588
580	Air starting valve
582	Air starting valve spring
583	Air starting valve spring washer, top
584	Air starting valve nut
585	Air starting valve balance bushing
586	Air starting valve balance bushing ring
588	Air starting valve spring washer, bottom
590	Air starting valve rocker, with roller, pins and bushings
590A	Air starting valve rocker bushings (set of 2)
590B	Air starting valve rocker button
593	Air starting valve rocker push rod
594	Air starting valve lifter with roller and pin
594A	Air starter valve lifter spring collar
594B	Air starter valve lifter spring
594C	Air starter valve lifter rod socket
594D	Air starter valve lifter wedge
594E	Air starter valve wedge fork and pin
594F	Air starter valve wedge fork bearing
594G	Air starter valve wedge fork shaft
594H	Air starter wedge fork pin
595	Air starting valve lifter roller
596	Air starting valve lifter roller pin
597	Air starting cam (see part No. 532)
599	Air starting valve lifter guide
600	Cylinder with studs
605	Cylinder cleanout cover
605A	Cylinder cleanout cover gasket
605B	Cylinder cleanout cover capscrew
610	Cylinder water passover pipe to head
610A	Cylinder water passover pipe rubber grammet
611	Cylinder lubricating pipe through jacket
612	Cylinder lubricating pipe gland
613	Cylinder lubricating pipe packing
614	Cylinder lubricating pipe elbow
G620	Piston, complete; with rings and pin
620	Piston
621	Piston pin
622	Piston ring, ½" double seal
622A	Piston ring, ¼" double seal
622B	Piston ring, ¼" step cut
628	Piston pin bushing
G630	Connecting rod, complete, with bushing and ball check

See Instructions for Ordering on Page 56

Part No.	Part Name
630	Connecting rod, drilled
632	Connecting rod ball check
634	Connecting rod shims
G636	Crank pin box, two halves; complete with bolts
636	Crank pin box, two halves
636A	Crank pin box shims
637	Crank pin box bolts
640	Crank shaft and pinion
644	Crank shaft bushing, flywheel end
646	Crank shaft bushing, center
655	Crank shaft throw off oil ring
660	Crank shaft pinion
664	Intermediate gear
665	Intermediate gear pin
665A	Intermediate gear pin bolt
666	Intermediate gear bearing
666A	Intermediate gear bearing cap screw
666B	Intermediate gear bearing lock set screw
670	Cam gear
672	Cam shaft
680	Cam shaft bearing, center
683	Cam shaft bearing, fan spindle end
685	Cam bushing
688	Cam shaft bushing, fan spindle end
690	Centerframe
691	Centerframe cover and governor shield
691A	Governor door top cover
691B	Governor door front cover
692	Centerframe door
692A	Centerframe door gasket
692D	Centerframe door cap screw
693	Centerframe and rotary pump cover
693A	Centerframe rotary pump door cap
693B	Rotary pump door ball retainer
693C	Rotary pump clamp cap
693D	Rotary pump cap stud
693E	Rotary pump clamp cap stud
695	Centerframe cover, end of frame; top
695A	Centerframe cover, end of frame; bottom
696	Centerframe cover
705	Valve lifter housing
705A	Valve lifter housing steel plate cover
705B	Valve lifter housing end plate
706	Valve lifter housing cover
707	Valve lifter guide push rod tube and nut
710	Base with caps and studs
712	Base cap, flywheel
713	Base cap, center
717	Base cap stud

Part No.	Part Name
718	Base lubricating oil strainer
719A	Base cap shims, flywheel end
720A	Base cap shims, center
722A	Base cap shims, opposite end to flywheel
724	Base oil pipe flange with pipe assembly
727	Base—frame—cylinder studs
727A	Base centerframe cylinder stud washer
727B	Base centerframe cylinder stud nut
729	Base frame stud
730	Base frame stud
750	Flywheel
751	Flywheel coupling
752	Flywheel friction bolt
753	Flywheel hub clamp bolt
753A	Flywheel coupling bolt washer
753B	Flywheel coupling bolt nut
754	Flywheel 1¾" wrench
756	Flywheel pointer
760	Exhaust elbow
760A	Exhaust elbow gasket
761	Exhaust pipe
764	Exhaust elbow stud
764A	Exhaust elbow stud nut
780	Water inlet pipe on cylinder
789	Water outlet connecting pipe
789A	Water outlet pipe gasket
796	High pressure fuel pump discharge fitting
796A	High pressure fuel pump discharge fitting
797	High pressure fuel pump discharge fitting nut
800	High pressure fuel pump body
800A	Fuel pump body nut
801	High pressure fuel pump suction valve
802	High pressure fuel pump suction valve cage
802A	Fuel pump suction union nut
802B	Fuel pump suction union sleeve
	Jewett packing ring
808	High pressure fuel pump gland
809	High pressure fuel pump gland nut
809A	Fuel pump gland lock nut
810	Fuel pump plunger head
810B	Fuel pump plunger nut
811	Fuel pump discharge valve
817	Fuel pump plate
	Fuel pump plate steel cover (front)
	Fuel pump plate steel cover (top)
	Fuel pump plate steel cover screw (large or small)

See Instructions for Ordering on Page 56

Part No.	Part Name
	Fuel pump plate and housing slotted cap screw
822	High pressure fuel pump crank shaft
822A	High pressure fuel pump coupling
822B	High pressure fuel pump coupling bolts
823	High pressure fuel pump crank shaft connecting rod, complete; Part Nos. 823, 824, 824A
824	High pressure fuel pump crank shaft connecting rod cap
824A	High pressure fuel pump crank shaft connecting rod bolts
G828	High pressure fuel pump connecting link and cross-head, assembled; Part Nos. 828, 828A, 831
828	High pressure fuel pump connecting link
828C	High pressure fuel pump connecting link pin
829	High pressure fuel pump crosshead guide
831	High pressure fuel pump crosshead
831A	High pressure fuel pump crosshead nut
831B	High pressure fuel pump crosshead button
831C	Fuel pump crosshead bushing
831D	Fuel pump crosshead oil guard
846	Fuel pump housing
	Fuel pump housing stud
	Fuel pump housing stud nut
847	Fuel pump housing cover
	Fuel pump housing cover hinge
	Fuel pump housing cover hinge screw
G849	Spray valve, complete; see page 16 (?)
850	Spray valve stem
851	Spray valve body
853	Spray valve spring casing
854	Spray valve clamp
854A	Spray valve clamp stud
855	Spray valve clamp bridge
855A	Spray valve clamp bridge nut
856	Spray valve seat nut
857	Spray valve spring plug
858	Spray valve spring
859	Spray valve spring ball bearing
860	Spray valve gasket
864	Spray valve nozzle
865	Spray valve gland nut
866	Spray valve gland

Part No.	Part Name
867	Spray valve packing
870	Spray valve rocker with pins
872	Spray valve rocker fulcrum
873	Spray valve rocker fulcrum pin
876	Spray valve rocker push rod
877	Spray valve rocker horse shoe collar
878	Spray valve rocker stem nut
878A	Spray valve lock nut
880	Spray valve rocker cam toe
881	Spray valve cam disc
881A	Spray valve disc toe washer
883	Spray valve lifter, with roller and pins
884	Spray valve lifter roller
885	Spray valve lifter roller pin
887	Spray valve lifter guide
888	Spray valve lifter guide spring
889	Spray valve push rod socket
895	Spray valve testing outfit
896	Spray valve cleaning needles
897	Spray valve tip remover
898	Spray valve tip cleaner
900	Air compressor cylinder
900A	Air compressor cylinder head stud
900B	Air compressor oil splash plates
G901	Air compressor head, complete; Part Nos. 901, 905, 907, 908, 908A, 915, 915A, 918, 918A, 919, 920, 922 922A, 923, 924
901	Air compressor head
902	Air compressor stud
905	Air compessor inlet valve
906	Air compressor grid
907	Air compressor inlet valve bushing
908	Air compressor inlet valve spring
908A	Air compressor inlet valve nut
908B	Air compressor inlet valve washer
915	Air compressor discharge valve
915A	Air compressor discharge valve adjusting screw
918	Air compressor discharge valve flange
918A	Air compressor discharge valve relief handle nut
918C	Air compressor discharge valve flange stud
919	Air compressor discharge valve spring
920	Air compressor discharge valve guide
922	Air compressor discharge valve cap nut

See Instructions for Ordering on Page 56

922A Air compressor discharge valve relief handle
923 Air compressor discharge valve guide cap
924 Air compressor discharge valve spring bushing
925 Air compressor piston
926 Air compressor piston ring
927 Air compressor piston pin
928 Air compressor connecting rod bushing
929 Air compressor connecting rod
930 Air compressor eccentric strap
932 Air compressor eccentric strap bolt and nut
933 Air compressor eccentric
936 Air compressor pass over pipe
936A Air compressor pass over pipe gasket
937 Air compressor gauge 300 lbs.
1060 Force feed lubricator
1060A Force feed lubricator drive arm
1060B Force feed lubricator connecting rod eye
1061 Force feed lubricator bracket
1063 Force feed lubricator oiler disc and cam shaft collar
1065 Force feed lubricator connecting rod
1065A Force feed lubricator connecting rod pin
1067 Lubricating oil sump
1067A Lubricating oil float guide flange
1067B Lubricating oil float guide stud
1068 Lubricating oil strainer cage
1069B Lubricating oil gauge float
1087 Pressure lubricating oil pump pressure gauge; 30 lbs.
G1090 Pressure lubricating oil relief valve, complete; Part Nos. 1090, 1091, 1092, 1093, 1095.
1090 Pressure lubricating oil relief valve body
1091 Pressure lubricating oil relief valve plunger
1092 Pressure lubricating oil relief valve adjusting screw
1093 Pressure lubricating oil relief valve spring
1095 Pressure lubricating oil relief valve adjusting screw nut
1096 Pressure lubricating oil relief valve check valve
G1100 Governor, complete; Part Nos. 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1113

1100 Governor body (always supplied with No. 1111 fitted on)
1101 Governor weight
1102 Governor weight pin
1103 Governor weight roller
1104 Governor weight roller pin
1105 Governor weight roller plate
1106 Governor thrust quill
1107 Governor thrust quill ball bearing, small
1108 Governor body ball bearing, large
1109 Governor shaft
1110 Governor body collar
1111 Governor pinion
1112 Governor bearing
1112A Governor bearing cap
1113 Governor thrust quill bushing
1114 Governor compression spring
1114A Governor compression spring collar
1114B Governor compression spring quill
1115 Governor compression spring block
G1117 Control handle, complete; Part Nos. 1117, 1118, 1119, 1124, 1125, 1249
1117 Governor control handle
1118 Governor control handle pawl
1119 Governor control handle sector
1120 Governor rack for compression spring
1121 Governor rack adjusting screw
1121A Rack adjusting screw nut
1122 Governor speed control socket with sector
1122A Governor control socket
1122B Governor control socket screw
1123 Governor control socket bearing
1124 Governor control handle pawl spring
1125 Governor control handle pawl spring screw
1127 Governor connecting rod between forks
1128 Governor fork
1128A Governor fork shaft
1129 Governor lever on vertical shaft
1129A Governor lever pin
1130 Governor fork on wedge shaft
1131 Governor wedge fork
1132 Governor fuel control wedge
1132A Governor fuel control wedge pin
1133 Governor fuel control shaft

See Instructions for Ordering on Page 56

Part No.	Part Name
1134	Governor fuel control shaft bearing
1134A	Governor fuel control shaft bearing nut
1135	Governor fuel shaft end tension spring
1136	Governor fuel shaft end tension spring clamp
1138	Fuel control wedge shaft handle
1170	High pressure fuel union nipple
1171	High pressure fuel pipe connection through head
1173	Fuel pump bleeder connection
1174	Fuel oil receiver drain connection
1176	High pressure fuel union nut
1177	High pressure fuel union sleeve
1178	High pressure fuel union sleeve, blind end
1183	Testing pipe-fuel rail to spray valve test clamp
1184	High pressure fuel pipe from fuel relief valve to pump suction
1185	High pressure fuel pipe from pump discharge to relief valve
1186	High pressure fuel pipe between pumps
1187	Fuel pump to fuel rail
1188	High pressure fuel pipe from union in head to spray valve
1188A	High pressure fuel pipe from rail to union in head
1189	Fuel pipe from fuel rail to fuel oil receiver
1189A	High pressure fuel pipe from fuel receiver to gauge
G1190	Safety valve, complete; Part Nos. 1190, 1191, 1192, 1193, 1195
1190	Safety valve body
1191	Safety valve stem
1192	Safety valve seat
1193	Safety valve spring
1194	Safety valve spring collar
1195	Safety valve lock screw
1196	Safety valve cylinder plug
G1197	Snifter valve, complete; Part Nos. 1197, 1198
1197	Snifter valve body
1198	Snifter valve stem
1199	Safety valve adjusting screw
G1200	High pressure fuel rail, complete
1201	High pressure fuel strainer body.

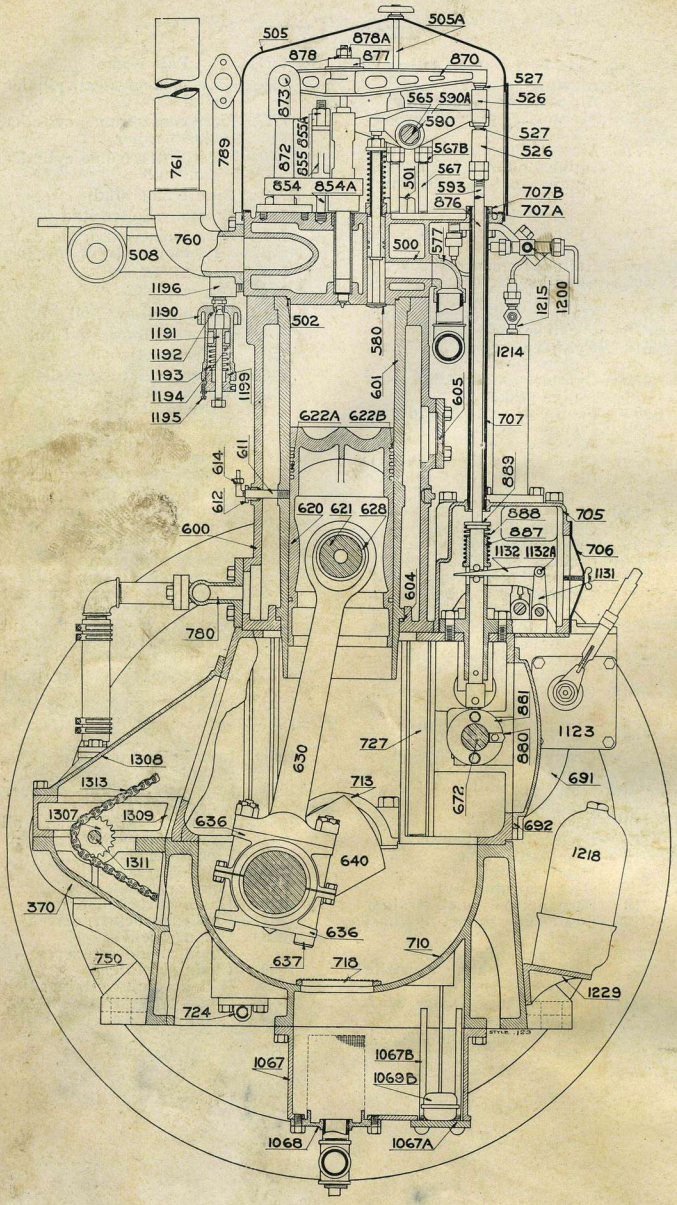
Part No.	Part Name
1202	High pressure fuel strainer stem
1203	High pressure fuel rail clamp
1204	High pressure fuel strainer gasket
1205	High pressure fuel isolating valve body
1206	High pressure fuel isolating valve stem
1207	High pressure fuel isolating valve gland
1208	High pressure fuel isolating valve gland nut
1214	Fuel oil receiver, end of line
G1215	Fuel oil receiver valve, complete; Part Nos. 1206, 1208, 1215
1215	Fuel oil receiver valve body
1216	High pressure fuel oil gauge bracket, 10,000 lbs.
1217	Fuel oil pressure gauge, 10,000 lbs.
1218	Fuel oil purolator.
1229	Fuel oil purolator bracket
G1230	Valve, complete; Part Nos. 1117, 1118, 1124, 1125, 1230, 1231, 1232, 1233, 1234, 1236, 1237, 1238, 1238A, 1239, 1240, 1242, 1243, 1244, 1245, 1249
1230	Body
1231	Gland
1231A	Gland packing ring
1232	Stud
1233	Stem collar
1234	Seat
1235	Stud collar
1236	Spring
1237	Spring cage
1238	Handle bearing
	Handle bearing lock screw
1238A	Handle bearing pin
1239	Handle adjusting screw
1240	Handle plug, lower
1241	Stud cap nut
1242	Fuel fitting
G1243	Handle, complete; Part Nos. 1117, 1118, 1124, 1125, 1243, 1249
1243	Handle
1244	Handle sector
	Handle sector cap screw
1245	Spring plug, top
1247	Stud collar gasket
1248	Stud gasket
1249	Handle screw
	Packing ring
G1274	Priming pump only; Part Nos. 1275, 1276, 1278
1275	Priming pump cylinder
1276	Priming pump plunger
1276A	Priming pump plunger nut
1278	Priming pump cap
1279	Priming pump plunger eye

See Instructions for Ordering on Page 56

Part No.	Part Name
1279A	Priming pump connecting rod link
1279B	Priming pump link eye
	Priming pump link eye nut
1280	Priming pump connecting rod
1280A	Priming pump connecting rod pin
1281	Priming pump handle
1284	Priming pump handle push rod
1284A	Priming pump handle push rod fulcrum
1287	Lubricating oil purolator
G1295	Day tank, complete; Part Nos. 1295, 1296, 1297, 1297A, 1297B, 1298, 1299
1295	Day tank casing
1296	Day tank cover
	Day tank cover pipe plug
	Day tank cover holding down cap screw
1297	Day tank casing collar
1297A	Day tank casing collar eye bolt
1297B	Day tank casing collar wing nut
	Day tank casing collar eye bolt pin
1298	Day tank casing collar bottom
	Day tank casing collar bottom clamp cap screw
1299	Day tank strainer
1306	Chain sprocket, driver
1307	Chain sprocket, driven
1308	Chain shield
	Chain shield cap screw
1309	Chain shield cap
1310	Ball bearing container
1310A	Ball bearing container, shaft end
1311	Pinion shaft
1312	Ball bearing, with adapter
1313	Silent chain
1314	Fan spindle silent chain adjusting screw
1315	Fan spindle
1315A	Fan spindle nut
1315C	Fan spindle nut lock washer
G1316	Fan spindle gearing, complete; Part Nos. 1314, 1315, 1315A, 1315C, 1316, 1317, 1318, 1319, 1319A, 1321, 1322, 1323, 1323A
1316	Fan spindle bearing
1317	Fan spindle chain sprocket
1318	Fan spindle roller bearing and cup
1319	Fan spindle steel cover
1319A	Fan spindle steel cover screw
1321	Fan spindle spacer
1322	Fan spindle spacer washer
1323	Fan spindle felt washer
1323A	Fan spindle felt washer retainer ring
	Fan spindle bearing stud
	Fan spindle bearing stud nut
	Fan spindle bearing stud washer
	Fan spindle sprocket key
	Fan spindle nut lock washer screw
1338	Rotary pump, complete, ¼" outlet
1341	Rotary pump gear and shaft driver for ¼" outlet pump
1342	Rotary pump gear and shaft driven for ¼" outlet pump
1351	Rotary pump felt washer
1352	Rotary pump gear, driven
1353	Rotary pump gear driver on cam shaft coupling
1354	Rotary pump ball bearing
1355	Rotary pump drive shaft
1356	Rotary pump ball bearing quill
1371	Rotary pump gear and shaft for ½" outlet pump
1372	Rotary pump gear and shaft driven for ½" outlet pump
1378	Rotary pump, complete; ½" outlet
	Rotary pump holding down cap screw
1533	Oil cup on air pump connecting rod

Liner Type

Part No.	Part Name
508	Air suction pipe
577	Air starting pipe elbow
577A	Air starting pipe elbow gasket
577B	Air starting pipe, including pipes, elbows, tee, flanged union, petcock, gaskets
600	Cylinder
601	Cylinder liner
604	Cylinder liner rubber packing ring
605	Cylinder clean out cover
605A	Cylinder clean out cover gasket
	Cylinder clean out cover cap screw
610	Cylinder water by pass pipe
610A	Cylinder water by pass pipe gasket
G620	Piston with rings and pin
620	Piston
621	Piston pin
622	Piston rings (double ring)
622A	Piston ring, ¼" double seal
622B	Piston ring, ¼" step cut
628	Piston pin bushing
G630	Connecting rod with ball check and bushing
630	Connecting rod, drilled
G632	Connecting rod ball check, assembled
632	Connecting rod ball check, complete
634	Connecting rod foot shims (state thickness)
G636	Crank pin box, assembled; Part Nos. 636, 637.
636	Crank pin box, 2 halves
637	Crank pin box bolt
	Crank pin box bolt nut
	Crank pin box cap screw and nut
640	Crank shaft
710	Base
712	Base cap, flywheel end
713	Base cap, center
717	Base cap stud
	Base cap stud nut
718	Base lubricating oil strainer
719A	Base cap shim, flywheel end
720A	Base cap shim, center
722A	Base cap shim, opposite flywheel end
724	Base oil pipe flange with pipes fitted in
	Base oil pipe flange cap screw
727	Base centerframe cylinder stud
727A	Base centerframe cylinder stud washer
727B	Base center frame cylinder stud nut
729	Base frame stud
730	Frame cylinder stud
731	Base frame, stud, air compressor end
760	Exhaust elbow
761	Exhaust pipe
764	Exhaust elbow stud
764A	Exhaust elbow stud nut
780	Water inlet pipe
780A	Water inlet pipe gasket
	Water inlet pipe flange to compressor
	Water inlet drain cock
	Water inlet drain cock nipple
	Water inlet pipe cap screw
789	Water outlet pipe
	Water outlet pipe cap screw
789A	Water outlet pipe gasket
854	Spray valve clamp
854A	Spray valve clamp stud
855	Spray valve clamp bridge
855A	Spray valve clamp stud nut
870	Spray valve rocker
872	Spray valve rocker stand
873	Spray valve rocker stand pin
876	Spray valve rocker push rod
1067	Lubricating oil sump
1067A	Lubricating oil float guide flange
1067B	Lubricating oil float guide stud
1068	Lubricating oil strainer cage
1087	Pressure lubricating oil gauge—30 lbs.
1218	Fuel oil purolator
1229	Purolator bracket
1287	Lubricating oil purolator
1306	Chain sprocket, driver
1307	Chain sprocket, driven
1308	Chain shield
	Chain shield cap screw
1309	Chain shield cap
1310	Ball bearing container
1311	Chain sprocket shaft
1312	Chain sprocket shaft ball bearing
1313	Silent chain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