INSTRUCTION BOOK

No. 27-12

FOR

INSTALLING AND OPERATING

ATLAS IMPERIAL

FOUR CYCLE

MECHANICAL INJECTION

DIESEL ENGINES

CLYDE GAGNE
ATLAS ENG. CO.
HOME AL. 1709
WE. 9446

ATLAS IMPERIAL DIESEL ENGINE CO.
MAIN OFFICE AND FACTORY
OAKLAND, CALIFORNIA, U. S. A.

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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 the 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 is instantly raised in the nature of an explosion 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 horsepower 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.

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 STROKE:**

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 above) the temperature of the compressed air is raised sufficiently to ignite the fuel. A few degrees before 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 always 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 of 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 opened.

This completes the four cycles or four strokes of the ATLAS-IMPERIAL MECHANICAL INJECTION DIESEL Engine and describes the method of its functioning.

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 of preignition.

This high temperature secured allows the use of cheap, low grade fuel oils of high fire test which are 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. No high pressure air is used to force this fuel oil in the cylinder.

With some methods (not true solid injection type) fuel is introduced under low pressure into a recessed casting, projecting 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 intended 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 DO NOT CONTINUALLY TRY 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 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. 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, therefore 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 the 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 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 see that it functions in the way that it should.

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 750 to 1000 horse power hours per gallon.

CYLINDERS:

Oil is supplied to the cylinder walls by means of the force feed lubricator through a small pipe connected to the inlet and exhaust side of the cylinder wall. It requires not more than 13 or 14 drops of oil to the cylinder wall per minute. It is very important that this lubrication be constant and does 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 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 then through oil pipes in the base (on the exhaust side of the engine) 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 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, thereby lubricating the connecting rod bearings or crank pins.

It is important that sufficient oil be always maintained in the oil reservoir to insure the proper function of the pumps so that the oil will circulate freely, unhampered by air bubbies. 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 oil reservoir; TWO—that the lubricating oil pumps are

not functioning properly; or 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 a filtering tank, then 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 crankbearing 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 into 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. (See section drawing on next page.)

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 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 feeds to the cylinders are generally employed. This aggravates the difficulties. The oil then works itself in between and behind

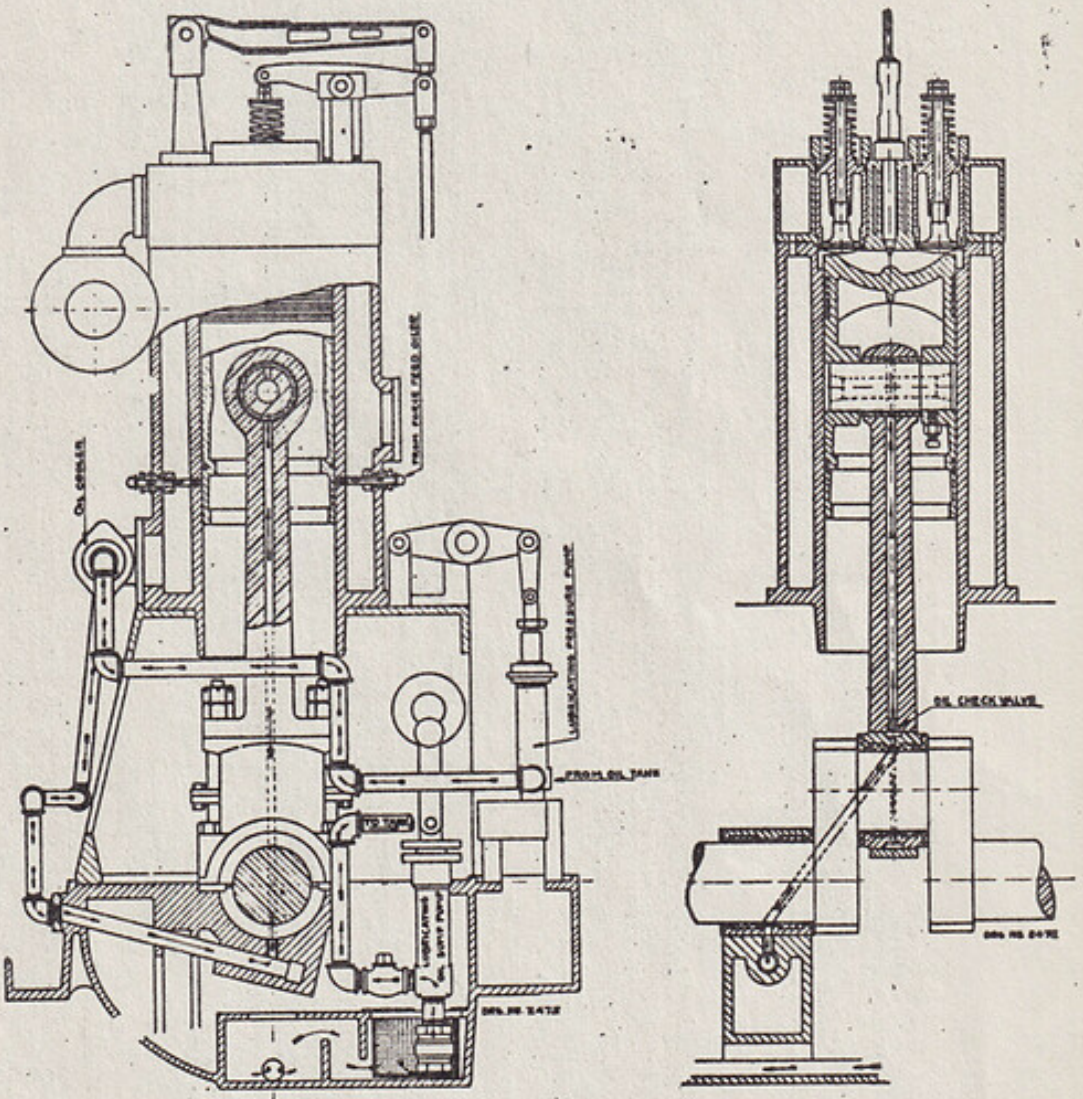


DIAGRAM SHOWING PATH (INDICATED BY ARROWS) OF LUBRICATING OIL THROUGH ENGINE

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 when selected according to the following guide as to viscosity:

Engine Room Temp. °F	S & E Viscosity Number
Below 40	10
20-60	20
30-75	30
50-90	40
65-100	50
75-130	60
85 and over	70

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.

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 experiments which have been conducted in the past.

In purchasing the fuel oil to be used for this engine, you should advise the oil company that it will be used in a mechanical injection type 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 oil

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.

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

Gravity—24° to 28° Baume.

Calorific value—18,500 to 19,500 B.T.U.'s.

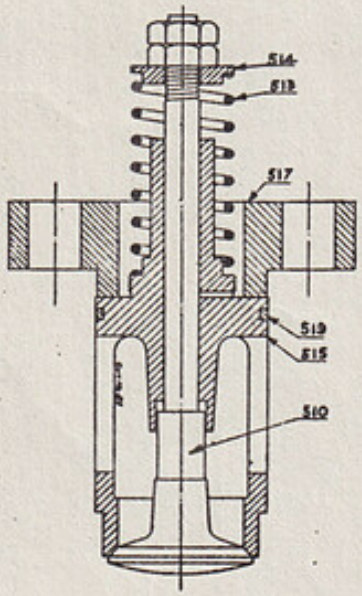
Irrespective of what oil is used, it is necessary that the oil be refined to the extent that all water, sand and grit has been removed.

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.

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.



EXHAUST AND INLET VALVE CAGE TYPE

G515	Valve and cage complete. Parts 510, 513, 514, 515 and valve nuts.
510	Exhaust or inlet valve.
512	Exhaust or inlet valve cage bushing (only in 11" bore engines and larger)
513	Exhaust or inlet valve spring.
514	Exhaust or inlet valve spring bushing—top
515	Exhaust or inlet valve cage.
517	Exhaust or inlet valve cage flange.
518	Exhaust or inlet valve cage gasket.
519	Exhaust or inlet valve cage ring.

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 36° 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

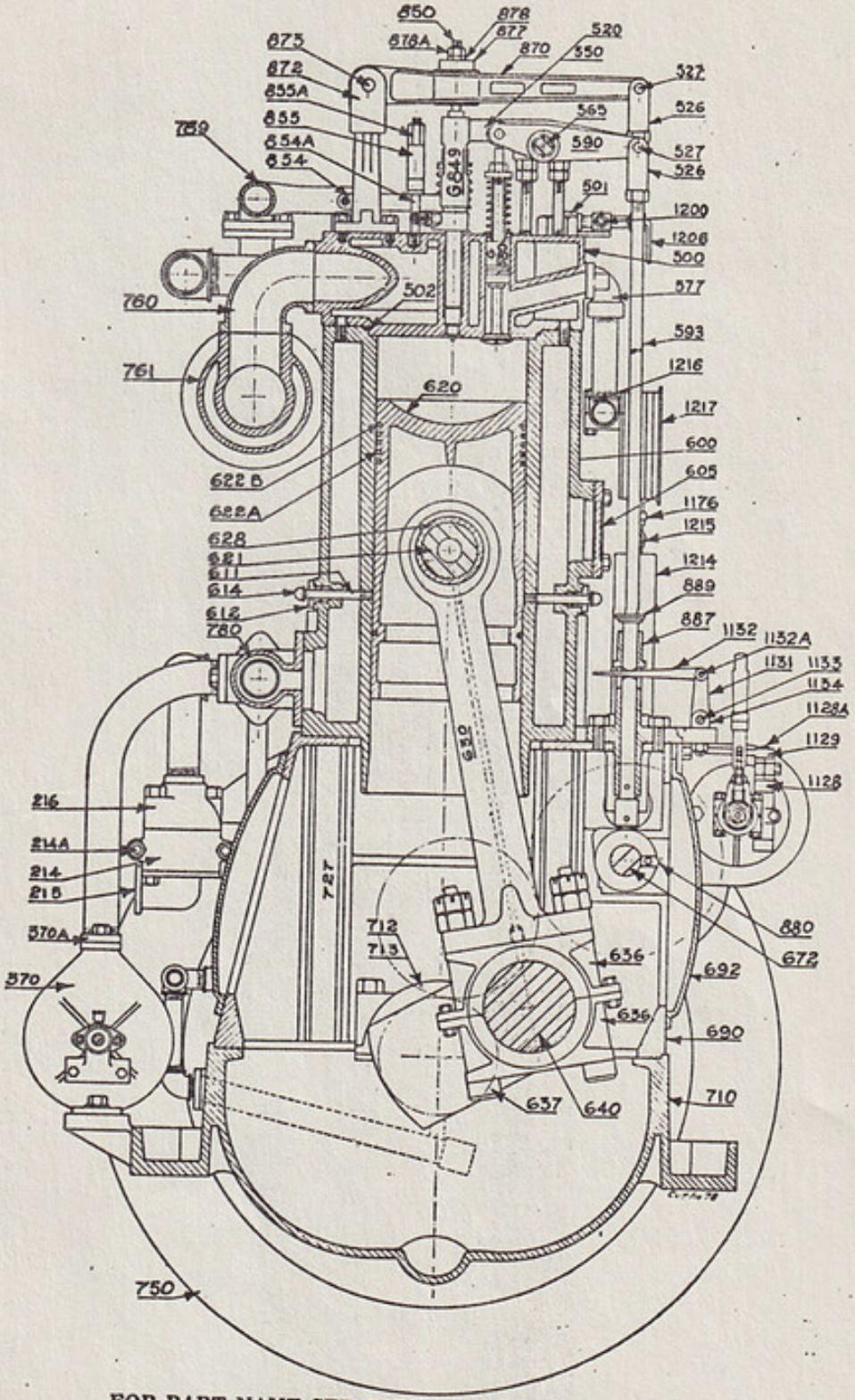
The best fuel oil can be ruined if not properly handled. Store and transport your fuel in clean container and use your containers for fuel oil only. Flush out the container frequently to remove any dirt, rust or scale that may accumulate.

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.

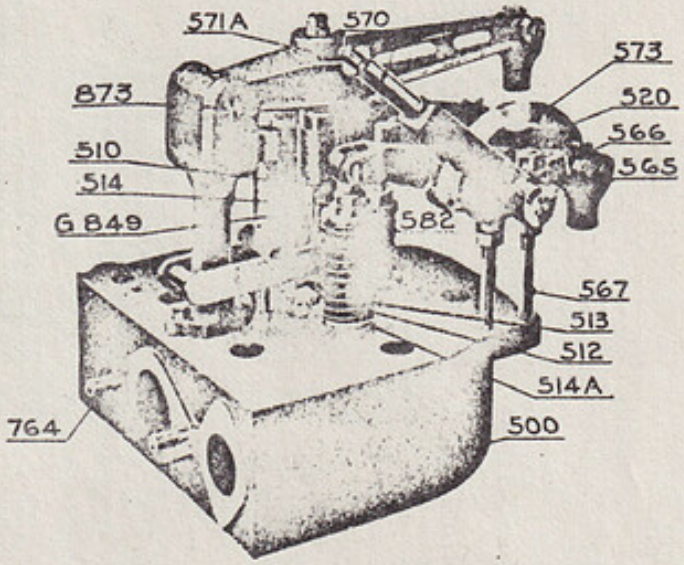
Draw fuel from storage tank through a pipe inserted in top of tank. Be sure the lower end of suction pipe is 3 or 4 inches above the bottom of tank. This allows dirt and water to settle to bottom of tank where they can be occasionally drawn off.

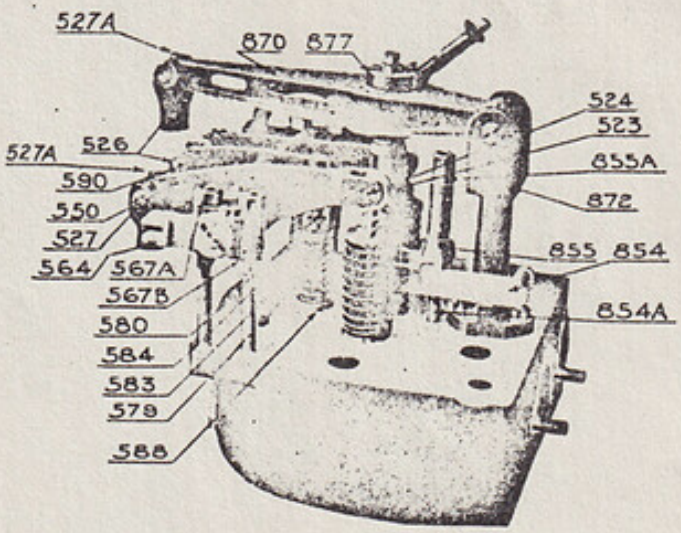
An engine supply tank should be provided big enough to hold at least a day's supply of fuel.

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.



FOR PART NAME SEE PARTS LIST ON PAGES 60 TO 67





CYLINDER HEAD

Cylinder Head

G500 Cylinder head complete assembly (as shown on page 12) except spray valve G849 and horse shoe collar 877, the following parts are included, Nos. 500, 510, 512, 513, 514, 514A, G520, G550, 564, 564B, 565, 566, 567, 567A, 567B, 579, 580, 582, 583, 584, 585, 586, 588, G590, 764, 854, 854A, 855, 855A, G870, 872, 873.
Specify whether handle or male connecting link is wanted with head. The following parts are also included if used: 515, 516, 517.

GA500 Cylinder head with exhaust, inlet, air starting valves and springs only. Part Nos. 500, 510, 512, 513, 514, 514A, 564, 579, 580, 582, 583, 584, 585, 586, 588.

500 Cylinder head only with studs 567 and 764.

501 Cylinder head stud.

501A Cylinder head stud, special for lifting head.

502 Cylinder head gasket.

510 Valve, inlet or exhaust. (Specify whether 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.

515 Valve cage, inlet or exhaust.

516 Valve cage stud.

517 Valve cage flange.

519 Exhaust or inlet valve cage ring.

G520 Inlet rocker, with roller and Pin. Parts 520, 520A, 523, 524, G527A.

520A Inlet rocker bushings (set of 2)

523 Rocker roller, for inlet, exhaust or air.

524 Rocker roller pin, for inlet, exhaust or air.

526 Push rod fork, for inlet, exhaust, air or fuel.

527 Fork pin, inlet, exhaust, air or fuel.

G527A Fork pin, ball lock.

G550 Exhaust rocker with roller and pins. 550, 550A, 523, 524, G527A.

550A Exhaust rocker bushings (set of 2)

564 Rocker shaft, connecting link (female).

564A Rocker shaft connecting link (male).

564B Rocker shaft connecting link pin.

565 Rocker shaft.

566 Rocker shaft bearing (state: with or without wings).

567 Rocker shaft bearing stud.

567A Rocker shaft bearing stud nut; top.

567B Rocker shaft bearing stud lock nut.

G570 Air starting handle, complete: Part Nos. 570, 571, 571A, 572, 573.

570 Air starting handle.

571 Air starting handle pawl.

571A Air starting handle pawl screw

572 Air starting handle pawl spring

573 Air starting handle sector.

G580 Air starting valve complete. Cage type—Parts No. 580, 581, 581A, 582, 582A, 584, 585, 585A, 586. (See page 19 for drawing.)

G590 Air starting rocker, with roller and pins. 523, 524, G527A. (590A when used).

590A Air starting rocker bushings (set of 2).

764 Exhaust elbow stud.

G849 Spray valve complete (see page 14 for parts).

854 Spray valve clamp.

854A Spray valve clamp stud.

855 Spray valve clamp bridge.

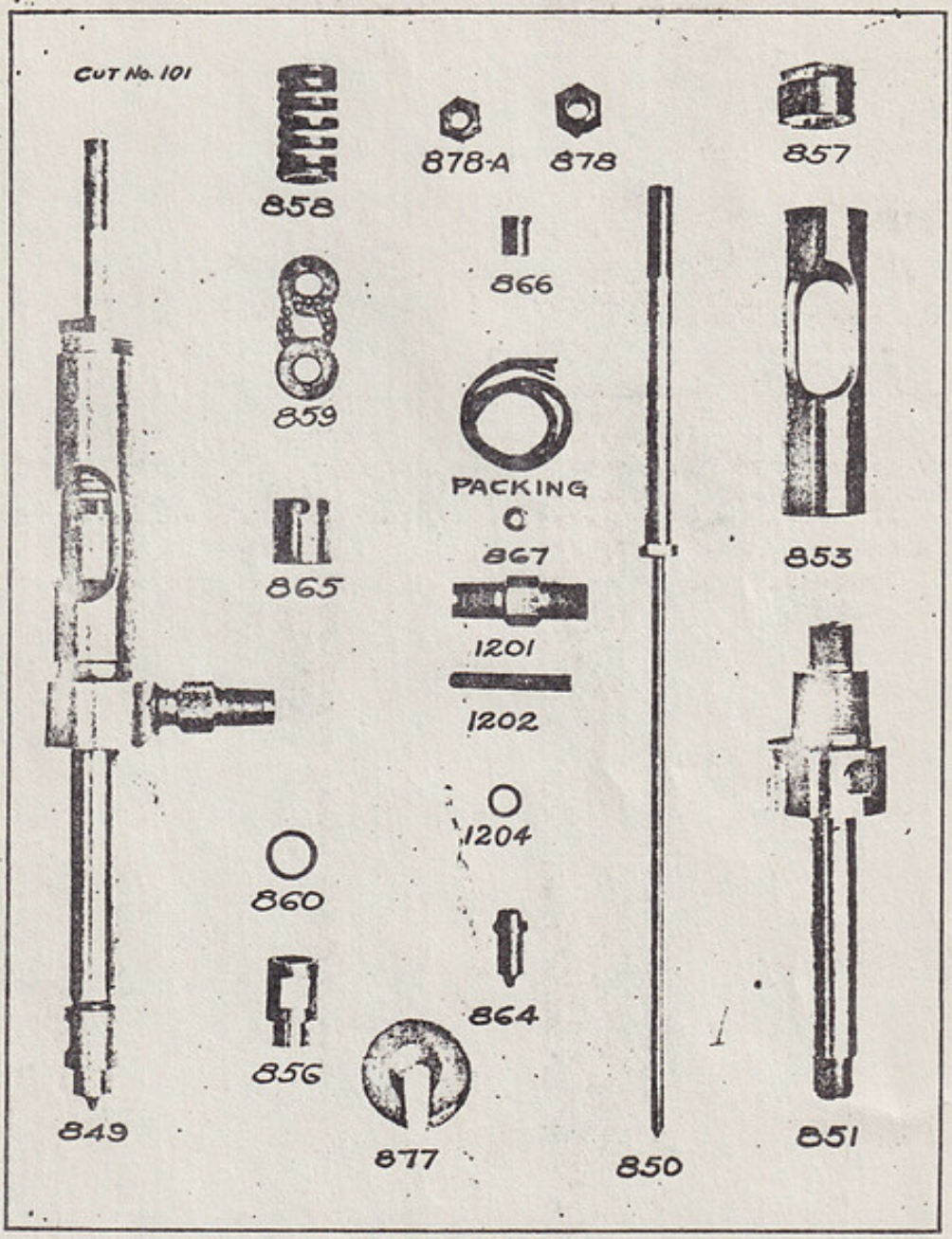
855A Spray valve clamp bridge nut.

G870 Spray valve rocker.
Spray valve rocker pin No. 527.
Spray valve rocker fork No 526.
Spray valve rocker fork pin lock No. 527A.

872 Spray valve rocker stand.

873 Spray valve rocker stand pin.

877 Spray valve horse shoe collar.



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

Spray Valve

FUNCTION:

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 cylinder 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 of 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 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 governor causes these valves to raise more and consequently admit additional fuel in direct proportion to the power developed.

SPRAY VALVE TIPS

Sizes used differ according to size of engine (bore and stroke) and are as follows:

6½	inch bore	8½	inch stroke use size	8 tips with 5 holes.
7	inch bore	10	inch stroke use size	8 tips with 5 holes.
7½	inch bore	10½	inch stroke use size	8 tips with 5 holes.
8½	inch bore	12	inch stroke use size	8 tips with 5 holes.
9	inch bore	12	inch stroke use size	10 tips with 5 holes.
9½	inch bore	13	inch stroke use size	10 tips with 5 holes.
10	inch bore	13	inch stroke use size	11 tips with 5 holes.
11½	inch bore	15	inch stroke use size	12 tips with 5 holes.
12	inch bore	16	inch stroke use size	14 tips with 5 holes.
14	inch bore	18	inch stroke use size	14 tips with 5 holes.

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. 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 unable to enter the combustion chamber in its usual manner and will cause a reduction in the revolutions of the engine, also in power. This condition is more apt to occur in a new installation due to dirt

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 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 on 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 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 compression stroke, which is easily ascertained by the fact that both inlet and exhaust valves remain closed on this 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 21.) If at that point the fuel pressure on gauge does not release, then loosen jam nut under the 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 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 the spray valve, turn the engine ahead until the mark on flywheel showing closing of spray valve

is past the pointer. Then pump up pressure, bar the flywheel backwards again until the pressure is released. This will determine the exact point on 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.

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

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

In timing the spray valves a certain amount of oil enters the cylinder when the fuel pressure is released. In order to clear the cylinders of the excess oil ALWAYS TURN THE ENGINE OVER ON AIR WITH THE SNIFTER VALVES OPEN, being sure of course that the isolating valves are closed, before starting on fuel.

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 admiting 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 spray valve must be checked up again as a slight alteration may be caused by the replacement:

SPRAY VALVE TEST CLAMP:

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

Two tapped holes are located directly beneath this connection on the center frame 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.

HOW TO USE 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 centerframe connect the spray valve, with its connection, to the connection on the fuel rail. After all connections have been inspected and made 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 is liable to cause trouble, due to the excessive oil being compressed in the cylinder.

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 loose, 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 small amount of kerosene mixed with lubricating oil (3 parts kerosene, 1 part lubricating oil) 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 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.

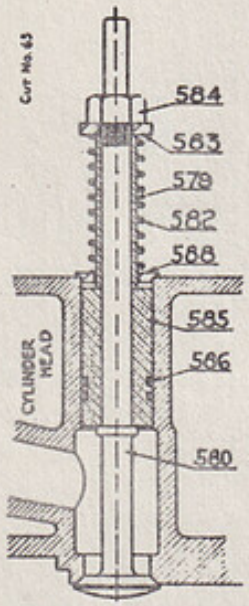
Draw water off bottom fuel oil tank and strainers as often as required to keep water out of engine. Always keep the engine clean.

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 still retains its lubricating value.

TIMING OF THE AIR STARTING VALVE:

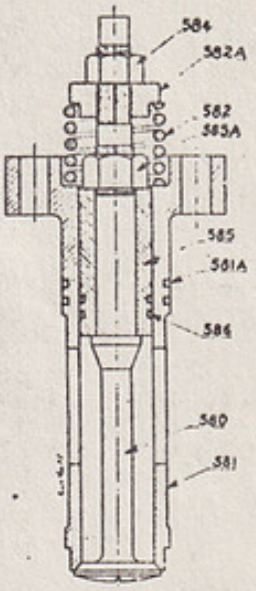
To time the air starting valves, first open all of the cylinder snifter valves, then turn the flywheel in the direction of rotation until top cen-

Air Starting Valve



AIR STARTING VALVE
PLAIN TYPE

15° A.T.C.



AIR STARTING VALVE
CAGE TYPE

G580	Air starting valve complete. Cage type—Parts No. 580, 582, 582A, 584, 585, 585A, 586.
579	Air starting valve spring bushing.
580	Air starting valve.
581	Air starting valve cage.
581A	Air starting valve cage ring.
581B	Air starting valve cage gasket.
582	Air starting valve spring.
582A	Air starting valve spring nut.
583	Air starting valve spring washer—top.
584	Air starting valve nut.
585	Air starting valve balance bushing.
585A	Air starting valve balance bushing nut.
586	Air starting valve balance bushing ring.
588	Air starting valve spring washer—bottom.

ter of No. 1 cylinder is opposite the pointer attached to the centerframe. Place the air starting valve handle in the starting position as shown in Figure A, page 20. Now adjust the starting valve push rod tight enough so that there is no play between the starting valve stem and the rocker arm roller (or button), then tighten the jam nut on the push rod. This adjustment will time the air starting valve to open at top center. The closing of the valve is taken care of in the shape of the cam. The above process must be repeated with each cylinder to properly time the air starting valve.

The air starting valve opens every other revolution and must be set when the piston is on that top center when both inlet and exhaust valves are closed.

VALVE TIMING:

Referring to the diagrams (page 21):

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. The diagram shows approximately the time that the intake valve should remain open. When the proper time for opening has been adjusted, which is 5° before top center, then the time of the closing of the intake valve will take care of itself, the same as the exhaust valve.

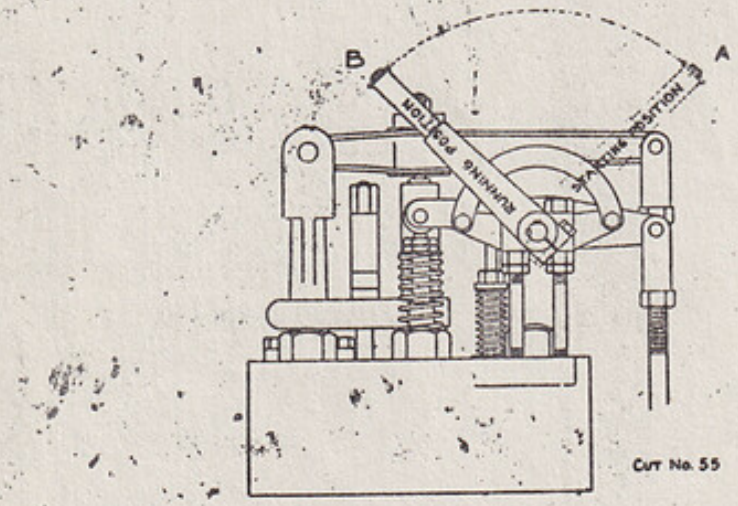
Diagram C—Exhaust valve—shows approximately the period that the exhaust valve should remain open. In timing the exhaust valve only pay attention to the closing time. If the cams are so set as to close the exhaust valve at approximately the correct position, which is 5° past top center, as shown on diagram, then the opening 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.

ADJUSTMENT AND TIMING OF ALL THE VALVES:

When an engine is shipped from the factory all of the 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 valves settings, (while crating or 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.



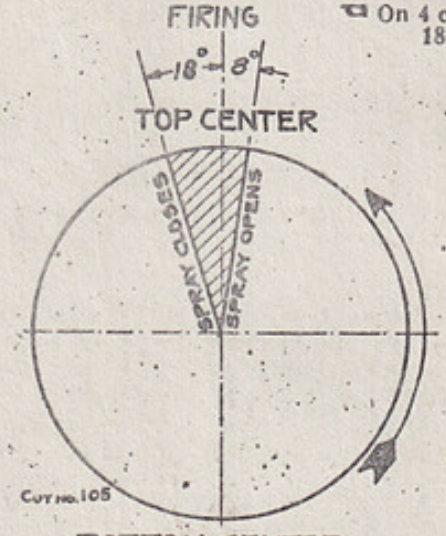
CUT No. 55

FIGURE A

FIRING ORDER OF THE ENGINES:

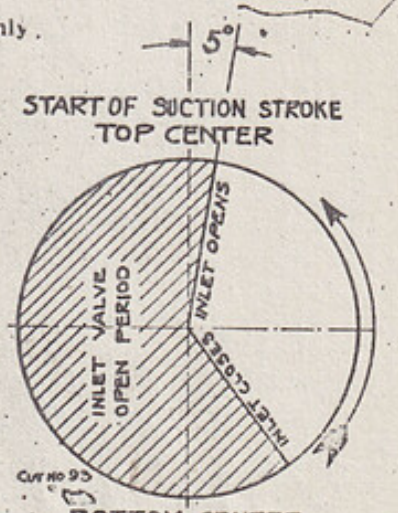
Number ONE cylinder is the one located next to the flywheel (except on a special engine, or such where the flywheel is placed near the reverse gear and thrust bearing). The firing order for the three cylinder engine is 1-2-3, for the four cylinder engine is 1-2-4-3, and for the six cylinder engine is 1-5-3-6-2-4.

Turning the engine "towards you" means turning the flywheel counter clock wise, the flywheel being viewed from the flywheel end of the engine looking aft toward the stern of the boat.

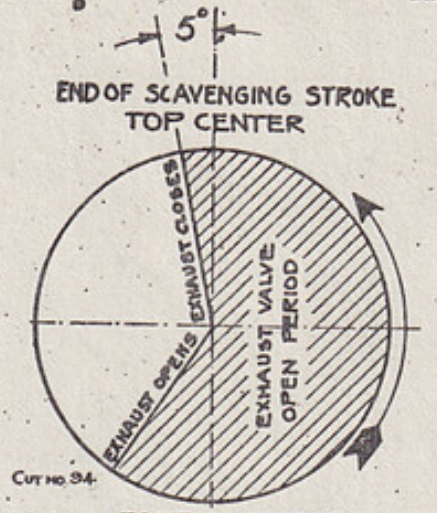


BOTTOM CENTER
SPRAY VALVE TIMING
DIAGRAM A

On 4 cyl. 6½x8½ only. 18° and 6°



BOTTOM CENTER
INLET VALVE TIMING
DIAGRAM B



BOTTOM CENTER
EXHAUST VALVE TIMING
DIAGRAM C

VALVE SETTING DIAGRAMS

Fuel Relief Valve---Marine Type

G1230	Relief 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	Relief valve body.
1231	Relief valve gland.
1232	Relief valve stud.
1233	Relief valve stem.
1234	Relief valve seat.
1235	Relief valve stud collar.
1236	Relief valve spring.
1237	Relief valve spring cage.
1238	Relief valve handle bearing.
1238A	Relief valve handle bearing pin.
1239	Relief valve handle adjusting screw.
1240	Relief valve handle plug, lower.
1241	Relief valve cap nut.
1242	Relief valve fuel fitting.
1244	Relief valve handle sector.
1245	Relief valve spring plug, top.
G1243	Relief valve handle, complete: Part Nos. 1117, 1118, 1124, 1125, 1243, 1249.
1117	Relief valve handle.
1118	Relief valve pawl.
1124	Relief valve pawl spring.
1125	Relief valve pawl spring screw.
1243	Relief valve handle cam.
1247	Relief valve stud collar gasket.
1248	Relief valve stud gasket.
1249	Relief valve 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 3800 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 distort 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 increase in depth as well as in area. This is likely to cause cracked piston heads and cylinder heads.

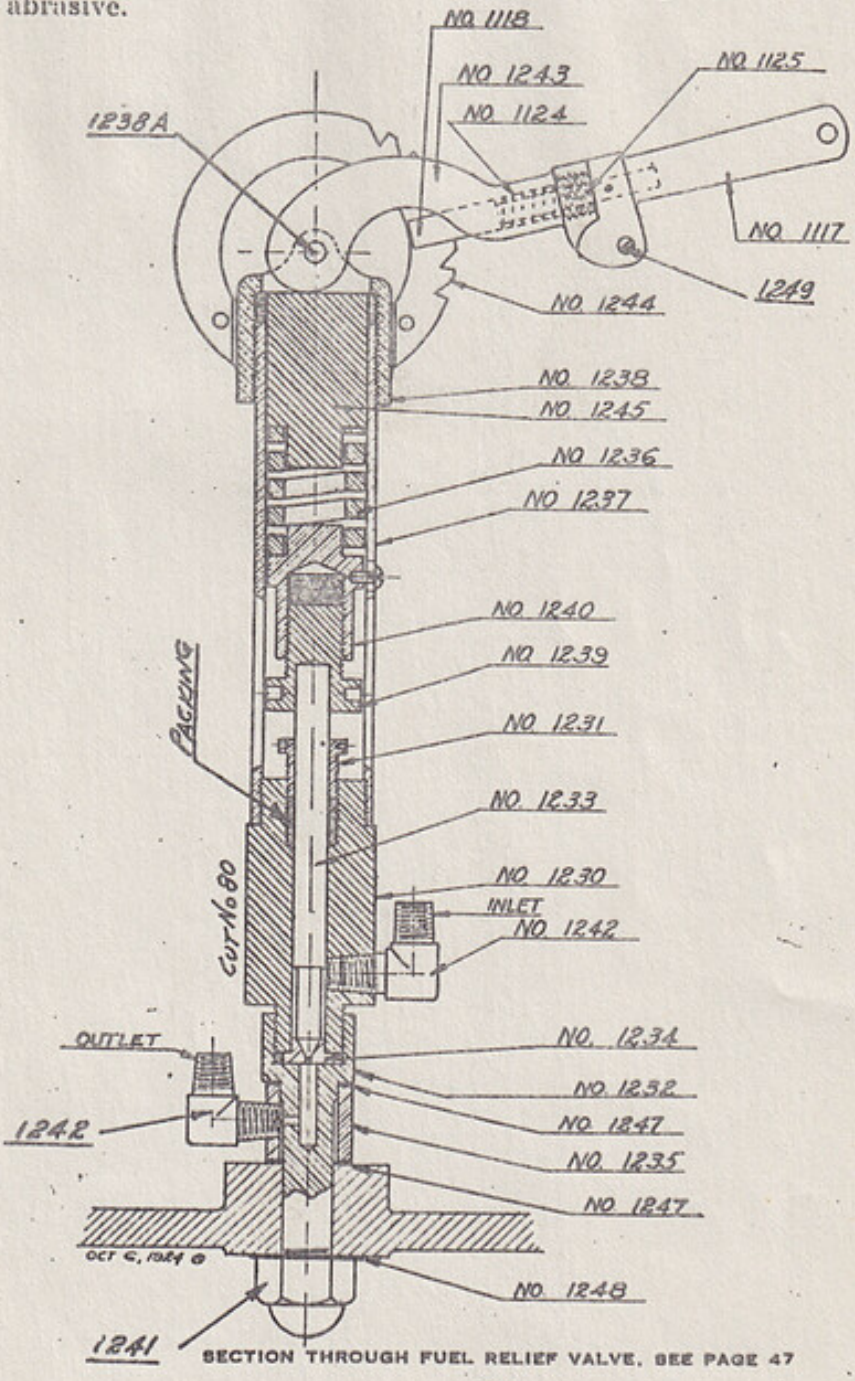
With the increased pressure on the fuel line, more oil is injected into the cylinder than can be used, and consequently it will leave a carbon deposit. This clings to the cylinder head and valves, causing the valves to leak.

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 suction line. In

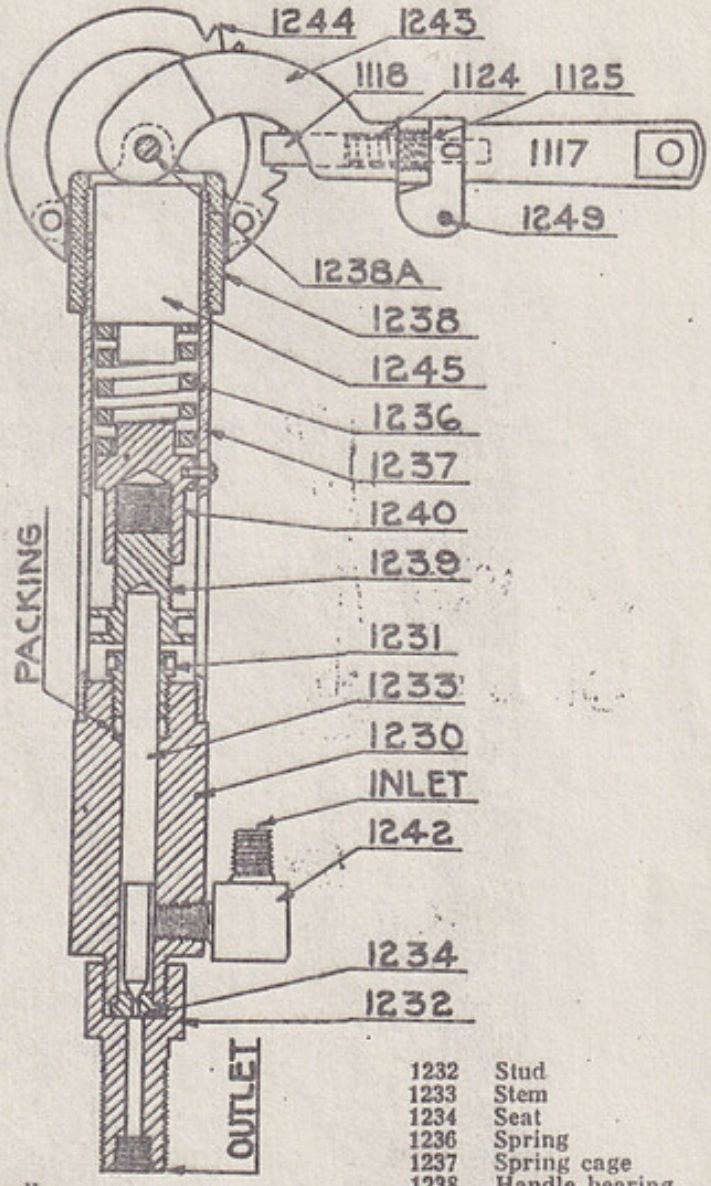
this way this fuel relief valve automatically maintains the pressure and takes care of the surplus fuel pumped by the high pressure fuel pumps.

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 valve is leaking at seat and should be reground with a very fine abrasive.



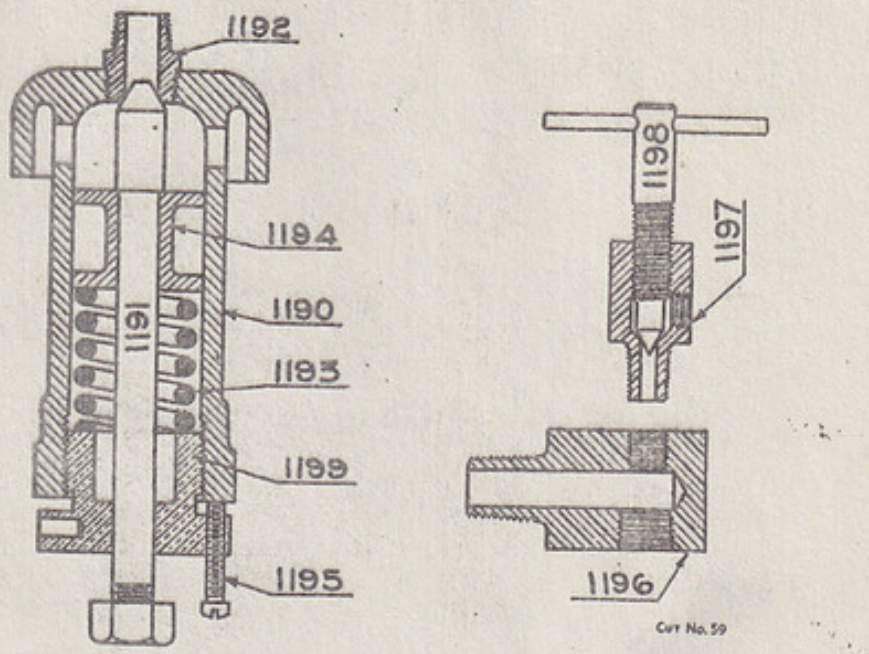
SECTION THROUGH FUEL RELIEF VALVE. SEE PAGE 47

Fuel Relief Valve---Remote Control Type



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 sector
1245	Spring plug, top
1249	Handle screw

Cylinder Relief Valves or Safety Valves



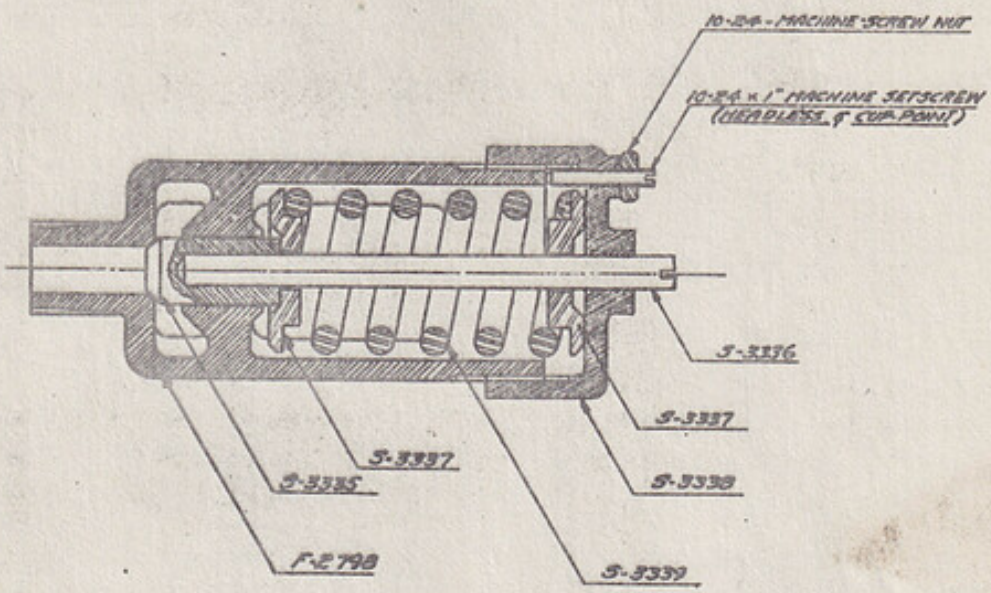
Cut No. 59

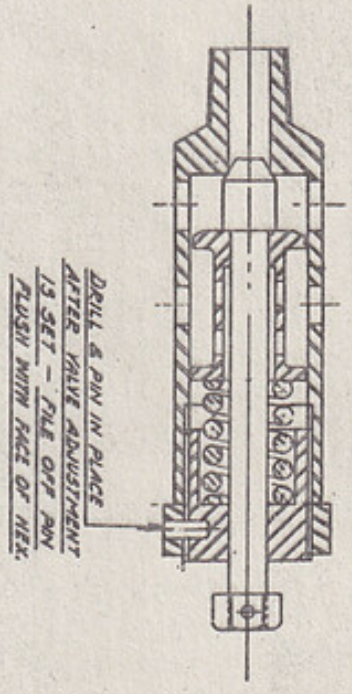
G1190	Cylinder relief valve, complete: Part Nos. 1190, 1191, 1192, 1193, 1194, 1195, 1199.	1195	Cylinder relief valve adjusting screw lock.
1190	Cylinder relief valve body.	1196	Cylinder relief valve cylinder plug.
1191	Cylinder relief valve stem.	1199	Cylinder relief valve adjusting screw.
1192	Cylinder relief valve seat.	G1197	Snifter valve, complete: Part Nos. 1197, 1198.
1193	Cylinder relief valve spring.	1197	Snifter valve body.
1194	Cylinder relief valve spring collar.	1198	Snifter valve stem.

Three types of cylinder relief valves are used as shown in accompanying cuts.

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. These valves are set at the factory at 750 pounds per square inch and should not be tampered with. Excess pressure escapes through these relief valves. It is just as essential to ascertain 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 day 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 a hammer and at the same time rotating the stem with a wrench on the nut, 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 steel needle valve, called snifter valve, is attached to these safety valves for the purpose of opening up to see if the cylinders are functioning properly.





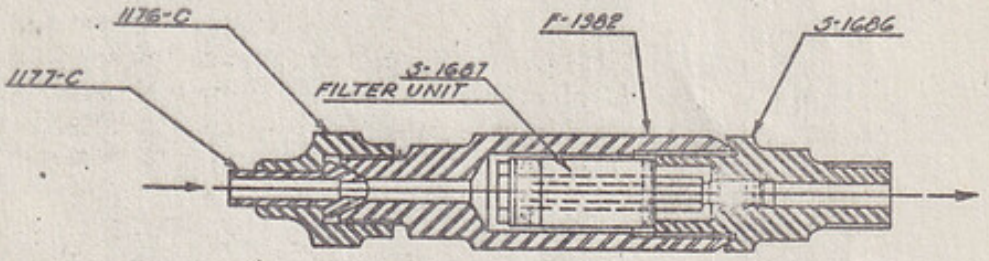
ADJUSTMENT OF SAFETY VALVES:

If while the engine is running the safety valve should blow off (at ordinary running speed) and the spray valve is known to be tight and not sluggish, then it indicates that the safety valve spring is weak or seat of valve is pitted.

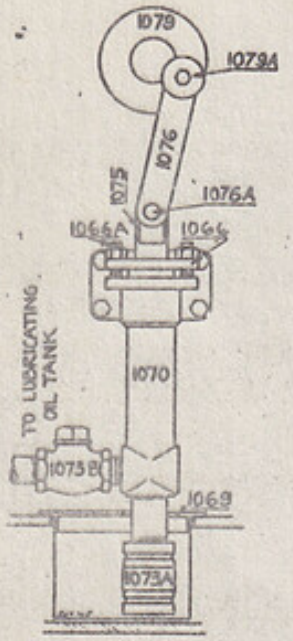
To remedy this, tap very lightly the end of the valve stem with a hammer and with a wrench on valve nut turn valve slowly while tapping. This will cause the valve to reseat itself; if blowing still continues increase tension of the valve spring by turning the adjusting nut until sufficient tension has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

Don't tighten up too much or there is danger of setting up the valve spring beyond the safety point. DO NOT TIGHTEN THE SPRING TO OVERCOME VALVE LEAKAGE. If it becomes necessary to regrind the valve to overcome leakage, be sure to get the valve spring adjusting screw back in the same position so as to maintain a pressure of 750 pounds.

Spray Valve Strainers



The Spray Valve Strainer is inserted in the fuel line directly before the spray valve. The function of the strainer is to remove any fine particles of sediment that may have passed through the main fuel strainers. The cleaning of the strainer's element should be required at very infrequent intervals. When it is necessary, the strainer should be removed from the spray valve and taken apart by unscrewing the two ends. The strainer element consists of a unit of laminated disks held together with a screw and nut. Wash the element off in gasoline before loosening the clamp screw. After all the dirt has been removed from the outside of element loosen the clamp screw about an eighth of an inch and rinse it out well in clean gasoline. Then thoroughly clean out the interior of the strainer body and reassemble. Be sure that all particles of dirt have been removed before reassembling, or clogging of spray valve tips will result.



SUMP PUMP

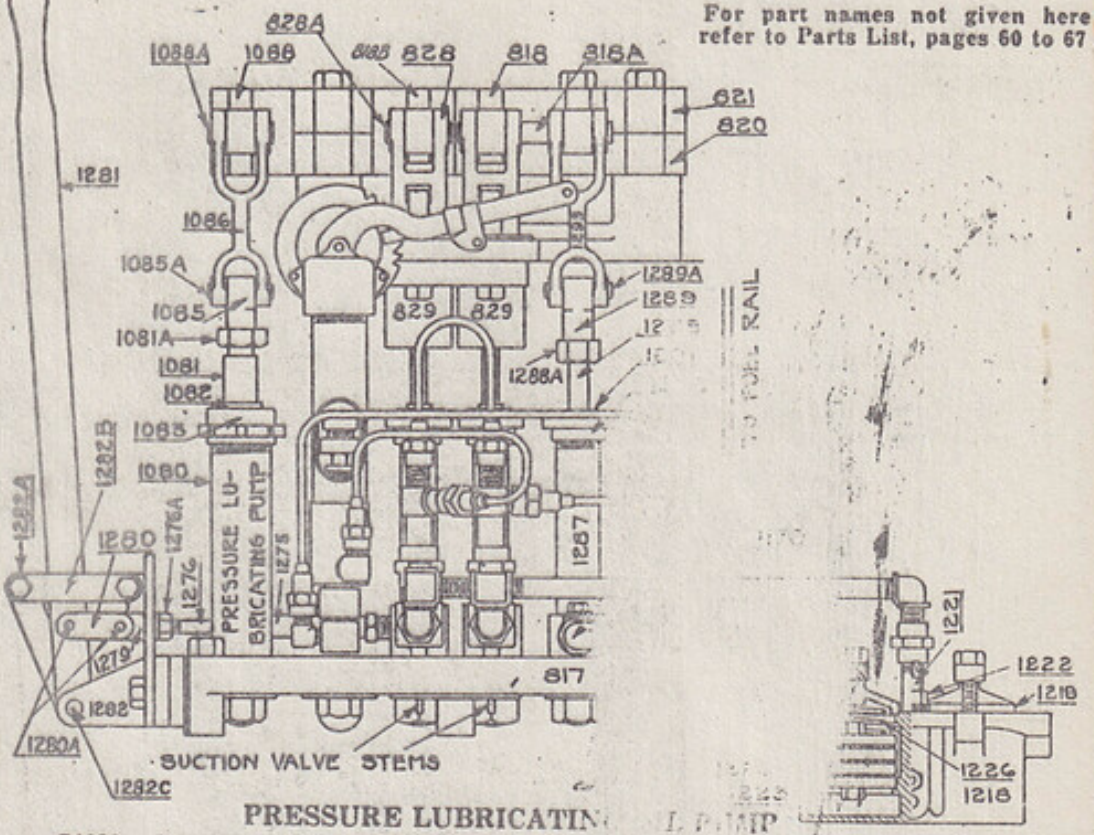
Lubricating Oil Sump Pump

1066	Sump pump gland.
1066A	Sump pump gland stud.
1069	Sump pump strainer.
G1070	Sump pump complete: 1070, 1066, 1066A, 1075, and packing.
1070	Sump pump body.
1073A	Sump pump check valve; inlet.
1073B	Sump pump check valve; outlet.
1075	Sump pump plunger.
1076	Sump pump connecting rod.
1076A	Sump pump connecting rod pin.
1079	Sump pump crank disc.
1079A	Sump pump crank washer.

Some models use Rocker No. 1088 to drive sump pump in place of crank No. 1079, otherwise same part numbers apply.

THE lubricating oil sump pump is located on the end on the center-frame and driven by means of a disc crank on the end of the cam shaft. The suction pipe extends down into the lubricating oil sump in the engine base drawing the lubricating oil through a sump strainer and maintaining the proper level of lubricating oil in the sump. The discharge from the pump is conducted to the lubricating oil service tank. Here the oil passes through another strainer settling into the bottom of the tank from which it is drawn by the high pressure lubricating oil pump.

For part names not given here refer to Parts List, pages 60 to 67



PRESSURE LUBRICATING PUMP

G1080 Pressure lubricating pump complete: Part Nos. 1080, 1081, 1082, 1083, and 1085.
1080 Pressure lub. pump cylinder.
1080A Pressure lub. pump suction check valve.
1080B Pressure lub. pump discharge check valve (spring loaded)
1081 Pressure lub. pump plunger.
1081A Pressure lub. pump plunger nut.
1082 Pressure lub. pump gland.
1083 Pressure lub. pump gland nut
1085 Pressure lub. pump plunger eye.
1085A Pressure lub. pump plunger eye pin.
1086 Pressure lub. pump connecting link.
1087 Pressure lub. pump oil pressure gauge (30 lbs.)
1088 Pressure lub. pump rocker.
1088A Pressure lub. pump rocker pin.

FUEL OIL STRAINER (See Page 30)

G1218 Fuel strainer complete: Part Nos. 1218, 1219, 1220, 1221, 1222, 1223, 1224, 1225, 1225A, 1225B, 1226.
1218 Fuel strainer body.
1219 Fuel strainer cover.
1220 Fuel strainer grid.
1221 Fuel strainer valve.
1222 Fuel strainer stuffing box.
1223 Fuel strainer gauze.
1224 Fuel strainer cover gasket.
1225 Fuel strainer cover clamp.
1225A Fuel strainer cover clamp cap screw.
1225B Fuel strainer cover clamp stud
1226 Fuel strainer grid spring.

HIGH PRESSURE FUEL PUMPS

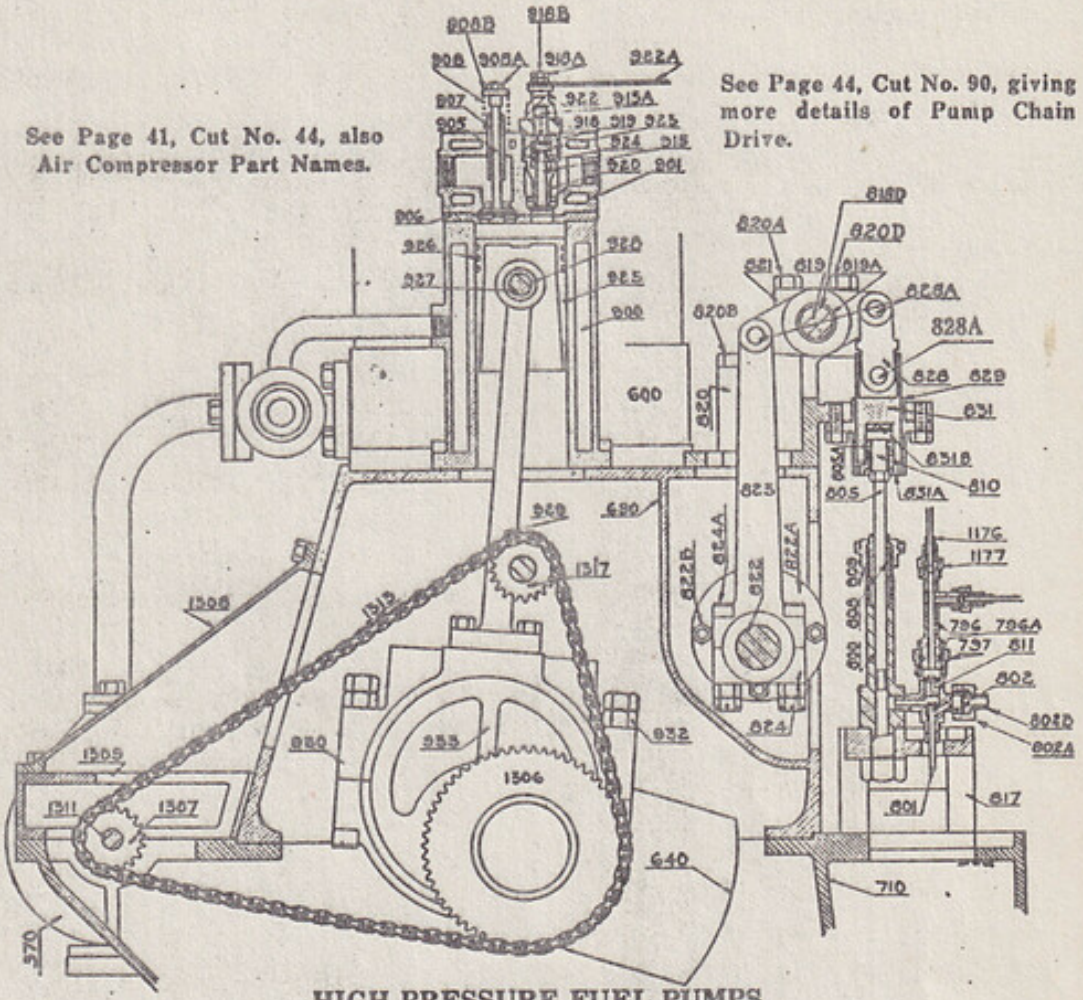
796 H. P. Fuel discharge fitting.
796A H. P. Fuel discharge fitting split ring.
797 H.P. Fuel discharge fitting nut
G800 H. P. Fuel pump complete: Parts Nos. 800, 805, 806, 808 809, 810, 810B.
800 H. P. Fuel pump body.
G802 H. P. Fuel pump suction valve cage with No. 801, and 811.
801 H. P. Fuel pump suction valve
802 H. P. Fuel pump suction valve cage.
802A H. P. Fuel pump suction union nut.
802B H. P. Fuel pump suction union sleeve.
805 H. P. Fuel pump plunger.
805A H. P. Fuel pump plunger spring.

811 = C 9534

801 = S 579

See Page 41, Cut No. 44, also Air Compressor Part Names.

See Page 44, Cut No. 90, giving more details of Pump Chain Drive.



HIGH PRESSURE FUEL PUMPS

806 H. P. Fuel pump packing ring.
808 H. P. Fuel pump gland.
809 H. P. Fuel pump gland nut.
810 H. P. Fuel pump plunger head
810B H. P. Fuel pump plunger nut.
811 H. P. Fuel pump discharge valve.
817 H. P. Fuel pump plate.
818 Pump rocker—double.
818A Pump rocker pin—long.
818B Pump rocker—single.
818D Pump rocker bushing—bronze.
819 Pump rocker shaft.
819A Pump rocker shaft sleeve—stud
G820 Pump rocker shaft bearing and caps.
820A Pump rocker shaft bearing stud—long.
820B Pump rocker shaft bearing stud—short.
820D Pump rocker shaft bearing cap stud.
821 Pump rocker shaft bearing cap.
822A Pump crank shaft coupling.
822 Pump crank shaft.
822B Pump crank shaft coupling bolts.
822C Fuel pump crank shaft washer
G823 Pump crank shaft connecting rod assembly; Part Nos. 823, 824, 824A.
824A Pump crank shaft connecting rod cap bolts.
828 Pump connecting link.
828A Pump connecting link pin.
829 Pump crosshead guide.
831 Pump crosshead.
831A Pump crosshead nut.
831B Pump crosshead button.

FOR PART NAMES NOT GIVEN HERE REFER TO PARTS LIST, PAGES 60 TO 67

HIGH PRESSURE FUEL PIPES COMPLETE WITH UNIONS

In ordering fuel pipes or fuel pipe unions, specify outside diameter of pipe. Each pipe complete with parts No. 1176, 1177.

1183 Testing pipe—Fuel rail to test clamp.
1184 Fuel pipe from fuel relief valve discharge to pump suction.
1185 Fuel pipe from high pressure fuel pump discharge to fuel relief valve inlet.
1186 Fuel pipe from connecting pipe between H. P. fuel pumps (discharge).
1187 Fuel pipe from fuel pump to fuel rail.
1188 Fuel pipe from fuel rail to spray valve.
1189 Fuel pipe from fuel rail to fuel oil receiver.
1189A Fuel pipe from fuel oil receiver to fuel pressure gauge.
1200 Fuel rail with isolating valves.
1170 High pressure union nipple.
1176 High pressure fuel union nut.
1177 High pressure fuel union sleeve.

Fuel Oil Strainer

(Parts on Page 48)

THE fuel oil strainer is composed of two compartments or chambers. In each of the chambers is located a built up strainer unit or cartridge, each having three layers of one hundred mesh bronze screen. These cartridges fit snugly into the chamber, and are held in position by means of spiral springs. The spiral springs are held down by the covers which are sealed with copper gaskets.

This strainer unit is provided with a passover valve with ports so constructed that by turning this valve in one position the fuel oil flows into one compartment of the strainer only, turning it in the other position permits the other strainer to be used. In this way one strainer can be shut off, taken apart and cleaned, while the other is in use, without interfering with the running of the engine.

It is important that these strainers be cleaned from time to time. The method of cleaning these strainer units or cartridges is by submerging them in a can of gasoline and washing them off thoroughly, remove all sediment in the bottom of the strainer chamber, and wipe all joints clean and free from grit and dirt before again assembling. Grit, dirt or impurities permitted to enter the fuel pump are apt to create trouble, and for that reason it is important to use as much care as possible in eliminating impurities from the fuel oil.

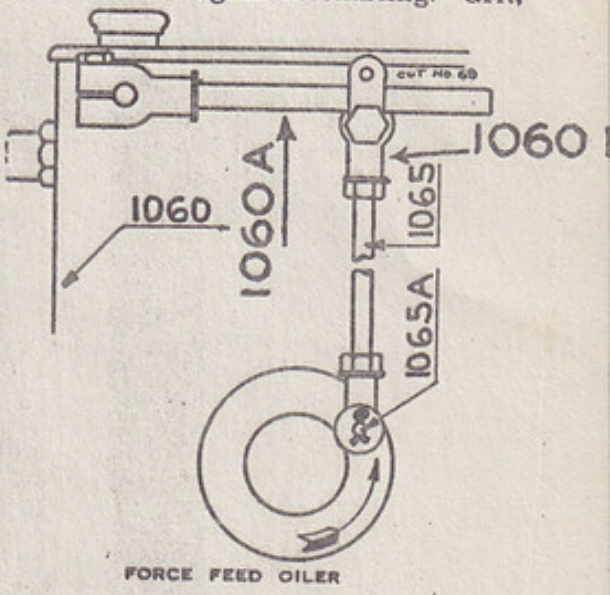
FORCE FEED OILER

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.

Some models lub. drive off water pump connecting rod. Same part numbers apply.

1060 Force feed lubricator (see note)
1065 Force feed lubricator drive rod
1065A Force feed lubricator drive rod pin.

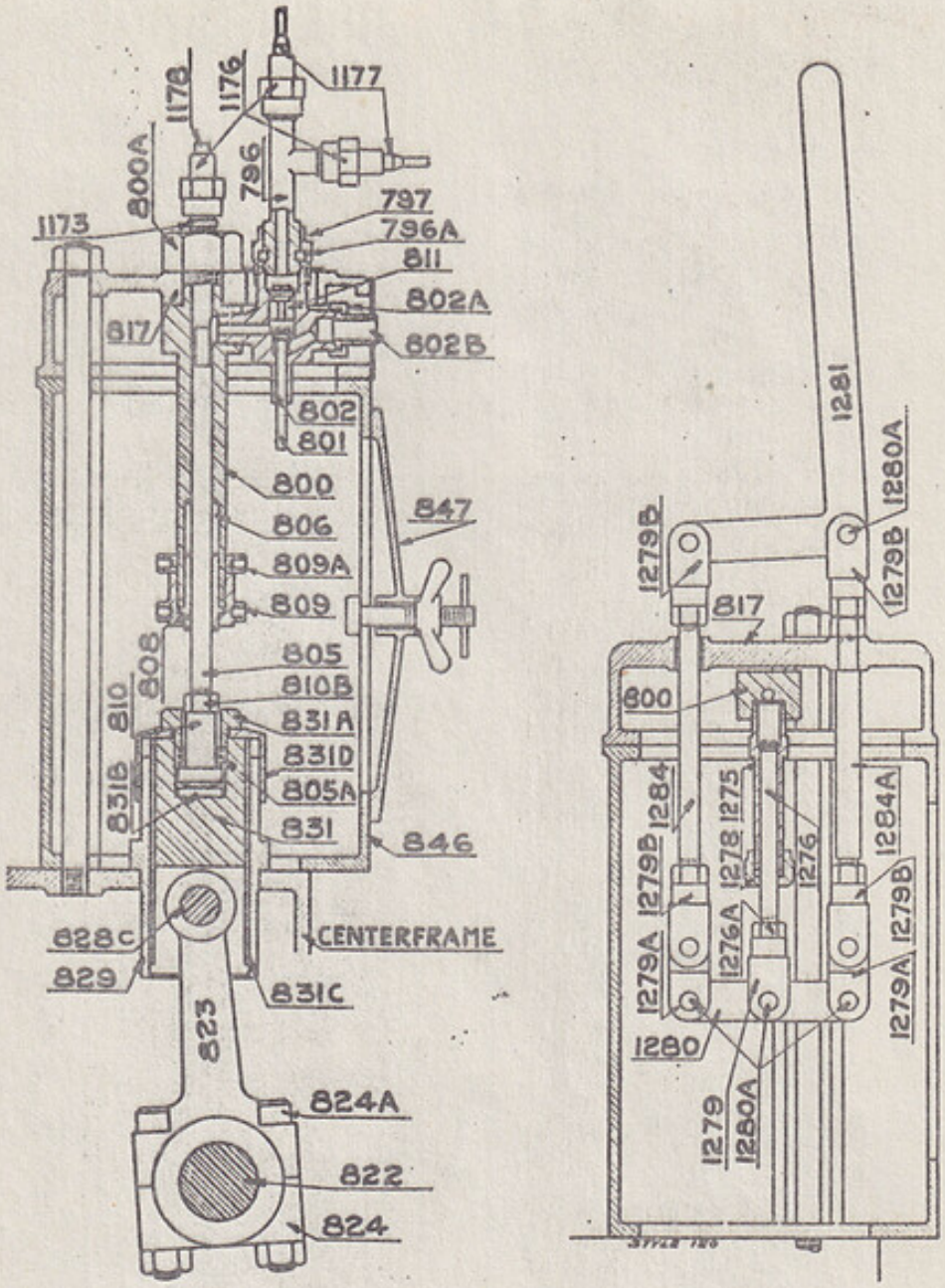
Note: When ordering new lubricator, state manufacturer, number of feeds, also type.



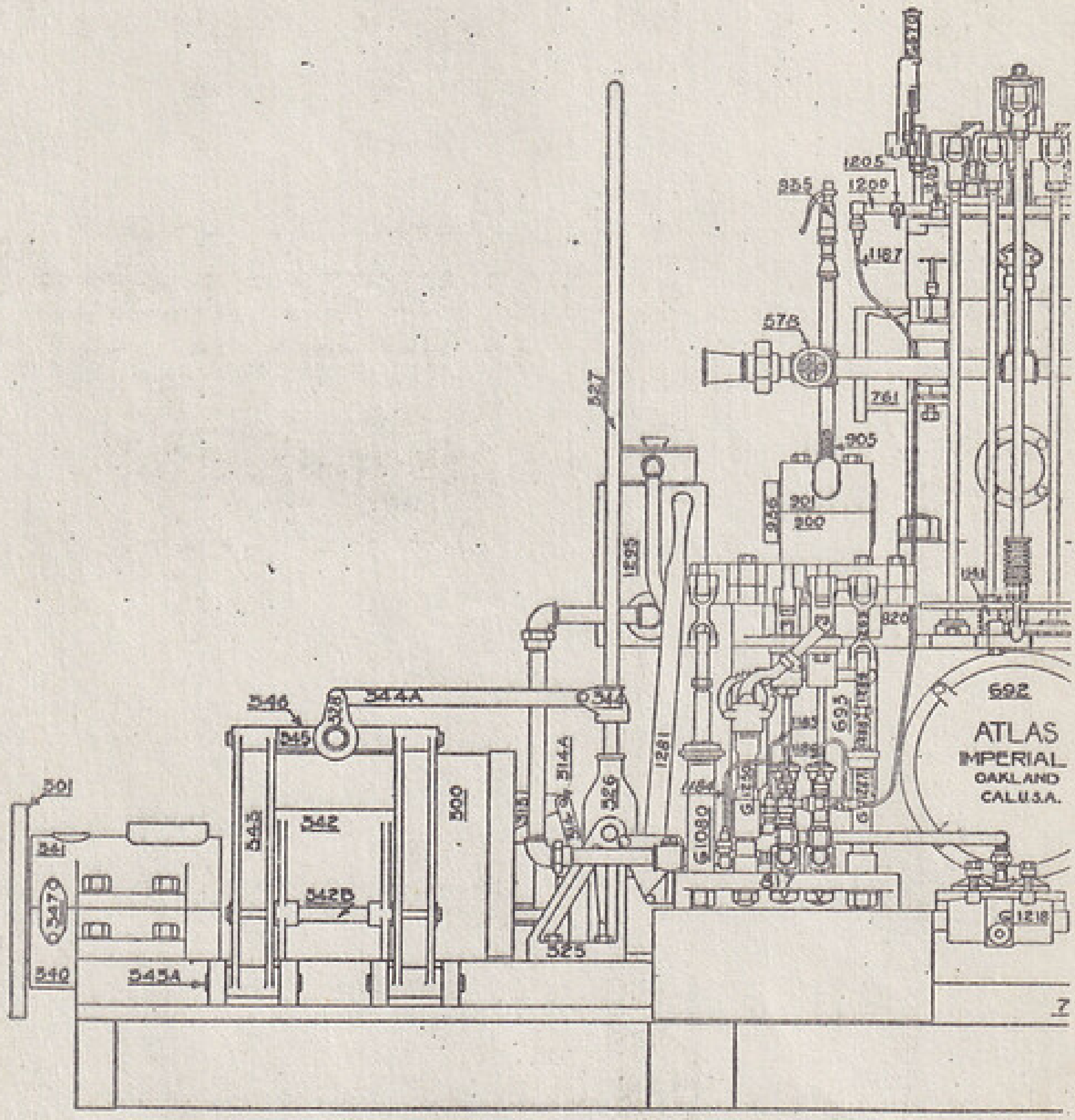
FORCE FEED OILER

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


1177
1178
1176
800A
796
797
1173
796A
811
802A
817
802B
802
801
800
847
806
809A
809
808
805
810
810B
831A
831D
831B
805A
831
846
828C
CENTERFRAME
829
831C
823
824A
822
824
1281
1280A
1279B
817
800
1284
1275
1278
1276
1284A
1279B
1279A
1276A
1279B
1279A
1280
1279
1280A

FUEL PUMP

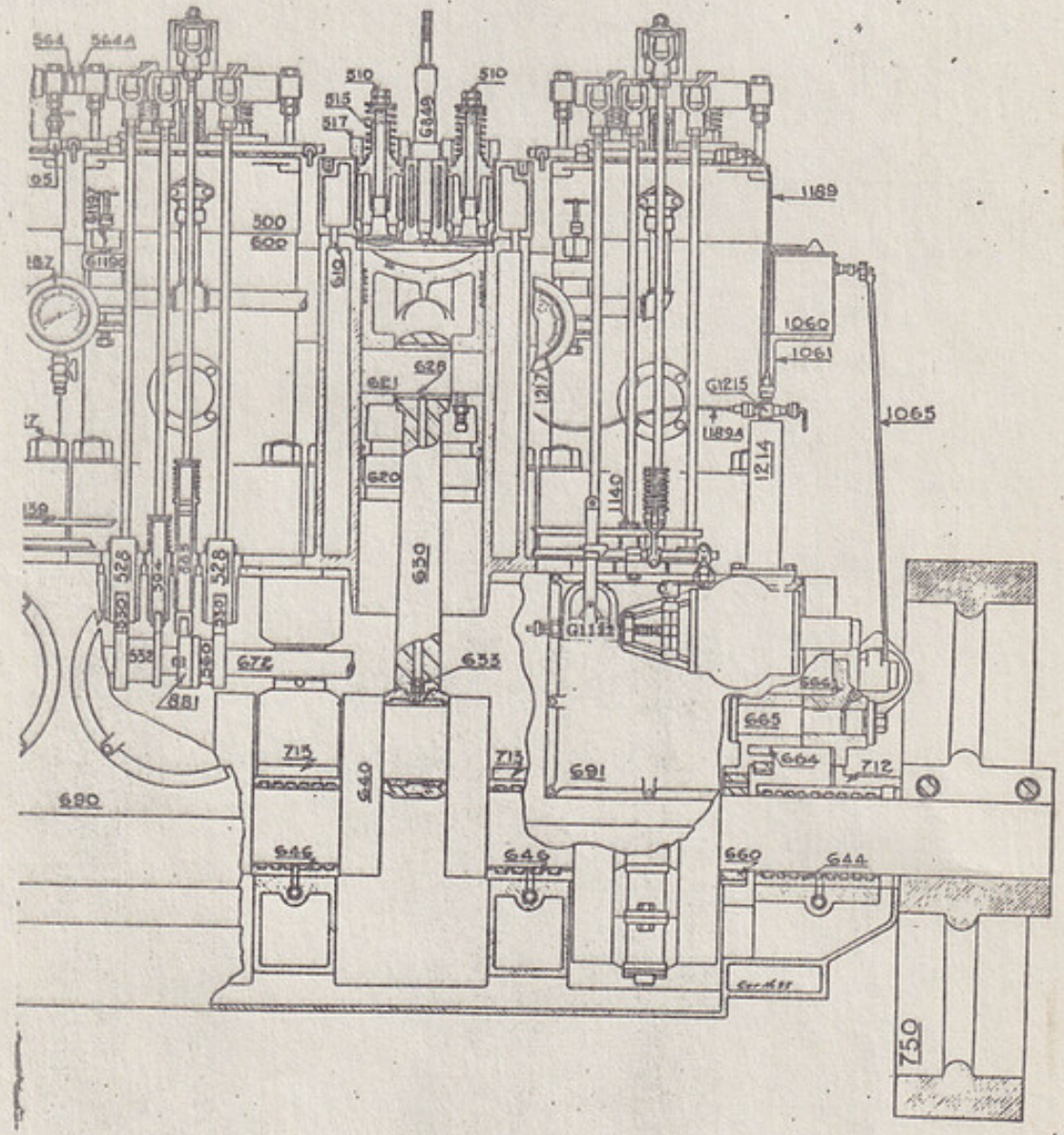

501
241
540
545A
546
544A
545
544
543
542
542B
500
514A
526
527
525
1281
578
855
1205
1209
1187
761
905
901
200
820
692
ATLAS
IMPERIAL
OAKLAND
CAL.U.S.A.
693
G1080
G1218

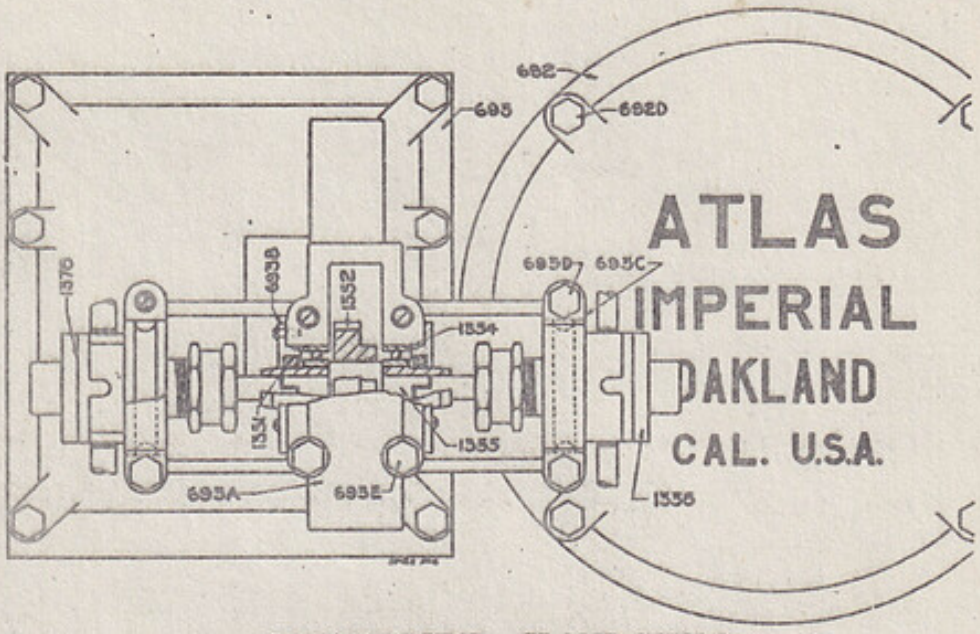
C

ATLAS IMPerial

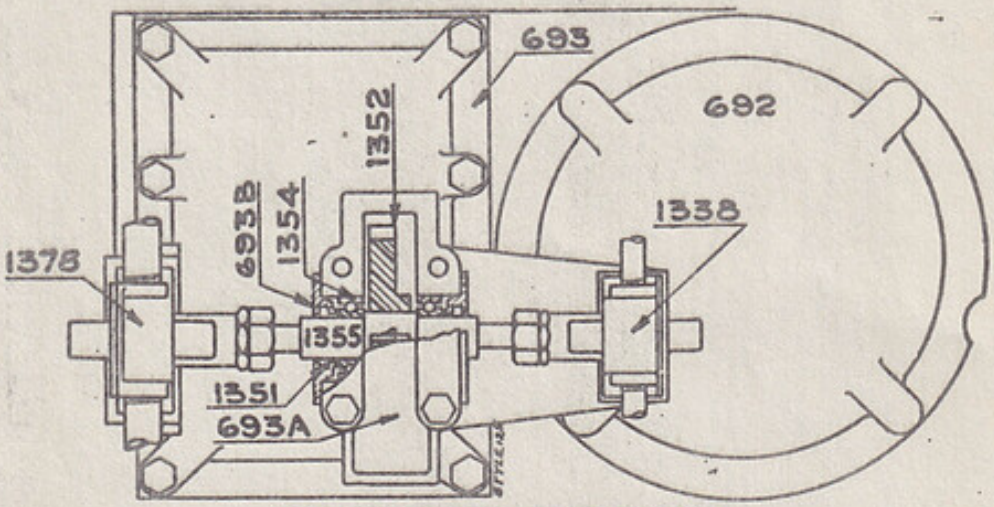
No 8251 - H.P. 110

1"





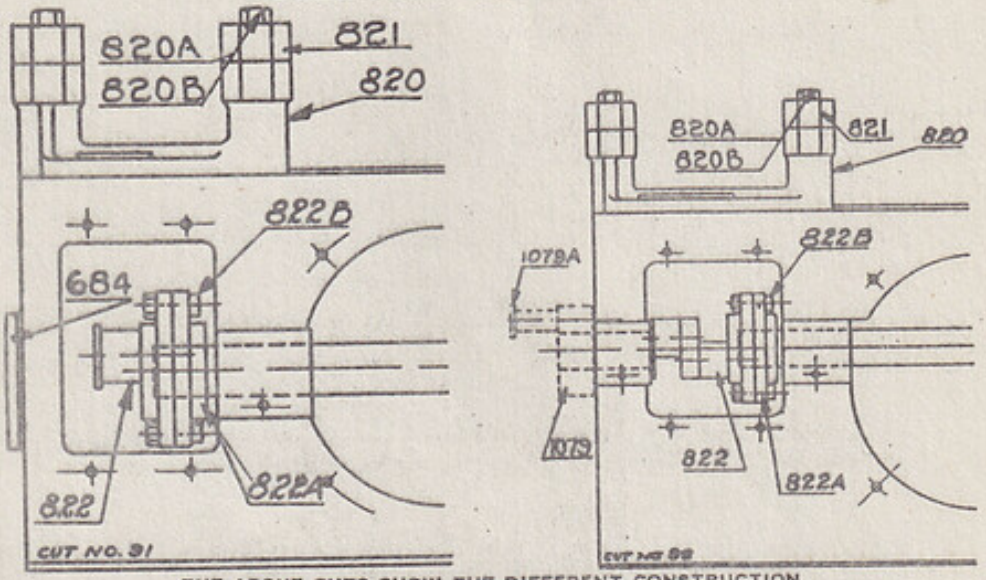
ROTARY PUMP—CLAMP STYLE



ROTARY PUMP—FOOT STYLE

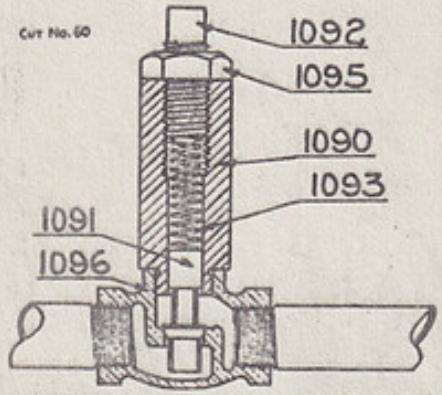
692	Centerframe door (round)
692A	Centerframe door gasket
692D	Centerframe cover cap screw
693	Rotary pump door
	Rotary pump door cap screw
	Rotary pump door gasket
693A	Rotary pump door bearing cap
693B	Rotary pump door ball bearing retainer
	Rotary pump door ball bearing retainer screw
693C	Rotary 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
1356	Rotary pump drive shaft
1371	Rotary pump gear and shaft for ⅛" outlet pump. Driver
1372	Rotary pump gear and shaft driven for ⅛" outlet pump
1376	Rotary pump, complete: ⅛" outlet
	Rotary pump holding down cap screw

FUEL PUMP CRANK SHAFTS



THE ABOVE CUTS SHOW THE DIFFERENT CONSTRUCTION EMPLOYED IN FUEL PUMP CRANK SHAFTS.
THE PART NUMBERS ARE THE SAME IRRESPECTIVE OF THE NUMBER OF CRANKS

684 Centerframe cover—end of camshaft.
G820 Fuel pump rocker shaft bearing and caps.
820A Fuel pump rocker shaft bearing stud (long).
820B Fuel pump rocker shaft bearing stud (short).
821 Fuel pump rocker shaft bearing cap.
822 Fuel pump crank shaft.
822A Fuel pump crank shaft coupling.
822B Fuel pump crank shaft coupling bolt.
1079 Lubricating sump pump crank disc.
1079A Sump pump crank disc washer



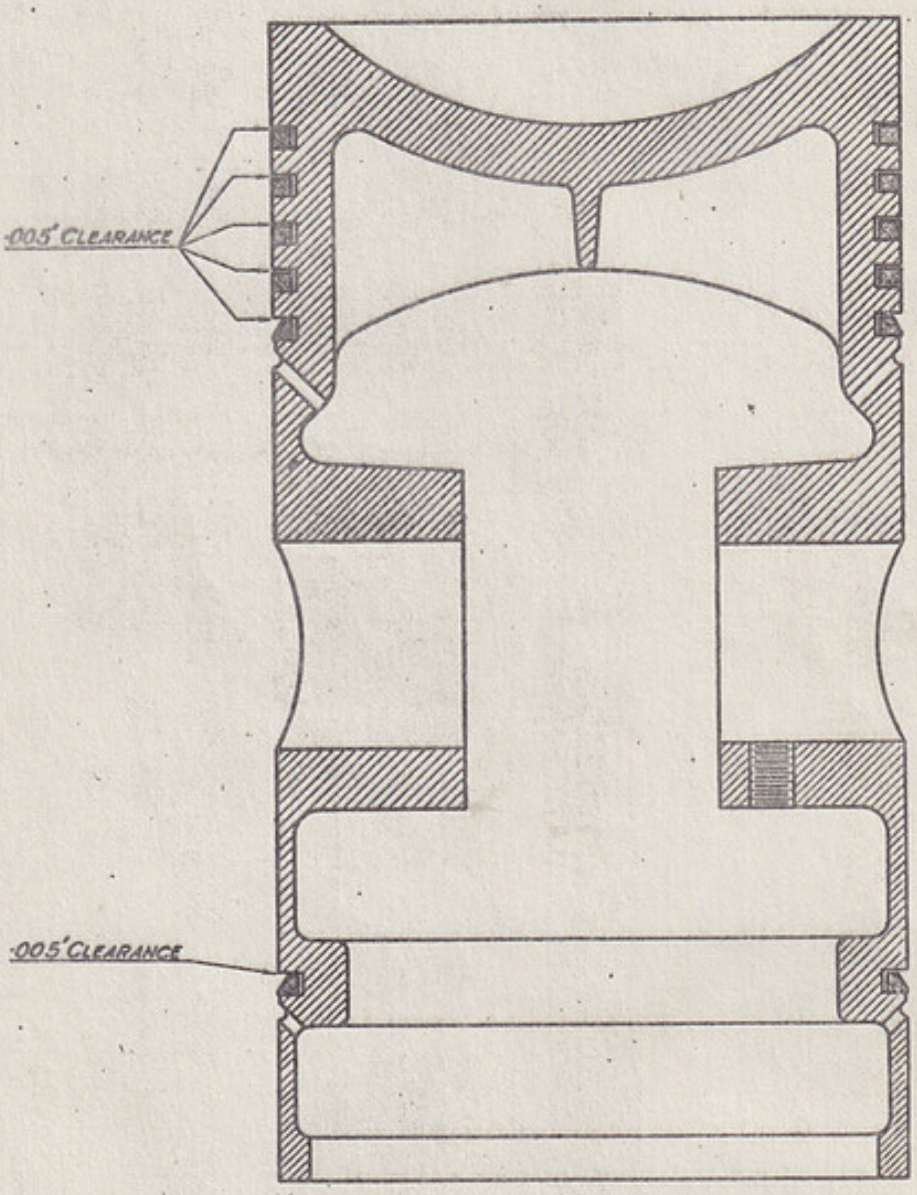
PRESSURE LUBRICATING RELIEF VALVE

G1090 Valve, complete: Part Nos. 1090, 1091, 1092, 1093, 1095, 1096.
1090 Lubricating relief valve body cap.
1091 Lubricating relief valve plunger.

PRESSURE LUBRICATING RELIEF VALVE

A pressure lubricating relief valve, used in connection with the pressure lubricating oil 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.

1092 Lubricating relief valve adjusting screw.
1093 Lubricating relief valve spring
1095 Lubricating relief valve adjusting screw nut.
1096 Lubricating relief valve check valve and body.


.005' CLEARANCE
.005' CLEARANCE

Piston Rings

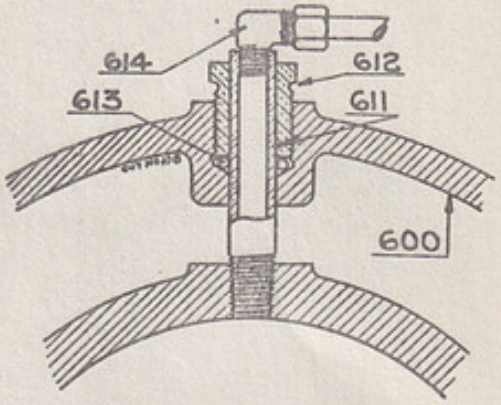
ALL pistons are fitted with six piston rings, five above the pin and one below, as illustrated. All rings are step cut rings. The rings just above the pin and the ring below the pin are oil scraper rings. Care should be taken to have these rings properly fitted in the ring grooves as shown.

In fitting new rings a vertical clearance of .005" should be given all rings and it is also important that there be plenty of clearance under the rings and that the sides of the ring grooves be parallel in order to realize the full effect of the rings. If the grooves are worn or tapered it will be necessary to face the sides of the grooves a little wider.

The opening between ends of rings No. 1, 2 and 3 should be not less than .005" per inch of cylinder diameter, while No. 5 and No. 6 ring should be fitted with about .002" per inch of cylinder diameter.

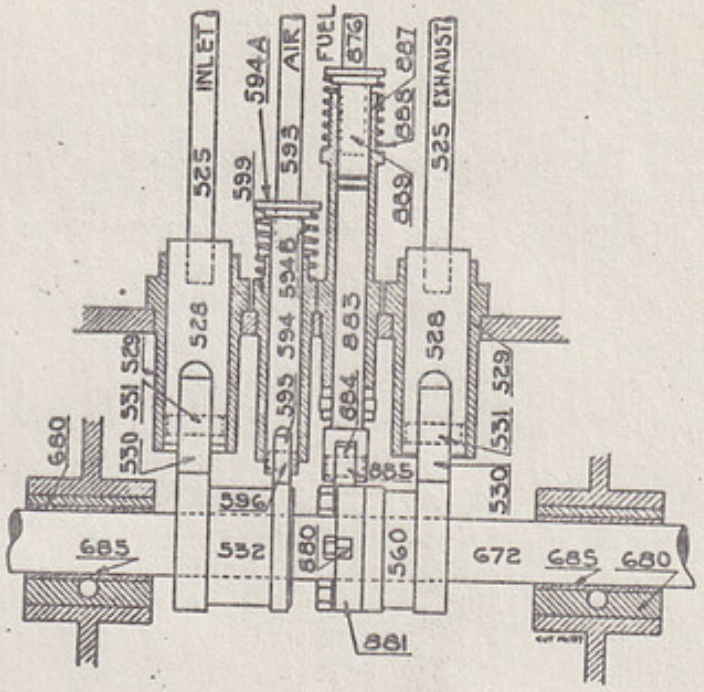
All ring openings should be measured with the rings in the cylinder.

Cylinder Lubricating Pipe



600 Cylinder.
611 Cylinder lubricating pipe through jacket.
612 Cylinder lubricating pipe gland.
613 Cylinder lubricating pipe packing.
614 Cylinder lubricating pipe elbow.

The cylinder lubricating oil pipe shown here for lubricating the piston and cylinder walls of engine 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.

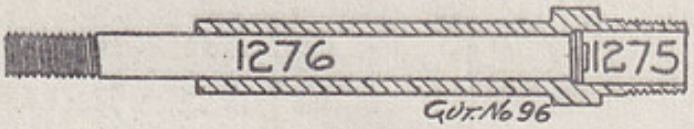


Valve Lifters

525 Push rod, inlet or exhaust.
G528 Valve lifter, with roller and pin for inlet or exhaust.
529 Valve lifter guide, inlet or exhaust.
530 Valve lifter roller, for inlet or exhaust.
531 Valve lifter roller pin, for inlet or exhaust.
532 Inlet and air starting cam.
560 Exhaust cam.
593 Push rod, air starting.
G594 Air starting valve lifter, with roller and pin.
594A Air starting valve lifter collar.
594B Air starting valve lifter spring.
595 Air starting valve lifter roller.
596 Air starting valve lifter roller pin.
599 Air starting valve lifter guide.
672 Cam shaft.
G680 Cam shaft bearing and bushing.
685 Cam shaft bushing.
876 Spray valve rocker push rod.
880 Spray valve cam toe.
881 Spray valve cam disc.
G883 Spray valve lifter, with roller and pin.
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.

PRIMING PUMPS

A priming pump, No. 1275, connected directly to the high pressure fuel pump and equipped with a hand lever, No. 1281 (See pages 28 and 32). When starting the engine this pump is used for the purpose of exhausting any air from the fuel oil piping and to pump up pressure on the high pressure pipes and manifolds so that when the engine is started the fuel is already at the point of the spray nozzles ready to be admitted to the cylinder as quickly as the spray nozzles are opened by the spray cam.



PRIMING PUMP

G1275	Priming pump, complete: Part Nos. 1275, 1276, 1276A, 1278 and packing.	1280A	Priming pump plunger pin.
1275	Priming pump cylinder.	1281	Priming pump handle.
1276	Priming pump plunger.	1282	Priming pump handle bracket.
1276A	Priming pump plunger nut.	1282A	Priming pump handle bracket spacer.
1278	Priming pump cap nut.	1282B	Priming pump handle bracket bar.
1279	Priming pump plunger eye.	1282C	Priming pump handle bracket lever pin.
1280	Priming pump plunger connecting rod.		

DAY TANK PUMP

SEE PAGE 28 FOR DRAWING OF PUMPS

G1287	Day tank pump, complete: Part Nos. 1287, 1288, 1288A, 1289, 1291, 1292.	1289A	Day tank pump plunger eye pin.
1287	Day tank pump body.	1290	Day tank pump check valve.
1288	Day tank pump plunger.	1291	Day tank pump gland.
1288A	Day tank pump plunger nut.	1292	Day tank pump gland nut.
1289	Day tank pump plunger eye.	1293	Day tank pump connecting rod.

High Pressure Fuel Pumps

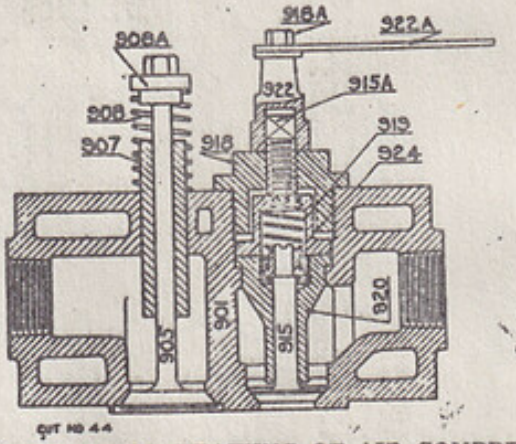
THE fuel pumps are of the plunger type with ½-inch diameter, hardened and ground plungers. These pumps are to pump the fuel up to the required pressure, and for that reason are very closely fitted. It is necessary to use care in packing these plungers. The packing glands should never be screwed down 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 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.

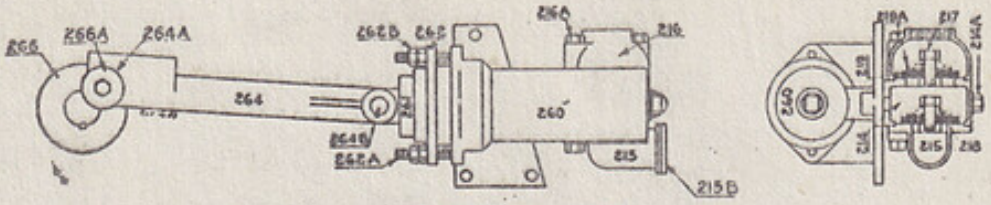
Air Compressor

PURPOSELY no provision has been made for continuous lubrication of this unit. It is intended that the operator should use a squirt can and give this a few drops of oil at the air intake when first starting the engine. After that it receives plenty of oil from the vapor within the base. If a continuous oil drip were used on the air compressor, the valves would carbon up very quickly and there would be danger of the vapor from the lubricating oil igniting, in which case the pipe or tanks would be carried away by an explosion. After the engine has run for a few hours, it will never need any more lubrication on the air compressor except what is received from vapor within the crank case.

900 Air compressor cylinder with 902.
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 with 907.
902 Air compressor cylinder head stud.
905 Air compressor 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 nut.
918A Air compressor discharge valve relief handle nut.
918B Air compressor inlet valve cap nut stud.
918C Air compressor inlet valve flange stud.
918D Air compressor inlet valve flange gasket.
919 Air compressor discharge valve spring.
920 Air compressor discharge valve guide.
922 Air compressor discharge valve cap nut.
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 piston pin bushing.
G929 Air compressor piston connecting rod; bushed.
G930 Air compressor eccentric strap (2 halves) and bolts.
932 Air compressor eccentric strap bolts.
933 Air compressor eccentric.
935 Air compressor relief valve.
936 Air compressor pass-over pipe.
937 Air compressor gauge; 300 lbs.



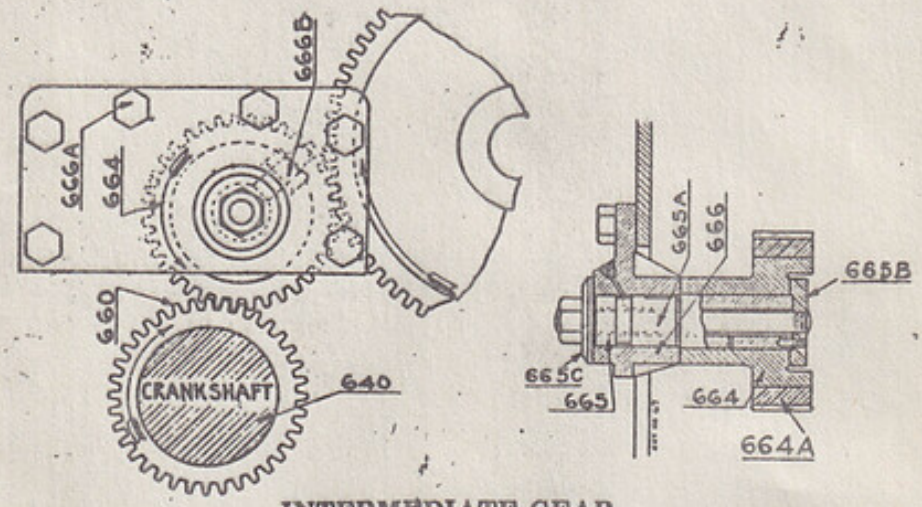
SEE PAGE 27 FOR DRAWING OF AIR COMPRESSOR



PLUNGER PUMP

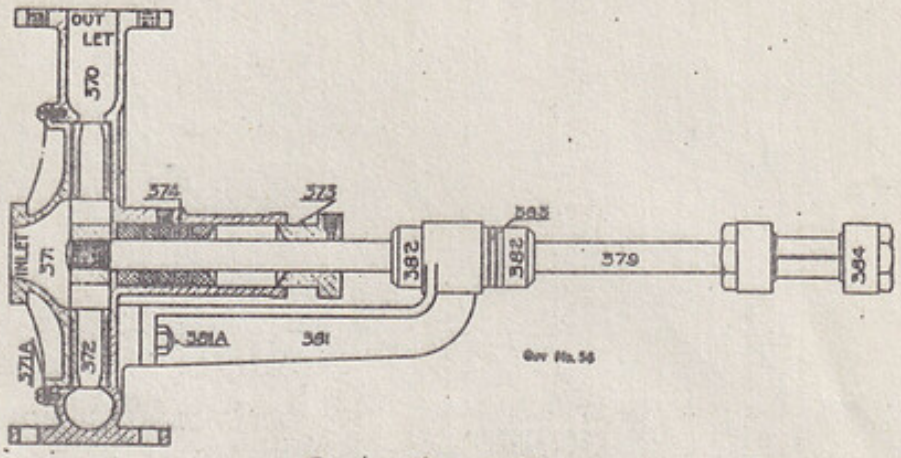
G260 Plunger pump complete: Parts 260, 261, 262, 262A, 262B.
214 Plunger pump valve cage.
214A Plunger pump valve cage center stud.
215 Plunger pump suction bonnet.
215A Plunger pump bonnet copper asbestos gasket.
215B Plunger pump inlet flange.
216 Plunger pump discharge bonnet
216A Plunger pump bonnet connecting stud.
217 Plunger pump valve guide stem
218 Plunger pump valve spring.
219 Plunger pump rubber disc valve
219A Plunger pump valve bushing.

GA260 Plunger pump body with 262A.
261 Plunger pump plunger.
262 Plunger pump gland.
262A Plunger pump gland stud.
262B Plunger pump gland stud nut.
G264 Plunger pump connecting rod with 264A.
264A Plunger pump connecting rod bushing.
264B Plunger pump connecting rod pin.
266 Plunger pump connecting rod crank disc.
266A Plunger pump connecting rod crank disc washer.



INTERMEDIATE GEAR

640 Crankshaft with 660 and 655.
660 Crankshaft pinion.
664 Intermediate gear (inc. 664A).
665 Intermediate gear pin.
665A Intermediate gear pin bolt.
665B Intermediate gear pin bolt washer.
665C Intermediate gear pin washer.
666 Intermediate gear bearing.
666A Intermediate gear bearing cap screws.
666B Intermediate gear bearing lock set screw.

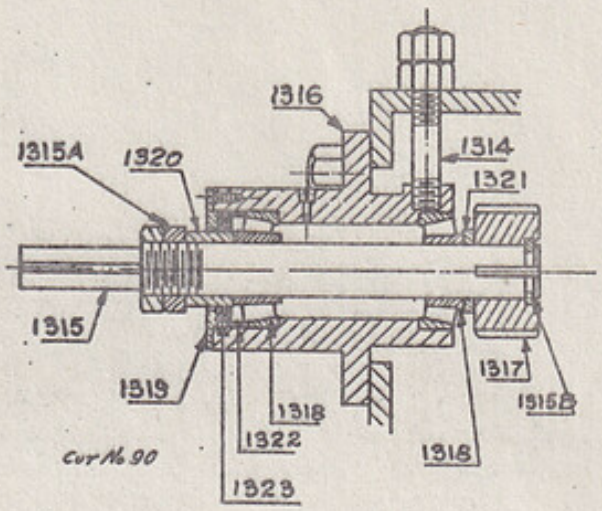


Centrifugal Pump

G370	Centrifugal pump, complete: Part Nos. 370. 371, 371A, 372, 373, 373A, 374, 379, 381, 381A, 382, 383.
GA370	Centrifugal pump body with 374.
370A	Centrifugal pump outlet flange.
371	Centrifugal pump cover.
371A	Centrifugal pump cover screws.
371B	Centrifugal pump inlet flange.
G372	Centrifugal pump runner with shaft.
373	Centrifugal pump gland.
373A	Centrifugal pump gland stud.
374	Centrifugal pump shaft bushing
379	Centrifugal pump shaft.
381	Centrifugal pump steady bearing.
381A	Centrifugal pump steady bearing cap screw.
382	Centrifugal pump collar.
383	Centrifugal pump ball bearing.
384	Centrifugal pump coupling.

THE centrifugal pump drive is by means of a silent chain from the crankshaft to the centrifugal pump shaft. With continued use, a slight amount of wear in the links will allow the silent chain to stretch and provision is made for taking up this stretch by means of a chain-adjusting spindle, as shown next page. Occasionally it is well to inspect the chain and take up apparent slackness. This is done by loosening the idler spindle bearing nuts and tightening up on the chain adjusting screws, No. 1314. When the proper tension has been obtained tighten the bearing bracket bolts again and secure them with wire to prevent from becoming loose. Tighten the lock nut on the chain tension adjusting screw. The chain must never be too tight. When properly adjusted there should be sufficient slack in the middle of the span between the pump sprocket and idler sprocket so that it can be lifted up and down with the fingers, about one inch.

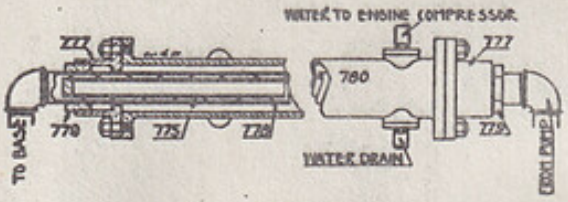
Do not allow the chain to become too slack as there is danger of the chain riding over the teeth on the sprocket which would ruin both the sprocket and the chain. Watch the chain tension and take up when necessary.



CENTRIFUGAL PUMP CHAIN DRIVE

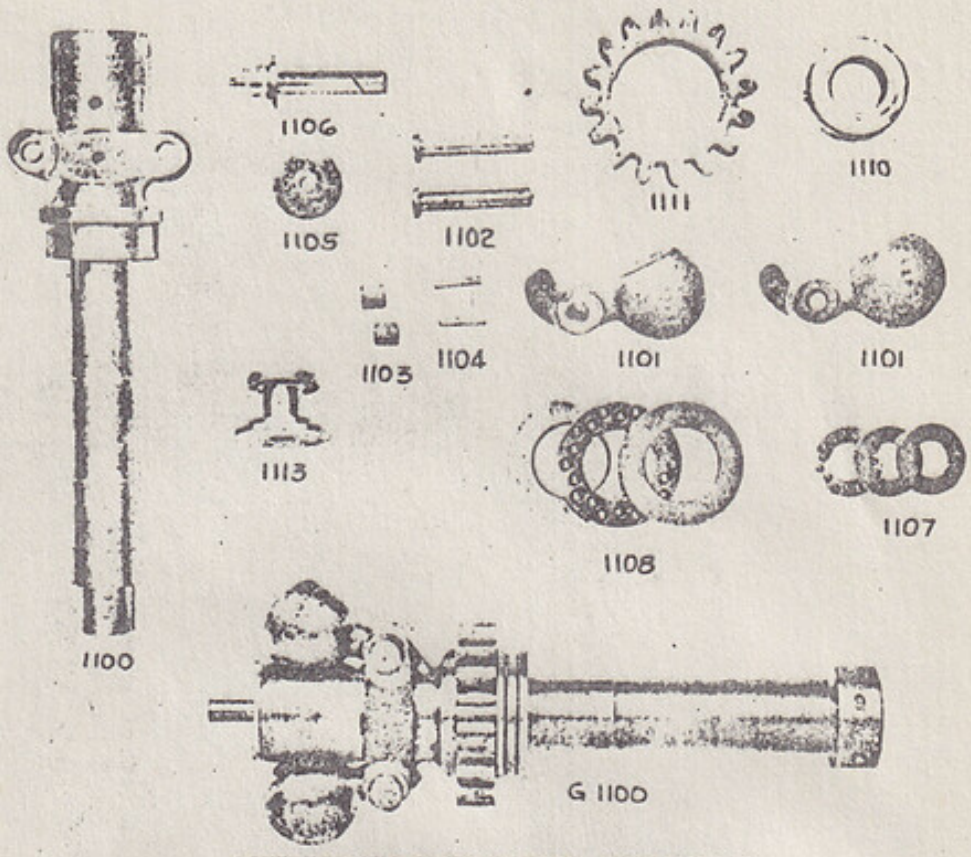
1306	Chain sprocket (driver on crank shaft).	1315	Idler spindle.
1307	Chain sprocket (driven on pump shaft).	1315A	Idler spindle lock nut.
1308	Chain shield.	1315B	Idler spindle split ring.
1309	Chain shield cap.	1316	Idler spindle bearing housing.
1310	Ball bearing container (blind end).	1317	Idler spindle chain sprocket.
1310A	Ball bearing container (shaft end).	1318	Idler spindle roller bearing (complete).
1311	Driven chain sprocket shaft.	1319	Idler spindle steel cover.
1312	Driven chain sprocket ball bearing.	1319A	Idler spindle steel cover screw
1313	Silent chain.	1320	Idler spindle roller bearing spacer.
1314	Silent chain adjusting screw.	1321	Idler spindle spacer.
		1322	Idler spindle spacer washer.
		1323	Idler spindle felt washer.

For Drawing showing Parts No. 1306, 1307, 1308, 1309, 1311, 1313, 1317, see page 29.



OIL COOLER

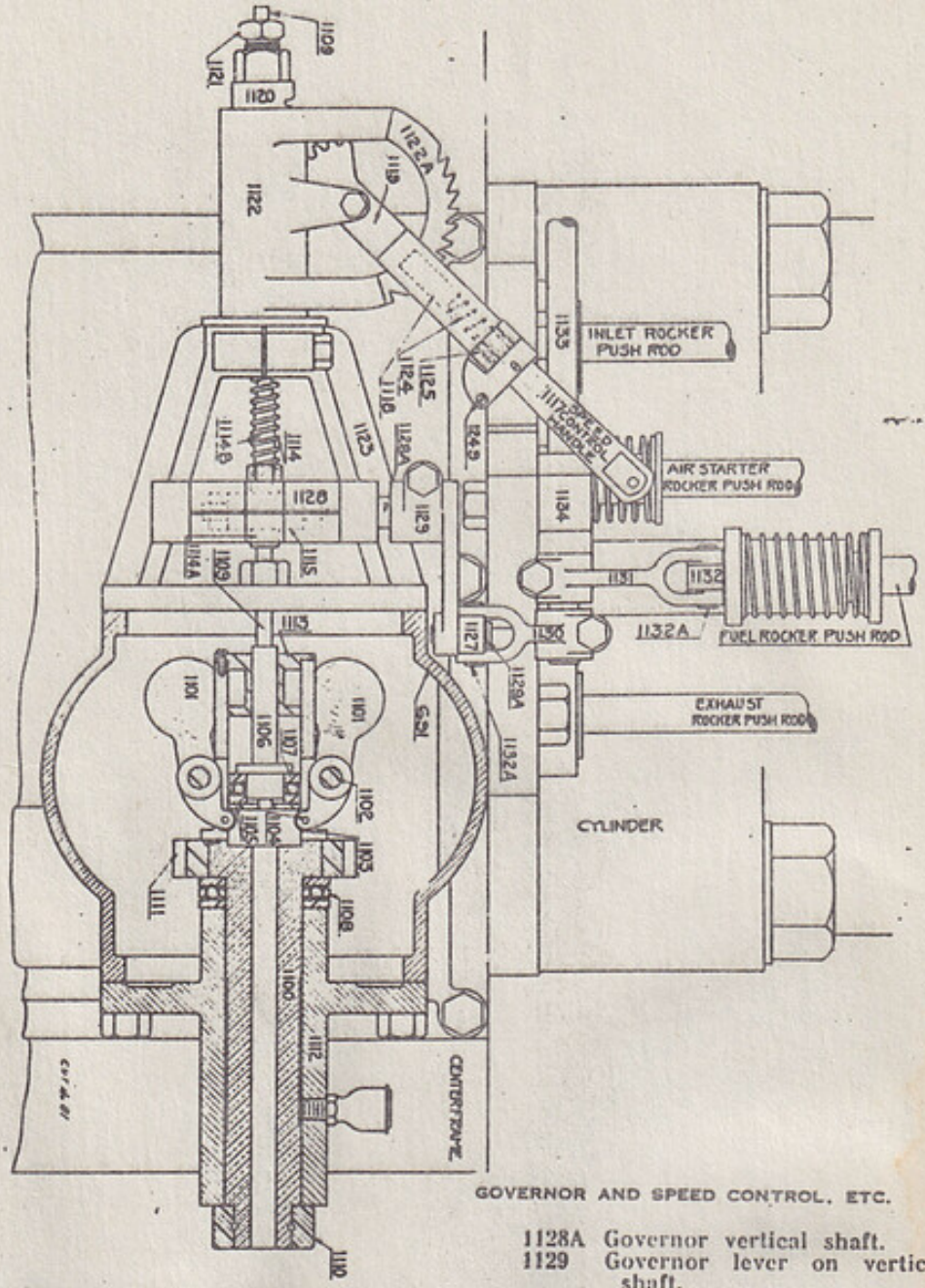
775	Oil cooler core.	779	Oil cooler gland.
777	Oil cooler head.	780	Oil cooler inlet pipe.
778	Oil cooler pipe.		



GOVERNOR AND SPEED CONTROL CONNECTIONS

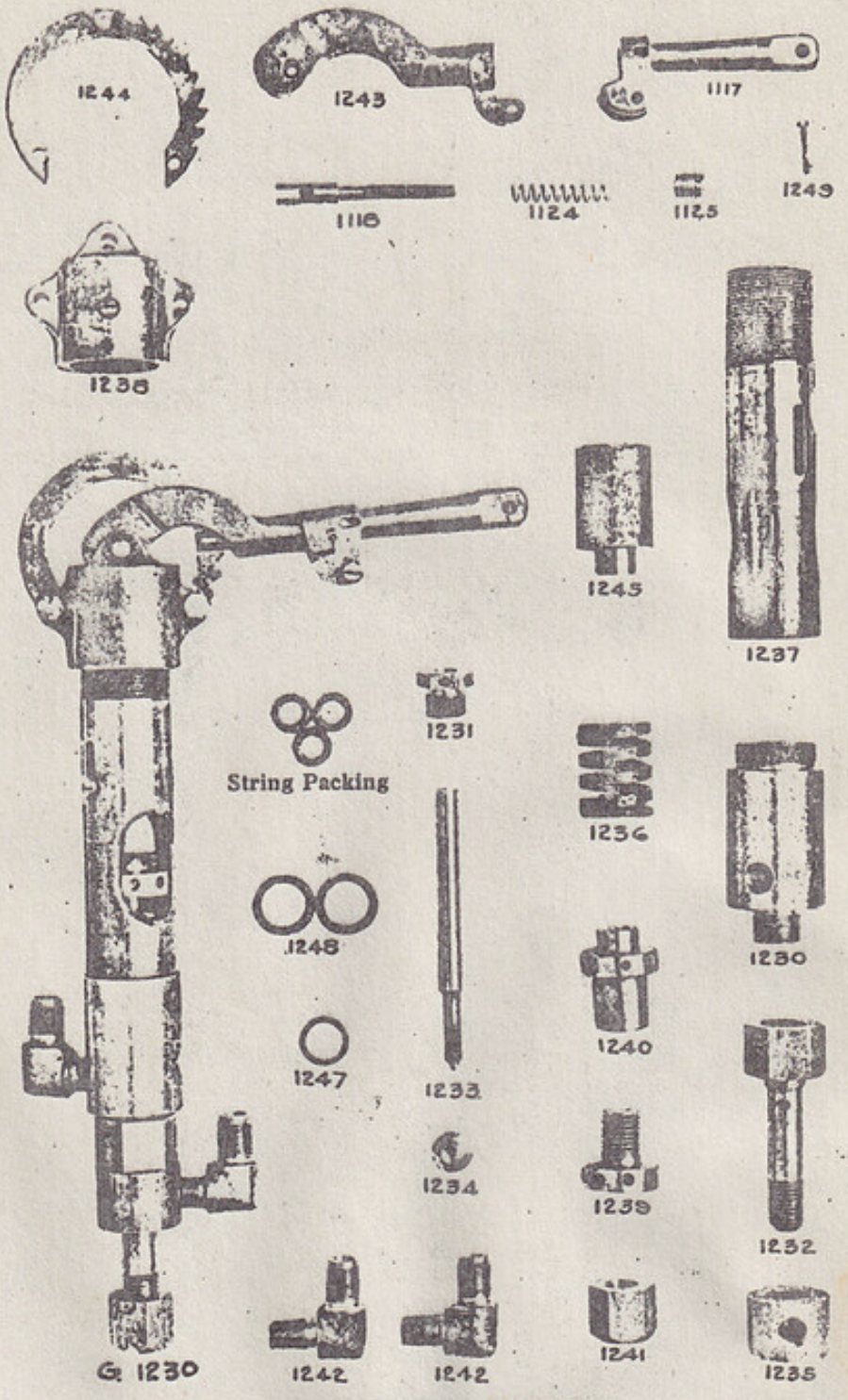
Governor

691	Governor shield.
691A	Governor shield gasket.
G1100	Governor assembly: Part Nos. 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1113.
GA1100	Governor body (always supplied with 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.
1113	Governor thrust quill bushing.
1114	Governor compression spring.
1114A	Governor compression spring collar.
1114B	Governor compression spring collar.
1115	Governor compression spring block.
G1117	Governor 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
GA1122	Governor speed control socket with sector 1122A.
1122A	Governor speed control socket sector.
G1122	Governor speed control socket and handle complete: Part Nos. 1117, 1118, 1119, 1120, 1121, 1122, 1122A, 1124, 1125 1249.

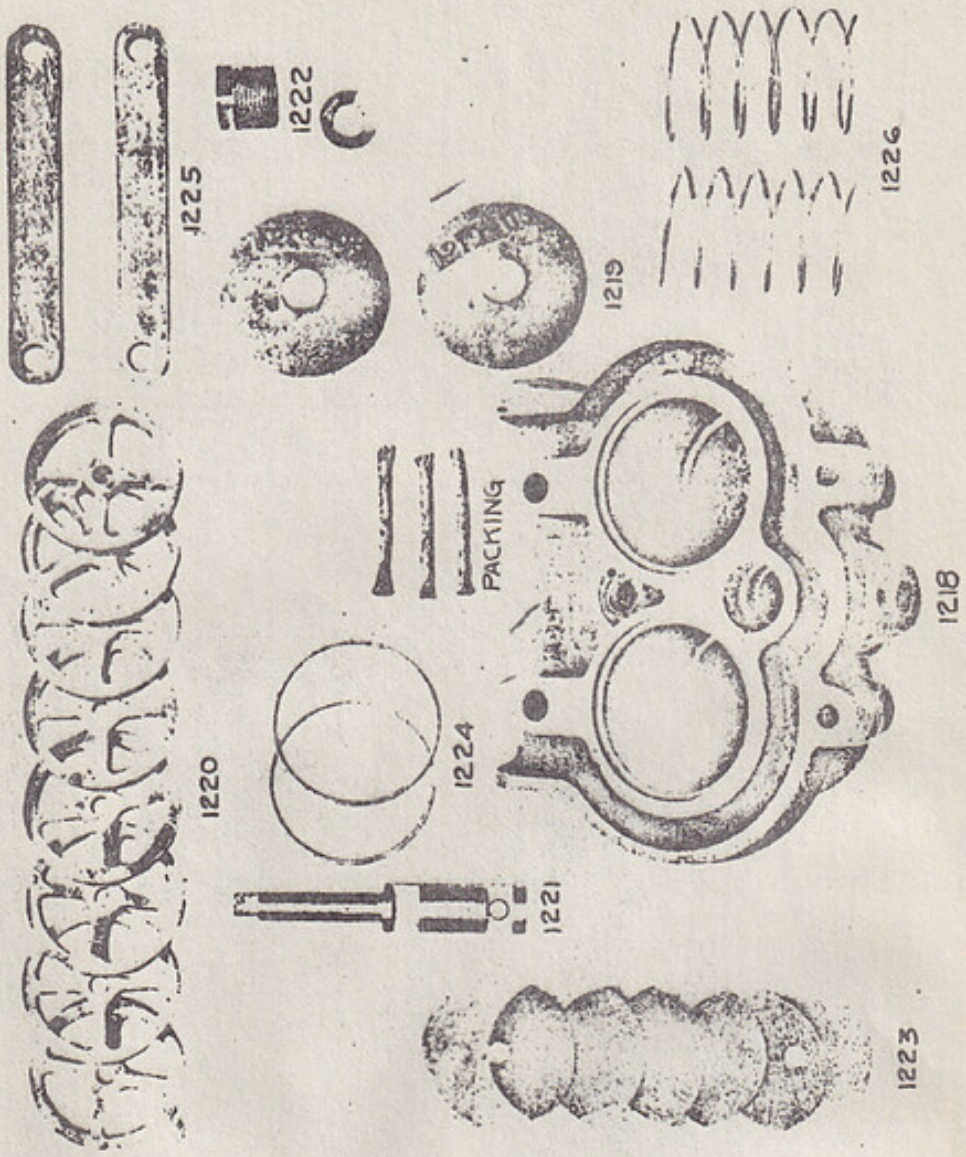


GOVERNOR AND SPEED CONTROL, ETC.

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 vertical shaft.
1129 Governor lever on vertical shaft.
1129A Governor lever on vertical shaft pin.
1130 Governor fork on wedge shaft
1131 Governor wedge forks.
1132 Fuel control wedge.
1132A Fuel control wedge pin.
1133 Fuel control shaft.
1134 Fuel control shaft bearing.
1249 Governor control handle screw



FUEL RELIEF VALVE, SEE PAGE 23



DUPLEX FUEL STRAINER

G1218	Fuel strainer complete.
1218	Fuel strainer body.
1219	Fuel strainer cover.
1220	Fuel strainer grid.
1221	Fuel strainer valve.
1222	Fuel strainer valve stuffing box.
1223	Fuel strainer gauze.
1224	Fuel strainer cover gasket.
1225	Fuel strainer cover clamp.
1226	Fuel strainer grid spring.

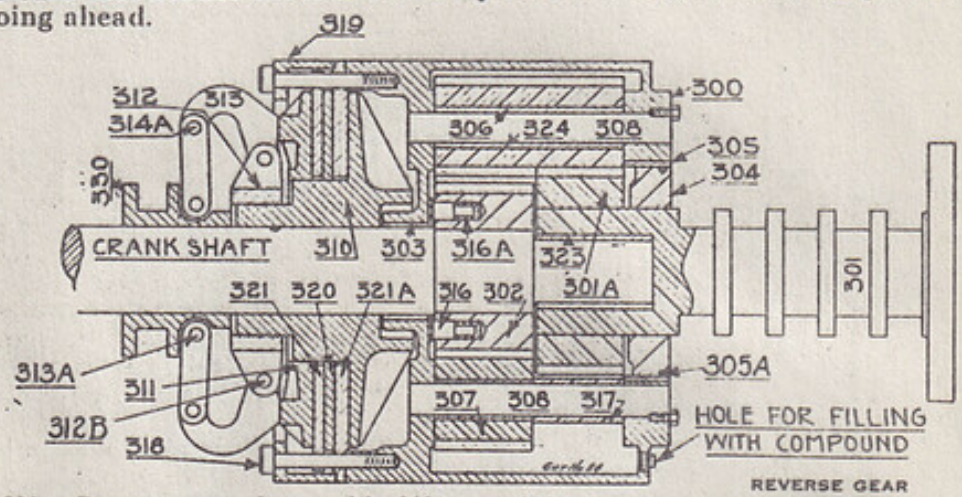
Reverse Gear

The gears, in the drum, when reversing should be constantly running in compound. Fill the drum with a good grade of compound (generally done at first in the factory) when needed, through the plugged hole in the after end of the drum. It is good practice to put about one quart of good transmission oil in drum every few weeks.

The friction clutch is of the multiple-disc type. In case the clutch begins to slip, loosen one of the bolts holding the crowder collar together and turn collar slightly in clockwise direction, thereby tightening on the threads of the driver. Be sure to tighten all bolts again before attempting to run engine.

Plates should be oiled occasionally by pouring oil in the open end of the reverse gear drum.

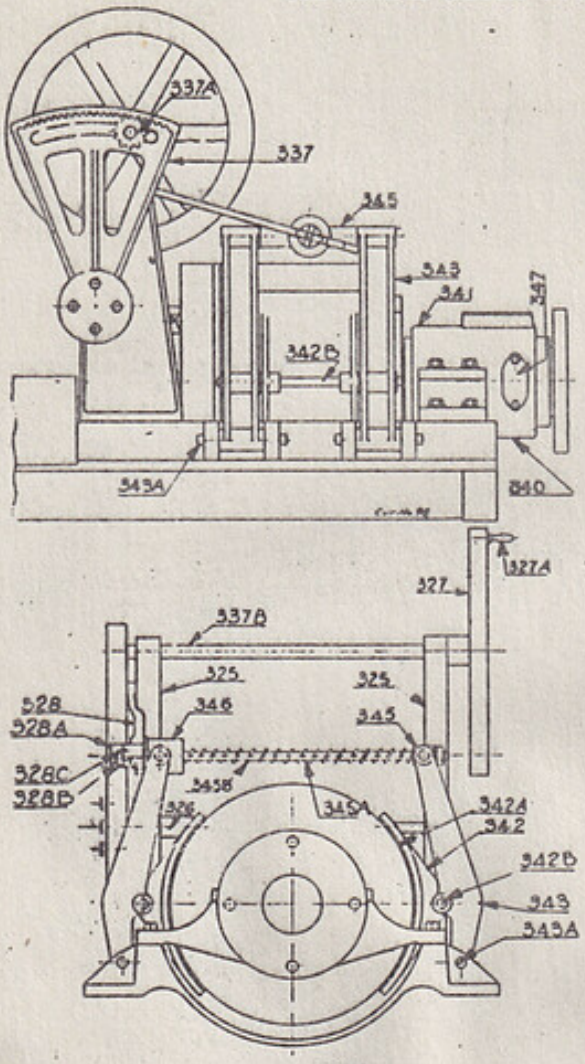
If the brake shoes, Part No. 342, become too loose, so as not to hold drum stationary when reversing, tighten tie rod connecting brake posts. Be sure that brakes shoes are entirely free of the drum when engine is going ahead.



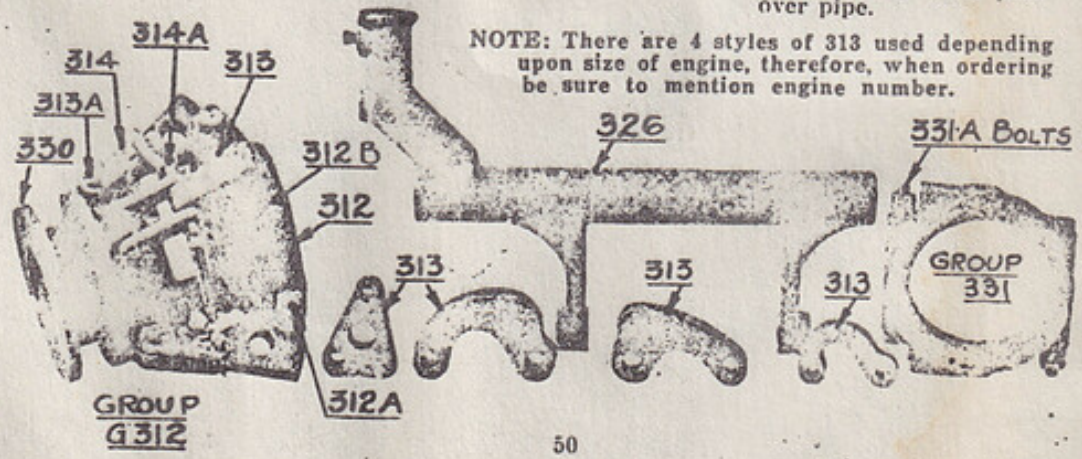
REVERSE GEAR

300 Reverse gear drum with 319 and 318.
301 Reverse gear thrust quill.
301A Reverse gear thrust gear.
302 Reverse gear center gear.
303 Reverse gear drum bushing.
304 Reverse gear drum cover.
305 Reverse gear drum cover bushing.
305A Drum cover bushing ring.
306 Reverse gear pinion (long).
307 Reverse gear pinion (short).
308 Reverse gear pinion pin.
310 Reverse gear driver.
311 Reverse gear driver plate.
G312 Reverse gear crowder collar and cone assembly, parts 312, 312A, 312B, 313, 313A, 314, 314A, 315, 330.
312 Reverse gear crowder collar.
312A Reverse gear crowder collar bolt and nut.
312B Reverse gear crowder collar pin.
313 Reverse gear crowder.
313A Reverse gear cone pin.
314 Reverse gear crowder link.
314A Reverse gear crowder link pin.
315 Reverse gear crowder spring.
316 Reverse gear friction release thrust ring and pins.
316A Reverse gear friction release thrust ring spring.
317 Reverse gear pinion spacing bushing.
318 Reverse gear retainer ring bolt.
319 Reverse gear retainer ring.
320 Reverse gear friction plate (square hole).
321 Reverse gear friction plate (round hole).
321A Reverse gear friction plate (round hole) fixed type.
323 Reverse gear thrust quill bushing.
324 Reverse gear pinion bushing (long or short).
330 Reverse gear cone.
333 Reverse gear crowder collar bolt.

REVERSE GEAR CONTROLS

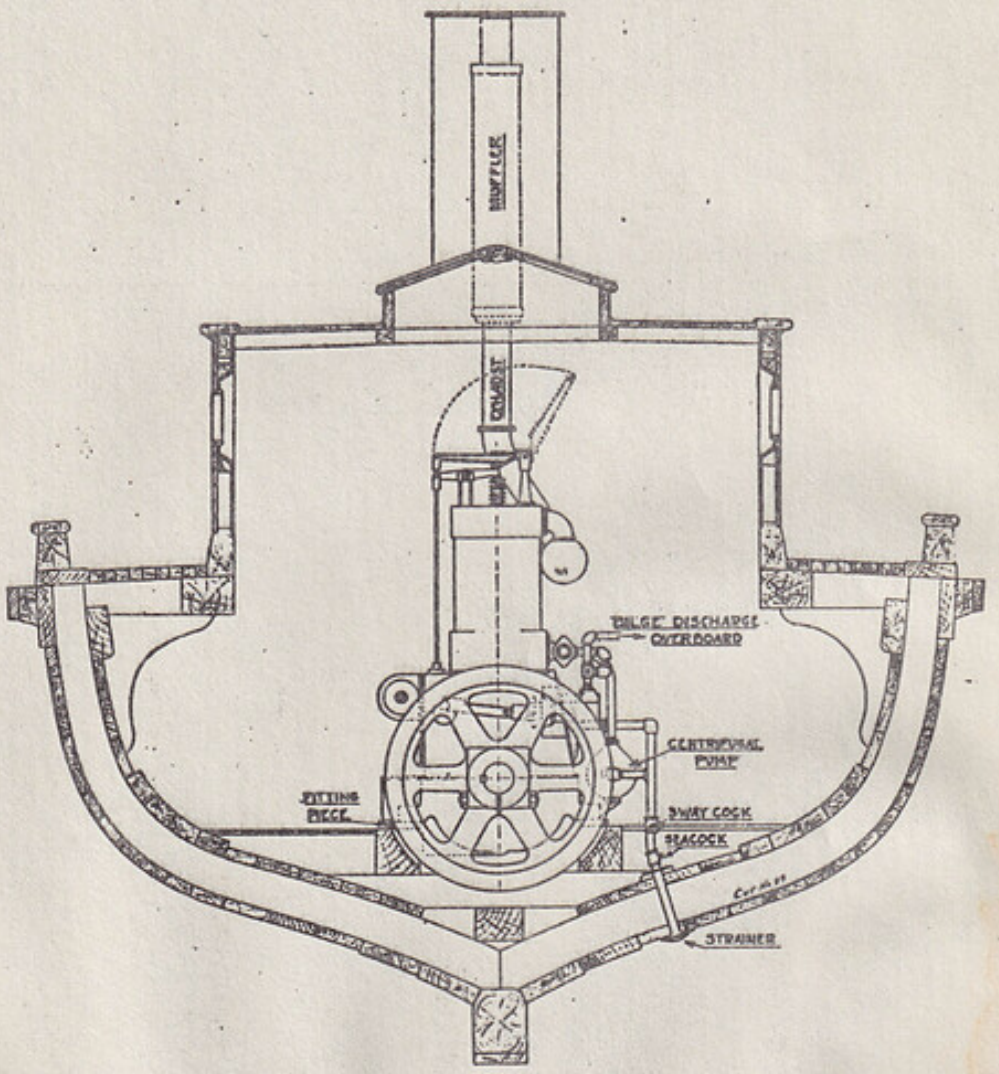


325 Reverse gear cone shifter stand—operator's side.
326 Reverse gear cone shifter.
326A Reverse gear cone shifter shaft.
327 Reverse gear cone shifter lever or wheel.
327A Reverse gear cone shifter wheel handle.
328 Reverse gear brake post crowder.
328A Reverse gear wedge roller block.
328B Reverse gear wedge roller.
328C Reverse gear wedge roller pin.
331 Reverse gear cone collar.
331A Reverse gear cone collar bolt.
335 Reverse gear cone shifter stand—exhaust side.
337 Reverse gear sector.
337A Reverse gear sector pinion.
337B Reverse gear sector pinion shaft.
340 Thrust bearing box.
341 Thrust bearing cap.
342 Reverse gear brake shoe.
342A Reverse gear brake shoe friction lining.
342B Reverse gear brake shoe pin.
343 Reverse gear brake post.
343A Reverse gear brake post pin (lower).
344 Reverse gear lever clamp.
344A Reverse gear brake post crowder link.
345 Reverse gear brake post swivel crowder.
345A Reverse gear brake post tie rod.
345B Reverse gear brake post tie rod spring.
346 Reverse gear brake post swivel.
347 Thrust bearing water pass-over pipe.

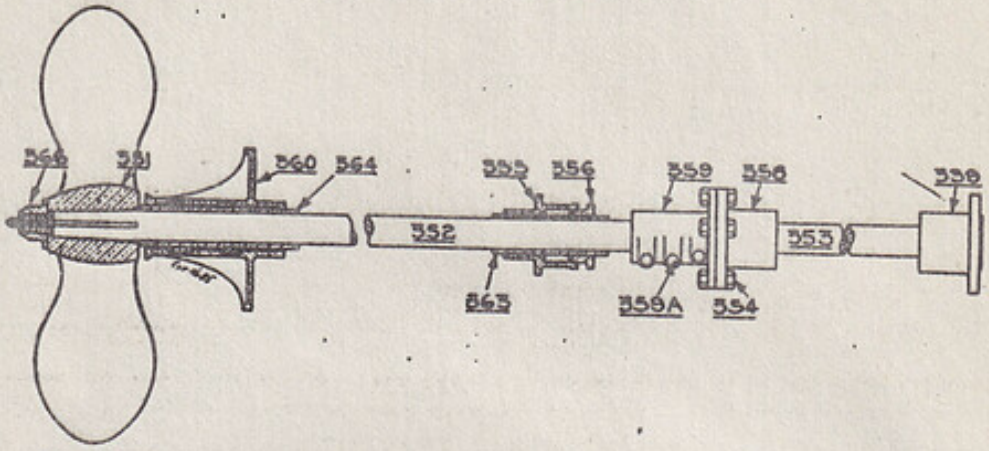


NOTE: There are 4 styles of 313 used depending upon size of engine, therefore, when ordering be sure to mention engine number.

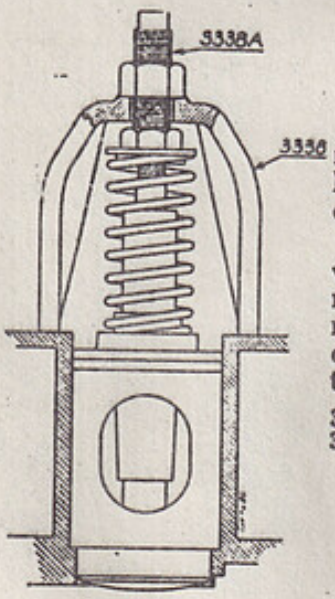
D


MUFFLER
EXHAUST
BILGE DISCHARGE OVERBOARD
CENTRIFUGAL PUMP
SUCTION PIPE
3 WAY COCK
SEACOCK
STRAINER

PROPELLER AND SHAFTING



339 Reverse gear coupling.
351 Propeller.
G352 Propeller shaft complete with Parts 359, 359A, 363, 364, 366.
G353 Intermediate shaft complete with Parts 339, 354, 358.
354 Intermediate shaft coupling bolt.
355 Stuffing box.
356 Stuffing box gland.
357 Stuffing box gland stud.
358 Intermediate shaft coupling.
359A Propeller shaft coupling bolt.
359 Propeller shaft coupling.
360 Stern bearing.
363 Propeller shaft bushing (stuffing box).
364 Propeller shaft bushing (stern bearing).
366 Propeller nut and lock screw.

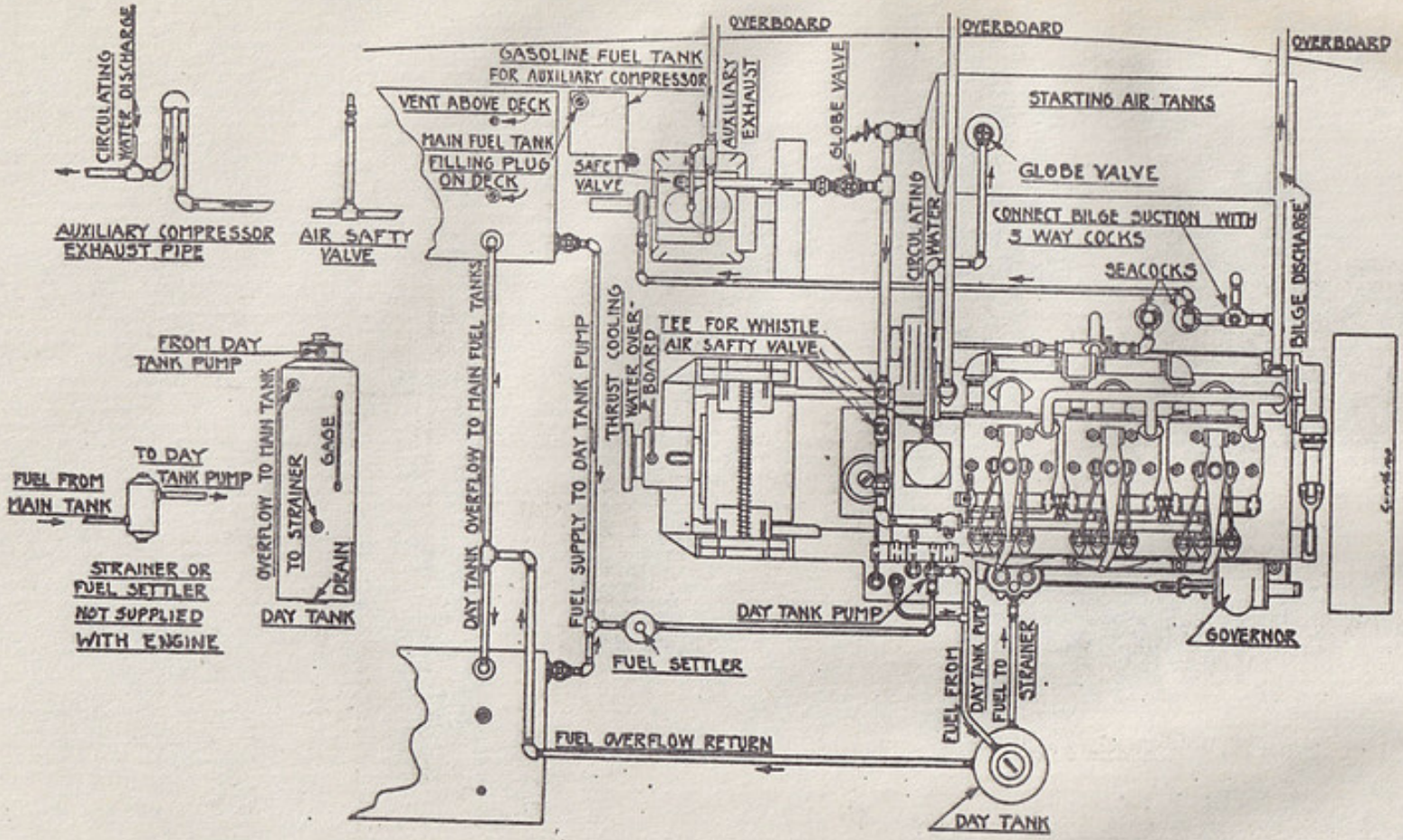


VALVE AND CAGE REMOVER

The cut opposite shows the proper way to remove valve in cages from the cylinder head. First remove the flange that holds the cage down, then remove the top lock nut of the valve.

Screw the stud over the valve stem all the way down until it is tight against the valve stem nut, then screw the large nut in a clockwise motion, which will raise the valve and cage enough to permit it to be readily removed from the cylinder head without any undue strain.

3338 Valve cage lifting yoke.
3338A Valve cage lifting yoke screw.


CIRCULATING WATER DISCHARGE
AUXILIARY COMPRESSOR EXHAUST PIPE
AIR SAFTY VALVE
GASOLINE FUEL TANK FOR AUXILIARY COMPRESSOR
VENT ABOVE DECK
MAIN FUEL TANK FILLING PLUG ON DECK
SAFETY VALVE
OVERBOARD
AUXILIARY EXHAUST
GLOBE VALVE
OVERBOARD
STARTING AIR TANKS
GLOBE VALVE
OVERBOARD
CIRCULATING WATER
CONNECT BILGE SUCTION WITH 3 WAY COCKS
SEACOCKS
BILGE DISCHARGE
TEE FOR WHISTLE AIR SAFTY VALVE
THRUST COOLING WATER OVER-BOARD
FROM DAY TANK PUMP
TO DAY TANK PUMP
FUEL FROM MAIN TANK
STRAINER OR FUEL SETTLER NOT SUPPLIED WITH ENGINE
OVERFLOW TO MAIN TANK
TO STRAINER
GAGE
DRAIN
DAY TANK
DAY TANK OVERFLOW TO MAIN FUEL TANKS
FUEL SUPPLY TO DAY TANK PUMP
FUEL SETTLER
DAY TANK PUMP
GOVERNOR
FUEL FROM DAY TANK PUMP
FUEL TO STRAINER
FUEL OVERFLOW RETURN
DAY TANK

Marine Installation

THE condition of the boat, its length, breadth and the purpose for which it is intended to be used, will largely determine the location for the installation of the engine. Another point that must be considered in the selection of the engine location is that a suitable foundation must be arranged for. Just as the heavy duty gas engine requires a heavier hull construction and foundations than the light, high speed engine, so the diesel engine requires still heavier construction, because of its heavier power impulses, than the heavy duty gas engine.

It has been found from experience that engine timbers extending fore and aft as far as the lines of the boat will permit, are essential if satisfactory operation is to be obtained. We strongly recommend that these timbers be well fastened to the ribs and the keelson by means of through bolts and cross bolts. If the width of the engine base is such that in locating these foundation timbers a space is left between them and the keelson, this space should be filled in with solid timbers for at least two or three feet fore and aft of the engine base.

Provision should be made in the form of long, tapered wedges equal in length to the length of the engine base, for alignment of the engine. In small engines, lag screws are used for fastening the engine to the foundation timbers, but in large engines the engine should be secured to the hull or foundation timbers by through bolts in at least three points on each side of the engine base.

It is important that in lining the engine up the driving flange on the thrust shaft should be square with the flange on the propeller shafting. It is also desirable that the inclination of the engine to the water line be as small as possible. The hole through the deadwood is best made water-tight by means of a lead sleeve. This lead sleeve extends through the deadwood about 1" on either end. These extensions are flanged over to form a gasket under the stern bearing and stuffing box. The lead sleeve should be selected of such a diameter that it can be readily slipped through the hole in the deadwood, after which it is expanded tight against the deadwood by driving greased wooden plugs through it. After the lead sleeve has been expanded and flanged over, the stern bearing and stuffing box may be set in place after coating the flanges well with white lead and screwing up tight against the deadwood by means of lag screws furnished with the engine. After the propeller shaft and the engine are installed, it is important in determining the length of the intermediate shaft, that sufficient clearance be allowed between the hub of the propeller and the stern bearing to allow for a slight lengthening of the boat, due to the swelling after it is placed in the water. When installing the propeller, it is well to coat the tapered end of the propeller shaft and the threads with a good coating of white lead and machine oil. This will prevent salt water from getting in between and starting corrosion. Be sure that the propeller nut is put on tight.

ALIGNMENT

When installing the engine, use great care in alignment, which can be best done by first installing the tail shaft, then lining up and bolting

the coupling of the intermediate shaft. Adjust the height and thwartship position of the engine so that the flanges of the engine and the intermediate shaft couplings are square with each other. The engine timbers should be set low enough to allow a soft, wooden shim about 1½" thick to be placed between the engine and engine timbers. After the engine is lined up, take measurements for the shims and cut them to fit snug. Check up the flanges of the engine and intermediate shafting couplings to make sure they are in perfect alignment before bolting up.

Base is tapped for jacking up screws for use in lining up engine.

EXHAUST PIPING

The exhaust piping should be of a size to correspond with the threaded flange on the end of the water-cooled exhaust pipe on the engine. We recommend that the exhaust pipe be run straight up, using as few elbows as possible and as direct as convenient to the exhaust stack. Where elbows must be used in the exhaust pipe, use 45° elbows in place of 90° elbows. The muffler furnished with the engine should be attached to the exhaust pipe at a point to come within the exhaust stack. Standard black iron pipe and fittings are recommended for exhaust piping. The exhaust stack, while not furnished with the engine, may be constructed of about No. 16 gauge galvanized sheet iron with an angle iron flange about 2"x2" at the bottom for bolting to the deck of the boat. The top end of the stack should be re-inforced by heading over a ring or flanging. The exhaust stack dimensions should be such as to allow the muffler to pass readily up through the stack.

CIRCULATING WATER PIPING

All circulating water piping and fittings should be of brass of standard iron pipe sizes. The size of pipe to use is determined by the suction opening on the pumps. Locate and place the seacocks and flanges about 3 feet from the suction openings on the pump and run the pipes direct, with as few bends as possible, to the pumps. The sea fittings or flanges are installed on the ship's planking and securely fastened to same. The seacocks are to be attached to this fitting directly inside of the ship's planking and so located as to be readily accessible. The overboard discharge from the engine leads out from the forward end of the exhaust pipe and should be carried horizontally, if possible, to the side of the ship and there discharged overboard. The centrifugal pump is ordinarily used for circulating water, while the plunger pump is used as an auxiliary circulating pump and also for bilge pumping. The discharge from the plunger pump is connected up to the circulating system on the engine and a three-way cock is also provided which may be connected up to a separate overboard discharge for use when pumping the bilges and may also be used by connecting to a proper outlet for washing decks; fire or other general service. The suction from the plunger pump should be provided with a three-way cock, one opening of which is connected to a separate sea-cock and the other run down to the bilge and provided with a bilge strainer. It is important that all piping be kept out of the splash of the bilge water. We recommend that this piping be kept above the engine room floor.

AIR RECEIVERS AND PIPING

The air receivers or air tanks should be installed as near as possible to the engine and connected to the starting air valve on the engine with a pipe of at least the size corresponding to the opening in the air tanks. Place the valve furnished with the engine directly on the air tank and provide an opening in this pipe for connecting up to the discharge of the auxiliary air compressor. The starting air pipe should be connected in the opening on the end of the air tank. The air compressor on the engine is connected to the air tank by means of a separate pipe. Air piping should be black pipe, preferably of Buyers brand. USE NO GALVANIZED OR BRASS PIPING ON THE AIR LINE.

See suggested installation plan, page 53.

LUBRICATING OIL PIPING

On all, except the largest engines, the lubricating oil system and piping is attached to the engine proper and need not be interfered with in installing the engine. However, on the larger engines, where it is inconvenient to attach the lubricating oil service tank to the engine, it is furnished separate and intended to be supported on a bulkhead as close as possible to the engine. The discharge from the sump pump should be connected to the top of the lubricating oil service tank by means of 1" Buyers black pipe. The side connection from the lubricating oil tank should be connected by means of 1½" brass pipe to the lubricating oil pressure pump. The discharge from the pressure pump is in all cases connected up to the lubricating system on the engine.

FUEL PIPING

The bottom of the main fuel tanks should be connected to the day tank pump with not less than ½" Buyers black iron pipe. Provide a settler in an accessible place and as close as possible to the fuel tanks. The fuel piping should be kept above the floor line if possible to prevent coming in contact with the bilge water. The discharge from the day tank pump should be connected up to the top opening of the day tank with ½" Buyers black iron pipe. The side opening of the day tank should be connected with the fuel oil strainer, using 1" brass pipe and reducing at the strainer. The overflow from the fuel day tank should be connected and run back to the main fuel tanks with ¾" black iron pipe. In the placing of the fuel tanks as well as air tanks, it is well to remember to arrange the seams on the inside and otherwise make the tanks as accessible as possible for inspection or repair. It is also important to keep them out of the splash of the bilge water.

Auxiliary Engine

EXHAUST

The exhaust pipe from the auxiliary engine is usually carried overboard together with the discharge circulating water. It is usual to provide a gooseneck or return bend extending upward to a point higher than the water line, then returning down to a point still above the water line and allowing the discharge water from the top of the cylinder head to enter the exhaust pipe beyond the gooseneck. In this way the exhaust from the engine is silenced and is cooled so as not to burn the side of the ship where it passes through. The exhaust piping should be covered where it comes close to any woodwork to prevent scorching.

STATIONARY ENGINE INSTALLATIONS

The installation of stationary engines will vary so much with the service for which the engine is intended and the location, that it is hard to give more than a general description of the requirements.

FOUNDATION

The foundation in all cases should be sufficient to absorb the natural vibrations of the engine. The size of the foundations will depend entirely upon the soil conditions. Under ordinary circumstances, when the foundation is made of concrete, brick or masonry, it may be 5 to 8 ft. deep, depending upon the size of the engine, and if it extends a foot beyond the edge of the engine base, it is usually sufficient. However, the condition of the soil on which the engine is mounted will determine, in a large measure, the size of the foundation. In silty sediment it frequently happens that concrete or brick cannot be used and timber cribbing must be resorted to.

EXHAUST PIPING

Exhaust pipe can be of black iron pipe and may be run directly up and through the roof, using a muffler if desired. In many cases, it is desirable to run the exhaust pipe down under the floor and out through the side of the building. In any case, the exhaust pipe should be of the size of the flange furnished on the end of the exhaust pipe and should be as free as possible of bends, using 45° elbows wherever necessary. If the exhaust pipe is of any considerable length, it is well to increase the size.

CIRCULATING WATER PIPE

The circulating pump furnished on the engine will determine the size of the suction pipe to be used. Connect up the pump suction with the source of supply with as short a pipe as possible and eliminate bends and elbows to the greatest extent. Where the cooling water supply is under pressure, it may be necessary to place a reducing valve in the line to prevent excessive pressures being placed upon the cylinder jackets. Pressure over 15 lbs. per sq. in. should be avoided. The discharge from the engine should be carried away in pipe of a size no smaller than the outlet water pipe on the engine. The cooling of the

engine may be effected by means of a circulating system, a cooling tower or a radiator. The circulating water piping may be wrought iron pipe, preferably galvanized, where a fresh water supply is available.

AIR PIPING

The air piping should be carried from the air tanks to the engine in as short a run as possible, avoiding elbows and short bends. The pipe size is determined by the opening in the air tanks and should be carried up directly to the air starting valve before reducing. Buyers black iron pipe is recommended for this service. Malleable iron fittings of extra heavy pattern should be used.

PREPARING THE ENGINE FOR STARTING

After the engine has been installed and all piping and connections have been properly made and tested, start the small air compressor and pump up the air starting tanks with a pressure of 200 lbs. per sq. in. When this pressure has been attained, test all of the safety valves and see that they are in proper working order. The time required to pump up the tanks varies with the size, but will average about 15 minutes.

Inspect the inside of the engine base to see that no tools have been left there to interfere with the operation of the engine. At the same time, it is well to see that all dirt, shavings, etc., left by workmen when installing, have been cleared out so as not to interfere with the proper lubrication of the engine. Pour sufficient lubricating oil into the engine base to submerge the suction valve on the sump pump. This requires about 2 or 3 inches of lubricating oil in the sump. Next fill the lubricating oil service tank about 2/3 full of lubricating oil and likewise fill up the sight feed pressure lubricator on the engine. See that all of the adjusting screws on the pressure lubricator are open so as to give an ample supply of lubricating oil to the cylinders. This can be tested by turning the hand crank on the pressure lubricator. After the engine has been run in for a while the adjustment on these lubricators can be attended to, giving each cylinder from 13 to 14 drops per minute. At this point it is well to go over the engine with an oil can, squirting a few drops into all oil holes on the rocker arms, fuel pump cranks, etc. Fill up the main fuel oil tanks with the proper grade of diesel fuel oil and put a small quantity into the fuel oil day tank.

Turn the engine over with the starting bar, being sure that all fuel isolating valves are closed and the cylinder snifter valves open. One turn of the engine in this manner will insure that everything is free and clear and that the engine can be safely turned over on air. Next pump up by means of the hand priming pump, about 2000 lbs. on the oil pressure gauge. This pumping should be done when all of the fuel valves are closed. To be sure of this, place the engine with the pointer about 25° past top center on the flywheel. If any difficulty is experienced in pumping up pressure on the oil gauge, it probably indicates that there is air in the fuel lines. To relieve this air, loosen the union on the fuel rail which connects the pipe leading to the pressure gauge. It may be necessary also to relieve the air at the discharge union from the fuel

pumps. After the fuel pressure has been pumped up, it is well to check the opening and closing of the spray valve (see instructions under Spray Valve Timing). After the timing has been found in order, the engine is ready to turn over a few turns under air pressure with the snifter valves open. This will clean out any accumulation of fuel oil in the cylinders and prevent excessive pressures when starting.

If everything is found in order, the engine is now ready to start. Bar the engine over to a point about 25° past top center, making sure that both the inlet and exhaust valves are closed on the particular cylinder indicated. Close the snifter valves and open the fuel isolating valves. Set the fuel pressure relief valve handle three or four notches up from the lowest position and pump up about 2000 lbs. on the gauge. Set the governor speed control handle in about medium position and see that the starting handle is in the running position. (See Fig. A, page 20.) Now open the air starting valve on the air manifold and the engine is ready to start. By pulling the starting handle over into the starting position, the engine will turn over and immediately start under its own power. The handle should then be quickly returned to the running position so as to save air and the starting valve on the air manifold closed.

It is well to pump up the tanks to their full pressure after each starting of the engine. To do this it is not necessary to start the auxiliary engine air compressor as the air tanks can be pumped with the compressor on the main engine. After the tanks have been pumped up, as indicated by the popping of the safety valves, the shut-off valves on the tanks themselves should be closed and the air compressor cut out by holding down the suction valve by means of the handle provided on the compressor cylinder head.

In pumping up the air tanks it is well to allow the safety valves to pop each time as this is a good check on the proper functioning of the valves.

Once a day, or each time the engine is started, it is well to squirt a mixture of cylinder oil and kerosene on the valve stems to prevent them from sticking.

PARTS LIST

For Atlas Imperial Diesel Engines

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).

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

CIRCULATING WATER

Part No.	Part Name
214	Plunger pump valve cage.
214A	Plunger pump valve cage stud
215	Plunger pump suction bonnet.
215A	Plunger pump bonnet copper asbestos gasket.
215B	Plunger pump suction bonnet flange.
216	Plunger pump discharge bonnet.
216A	Plunger pump discharge bonnet stud.
217	Plunger pump valve guide stem.
218	Plunger pump valve spring.
219	Plunger pump valve (rubber)
219A	Plunger pump valve bushing.
G260	Plunger pump complete: Parts 219A, 260, 261, 262, 262A, 262B.
GA260	Plunger pump body with 262A.
261	Plunger pump plunger.
262	Plunger pump gland.
262A	Plunger pump gland stud.
262B	Plunger pump gland stud nuts
G264	Plunger pump connecting rod with 264A.
264A	Plunger pump connecting rod bushing.
264B	Plunger pump connecting rod pin.
266	Plunger pump crank disc.
266A	Plunger pump crank disc washer.
300	Reverse gear drum with 319 and 318.
301	Reverse gear thrust quill.
301A	Reverse gear thrust gear.
302	Reverse gear center gear.
303	Reverse gear drum bushing.
304	Reverse gear drum cover.
305	Reverse gear drum cover bushing.
305A	Drum cover bushing ring.
306	Reverse gear pinion (long).
307	Reverse gear pinion (short).
308	Reverse gear pinion pin.
310	Reverse gear driver.
311	Reverse gear driver plate.
G312	Reverse gear crowder collar and cone assembly, Parts 312, 312A, 312B, 313, 313A, 314, 314A, 315, 330.
312	Reverse gear crowder collar.
312A	Reverse gear crowder collar bolt and nut.
312B	Reverse gear crowder collar pin.
313	Reverse gear crowder.
313A	Reverse gear cone pin.
314	Reverse gear crowder link.
314A	Reverse gear crowder link pin.
315	Reverse gear crowder spring.
316	Reverse gear friction release thrust ring and pins.
316A	Reverse gear friction release thrust ring spring.
317	Reverse gear pinion spacing bushing.
318	Reverse gear retainer ring bolt.
319	Reverse gear retainer ring.
320	Reverse gear friction plate (square hole).
321	Reverse gear friction plate (round hole).
321A	Reverse gear friction plate (round hole) fixed type.
323	Reverse gear thrust quill bushing.
324	Reverse gear pinion bushing (long or short).
325	Reverse gear cone shifter stand—operator's side.
326	Reverse gear cone shifter.
326A	Reverse gear cone shifter shaft.

Part No.	Part Name
327	Reverse gear cone shifter lever or wheel.
327A	Reverse gear cone shifter wheel handle.
328	Reverse gear brake post crowder.
328A	Reverse gear wedge roller block.
328B	Reverse gear wedge roller.
328C	Reverse gear wedge roller pin
330	Reverse gear cone.
331	Reverse gear cone collar.
331A	Reverse gear cone collar bolt.
333	Reverse gear crowder collar bolt.
335	Reverse gear cone shifter stand—exhaust side.
337	Reverse gear sector.
337A	Reverse gear sector pinion.
337B	Reverse gear sector pinion shaft.
339	Reverse gear coupling.
339A	Reverse gear coupling bolt.
340	Thrust bearing box.
341	Thrust bearing cap.
342	Reverse gear brake shoe.
342A	Reverse gear brake shoe friction lining.
342B	Reverse gear brake shoe pin.
343	Reverse gear brake post.
343A	Reverse gear brake post pin (lower).
344	Reverse gear lever clamp.
344A	Reverse gear brake post crowder link.
345	Reverse gear brake post swivel crowder.
345A	Reverse gear brake post tie rod.
345B	Reverse gear brake post tie rod spring.
346	Reverse gear brake post swivel.
347	Thrust bearing water pass-over pipe.

PROPELLER EQUIPMENT

351	Propeller.
G352	Propeller shaft complete with Parts 359, 359A, 363, 364, 366.
G353	Intermediate shaft complete with 339, 354, 358.
354	Intermediate shaft coupling bolt.
355	Stuffing box.
356	Stuffing box gland.
357	Stuffing box gland stud.
358	Intermediate shaft coupling.
359	Propeller shaft coupling.
359A	Propeller shaft coupling bolts.
360	Stern bearing.
363	Propeller shaft bushing (stuffing box).
364	Propeller shaft bushing (stern bearings).
366	Propeller nut and lockscrew.

Part No.	Part Name
G370	Centrifugal pump complete: Parts 370, 371, 371A, 372, 373, 373A, 374, 379, 381, 381A, 382, 383.
GA370	Centrifugal pump body with 374.
370A	Centrifugal pump outlet flange
371	Centrifugal pump cover.
371A	Centrifugal pump cover screw
371B	Centrifugal pump inlet flange.
G372	Centrifugal pump runner and shaft.
373	Centrifugal pump gland.
373A	Centrifugal pump gland stud.
374	Centrifugal pump shaft bushing.
379	Centrifugal pump shaft.
381	Centrifugal pump steady bearing.
381A	Centrifugal pump steady bearing cap screw.
382	Centrifugal pump shaft collar
383	Centrifugal pump ball bearing
384	Centrifugal pump shaft coupling (complete).
G500	Cylinder head complete assembly (as shown on page 12), except spray valve G849, and horse shoe collar 877, the following parts are included, Nos. 500, 510, 512, 513, 514, 514A, G520, G527A, G550, 564, 564B, 565, 566, 567, 567A, 567B, 579, 580, 582, 583, 584, 585, 586, 588, G590, 764, 854, 854A, 855, 855A, G870, 872, 873. Specify whether handle or male connecting link is wanted with head. The following parts are also included if used: 515, 516, 517.
GA500	Cylinder head with exhaust inlet, air starting valves and springs only. Part Nos. 500, 510, 512, 513, 514, 514A, 564, 579, 580, 582, 583, 584, 585, 586, 588.
500	Cylinder head only with studs 567 and 764.
501	Cylinder head stud.
501A	Cylinder head stud, special for lifting head.
502	Cylinder head gasket.
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.
G515	Inlet or exhaust valve and cage complete: Parts 510. 513, 514, and 515.

Part No.	Part Name
515	Valve cage, inlet or exhaust with 512 in engines 11" bore and larger.
516	Valve cage stud.
517	Valve cage flange.
518	Valve cage gasket.
519	Exhaust or inlet valve cage ring.
G520	Inlet rocker, with roller and pin. Parts 520, 520A, 523, 524, G527A.
520	Inlet rocker only.
520A	Inlet rocker bushings (set of 2)
523	Rocker roller, for inlet, exhaust or air.
524	Rocker roller pin, for inlet, exhaust or air.
525	Inlet or exhaust valve push rod.
526	Push rod fork, for inlet, exhaust, air or fuel.
527	Fork pin, inlet, exhaust, air or fuel.
G527A	Fork pin, ball lock.
G528	Inlet or exhaust valve lifter with roller and pin.
529	Exhaust or inlet valve lifter guide.
530	Exhaust or inlet valve lifter roller.
531	Exhaust or inlet valve lifter roller pin.
532	Inlet and air starting cam.
G550	Exhaust rocker with roller and pins, 550, 550A, 523, 524, G527A.
550A	Exhaust rocker bushings (set of 2).
560	Exhaust cam.
564	Rocker shaft, connecting link (female).
564A	Rocker shaft connecting link (male).
564B	Rocker shaft connecting link pin.
565	Rocker shaft.
566	Rocker shaft bearing (state: with or without wings).
567	Rocker shaft bearing stud.
567A	Rocker shaft bearing stud nut; top.
567B	Rocker shaft bearing stud lock nut.
G570	Air starting handle, complete: Part Nos. 570, 571, 571A, 572, 573.
570	Air starting handle.
571	Air starting handle pawl.
571A	Air starting handle pawl screw
572	Air starting handle pawl spring.
573	Air starting handle sector.
577	Air starting pipe elbow.
578	Air starting pipe shut off valve (state whether globe, gate or quick opening valve).
579	Air starting valve spring bushing.
G580	Air starting valve complete. Cage type—Parts No. 580, 581, 581A, 582, 582A, 584, 585, 585A, 586. (See page 19 for drawing.)
580	Air starting valve.
581	Air starting valve cage.
581A	Air starting valve cage ring.
581B	Air starting valve cage gasket.
582	Air starting valve spring.
582A	Air starting valve spring nut.
583	Air starting valve spring washer—top.
584	Air starting valve nut.
585	Air starting valve balance bushing.
585A	Air starting valve balance bushing nut.
586	Air starting valve balance bushing ring.
588	Air starting valve spring washer—bottom.
G590	Air starting rocker with roller and pins. 523, 524, G527A. (and 590A when used). Air starting valve rocker roller. Part 523. Air starting valve rocker roller pin. Part 524.
590A	Air starting valve rocker bushing (set of 2). Air starting valve rocker fork. Part 526. Air starting valve rocker fork pin. Part 527. Air starting valve rocker fork pin lock. Part 527A.
593	Air starting valve push rod.
G594	Air starting valve lifter with roller and pin.
594A	Air starting valve lifter collar
594B	Air starting valve lifter spring
595	Air starting valve lifter roller.
596	Air starting valve lifter roller pin.
599	Air starting valve lifter guide.
600	Cylinder.
605	Cylinder clean out cover.
610	Cylinder water by-pass (cast iron).
610	Cylinder head water pipe (brass tube).
610A	Cylinder head water pipe rubber gromet.
611	Cylinder lubricating pipe.
612	Cylinder lubricating pipe gland
613	Cylinder lubricating pipe packing ring.
614	Cylinder lubricating pipe elbow.

Part No.	Part Name
620	Piston.
G621	Piston pin.
622	Piston ring.
628	Connecting rod bushing (piston pin).
630	Connecting rod.
G632	Connecting rod check valve.
634	Connecting rod foot shims (state thickness).
636	Crank pin bearing (2 halves) babbitted.
636A	Crank pin bearing shims (state thickness).
637	Crank pin bearing bolts and nuts.
638	Crank pin bearing bolts locking strap.
640	Crankshaft with 660 and 655.
644	Main bearing shells—flywheel end (2 halves).
646	Main bearing shells—center (2 halves).
649	Main bearing shells—after end (2 halves).
655	Crankshaft oil throw ring.
660	Crankshaft pinion.
664	Intermediate gear (including band 664A).
665	Intermediate gear—pin.
665A	Intermediate gear—pin bolt.
665B	Intermediate gear—pin bolt washer.
665C	Intermediate gear—pin washer
666	Intermediate gear bearing.
666A	Intermediate gear bearing cap screw.
666G	Intermediate gear bearing lock set screw.
670	Cam shaft gear.
672	Cam shaft.
G680	Cam shaft bearing and bushing.
684	Centerframe blind flange—end of cam shaft.
685	Cam shaft bushing.
690	Centerframe.
691	Centerframe cover and governor shield.
691A	Governor shield gasket.
692	Centerframe cover—round.
692A	Round centerframe cover gasket.
693	Centerframe cover—air pump pit.
695	Centerframe cover—end of frame.
710	Base with caps and studs.
712	Base cap—flywheel end.
713	Base cap—center.
715	Base cap—after end.
717	Base cap studs.
719	Base cap parting piece—flywheel end.
719A	Base cap shim—flywheel end.
720	Base cap parting piece—center
720A	Base cap shim—center.
722	Base cap parting piece—after end.
722A	Base cap shim—after end.
727	Base to cylinder stud.
729	Base to centerframe stud (cylinder).
730	Cylinder to centerframe stud.
731	Base to centerframe stud (air pump).
750	Flywheel with 753.
753	Flywheel hub clamp bolt.
754	Flywheel hub clamp bolt wrench.
760	Exhaust elbow (on cylinder head).
761	Exhaust pipe.
763	Exhaust pipe blind flange.
764	Exhaust elbow stud (on cylinder head).
765	Exhaust elbow (on end exhaust pipe).
766	Stud for exhaust elbow (on end exhaust pipe).
767	Exhaust flange for elbow (on end exhaust pipe).
775	Lubricating oil cooler core.
777	Lubricating oil cooler head.
778	Lubricating oil cooler pipe.
779	Lubricating oil cooler gland.
780	Inlet water manifold (or oil cooler body).
784	Inlet water manifold end flange (threaded). State pipe size.
786	Inlet water manifold end flange (blind).
787	Inlet water manifold side flange (state pipe size).
789	Outlet water manifold.
791	Outlet water pipe—outlet from manifold.
791A	Outlet water pipe flange.
792	Water passover pipe on exhaust pipe.
794	Outlet water pipe—manifold to exhaust pipe.
795	Outlet water pipe gland for 794.
796	High pressure fuel discharge fitting.
796A	High pressure fuel dicharge fitting split ring.
797	High pressure discharge fitting nut.
G800	H. P. Fuel pump complete: Parts 800, 805, 806, 808, 809, 810, 810B
800	High pressure fuel pump body
801	High pressure fuel pump suction valve.
G802	H. P. Fuel pump suction valve cage with 801 and 811.
802	High pressure fuel pump suction valve cage.
802A	High pressure fuel pump suction union nut.
802B	High pressure fuel pump suction union sleeve.
805	High pressure fuel pump plunger.

Part No.	Part Name
805A	High pressure fuel pump plunger spring.
806	High pressure fuel pump plunger packing rings.
808	High pressure fuel pump gland
809	High pressure fuel pump gland nut.
810	High pressure fuel pump plunger head.
810B	High pressure fuel pump plunger nut.
811	High pressure fuel pump discharge valve.
817	High pressure fuel pump plate
818	High pressure fuel pump rocker (double).
818A	High pressure fuel pump rocker pin (long).
818B	High pressure fuel pump rocker (single).
818D	High pressure fuel pump rocker bushing (bronze).
819	High pressure fuel pump rocker shaft.
819A	High pressure fuel pump rocker shaft sleeve (steel).
G820	High pressure fuel pump rocker shaft bearing and caps.
820A	High pressure fuel pump rocker shaft bearing stud (long).
820B	High pressure fuel pump rocker shaft bearing stud (short).
820D	High pressure fuel pump rocker shaft bearing cap stud.
821	High pressure fuel pump rocker shaft bearing cap.
822	High pressure fuel pump crank shaft.
822A	High pressure fuel pump crank shaft coupling.
822B	High pressure fuel pump crank shaft coupling bolts.
822C	High pressure fuel pump crank shaft washer.
G823	H. P. Fuel pump crank shaft connecting rod assembly: Parts 823, 824, 824A.
824A	High pressure fuel pump crank shaft connecting rod cap bolts.
828	High pressure fuel pump connecting link.
	...h pressure fuel pump con- ...k pin.
	...sure fuel pump ...guide.
	...sure fuel pump
	...sure fuel pump ...nut.
	...sure fuel pump ...button.
	...complete.

Part No.	Part Name
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 stud nut.
856	Spray valve seat nut.
857	Spray valve spring plug.
858	Spray valve spring.
859	Spray valve ball bearing.
860	Spray valve gasket.
864	Spray valve nozzle or tip.
865	Spray valve gland nut.
866	Spray valve gland.
867	Spray valve packing seat.
870	Spray valve rocker.
	Spray valve rocker pin No. 527
	Spray valve rocker fork No. 526.
	Spray valve rocker fork pin lock No. 527A.
872	Spray valve rocker stand.
873	Spray valve rocker stand pin.
876	Spray valve push rod.
877	Spray valve horseshoe collar.
878	Spray valve stem nut.
878A	Spray valve stem lock nut.
880	Spray valve cam toe.
881	Spray valve cam disc.
G883	Spray valve lifter with roller and pin.
884	Spray valve lifter roller.
885	Spray valve lifter roller pin.
887	Spray valve lifter guide.
888	Spray valve lifter spring.
889	Spray valve push rod socket.

AIR COMPRESSOR (on Engine)

900	Air compressor cylinder with 902.
G901	Air compressor head, complete: Parts 901, 905, 907, 908, 908A, 915, 915A, 918, 918A, 919, 920, 922, 922A, 923, 924.
901	Air compressor cylinder head with 907.
902	Air compressor cylinder head stud.
905	Air compressor inlet valve.
906	Air compressor valve 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.
620	Piston.
G621	Piston pin.
622	Piston ring. Specify if plain, double seal or oil control. Also specify width.
628	Connecting rod bushing (piston pin).
630	Connecting rod.

Part No.	Part Name
915	Air compressor discharge valve.
915A	Air compressor discharge valve adjusting screw.
918	Air compressor discharge valve nut.
918A	Air compressor discharge valve relief handle nut.
918B	Air compressor inlet valve cap nut stud.
918C	Air compressor inlet valve flange stud.
918D	Air compressor inlet flange gasket.
919	Air compressor discharge valve spring.
920	Air compressor discharge valve guide.
922	Air compressor discharge valve cap nut.
922A	Air compressor discharge 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 piston pin bushing.
G929	Air compressor connecting rod bushed.
G930	Air compressor eccentric strap (2 halves) and bolts.
932	Air compressor eccentric strap bolts.
933	Air compressor eccentric.
935	Air compressor relief valve.
936	Air compressor pass over pipe
937	Air compressor gauge (300 pounds).
1060	Sight feed pressure lubricator. When ordering lubricator state manufacturer, number of feeds, also type.
1061	Sight feed pressure lubricator bracket.
1065	Sight feed pressure lubricator drive rod.
1065A	Lubricator drive rod pin.
1066	Lubricating sump pump gland
1066A	Lubricating sump pump gland stud.
1069	Lubricating sump pump strainer.
G1070	Sump pump assembly.
1070	Lubricating sump pump body.
1073A	Lubricating sump pump check valve—inlet.
1073B	Lubricating sump pump check valve—outlet.
1075	Lubricating sump pump plunger.
1076	Lubricating sump pump connecting rod.

Part No.	Part Name
1076A	Lubricating sump pump connecting rod pin.
1079	Lubricating sump pump crank disc.
1079A	Lubricating sump pump crank disc washer.
G1080	Pressure lubricating pump complete: Parts 1080, 1081, 1082, 1083, 1085.
1080	Pressure lubricating pump cylinder.
1080A	Pressure lubricating pump suction check valve.
1080B	Pressure lubricating pump discharge check valve.
1081	Pressure lubricating pump plunger.
1081A	Pressure lubricating pump plunger nut.
1082	Pressure lubricating pump gland.
1083	Pressure lubricating pump gland nut.
1085	Pressure lubricating pump plunger eye.
1085A	Pressure lubricating pump plunger eye pin.
1086	Pressure lubricating pump connecting link.
1087	Pressure lubricating pump oil pressure gauge (30 lbs.)
1088	Pressure lubricating pump rocker.
1088A	Pressure lubricating pump rocker pin.
G1090	Pressure lubricating relief valve complete: Parts 1090, 1091, 1092, 1093, 1095, 1096.
1090	Lubricating oil pressure relief valve body cap.
1091	Lubricating oil pressure relief valve plunger.
1092	Lubricating oil pressure relief valve adjusting screw.
1093	Lubricating oil pressure relief valve spring.
1095	Lubricating oil pressure relief valve adjusting screw nut.
1096	Lubricating oil pressure relief check valve and body.
G1100	Governor assembly: Parts 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1113.
1100	Governo... No. 111...
1101	Governor...
1102	Governo...
1103	Governo...
1104	Governo...
1105	Governo...
1106	Governo...
1107	Governo... bearing
1108	Governo... (large)

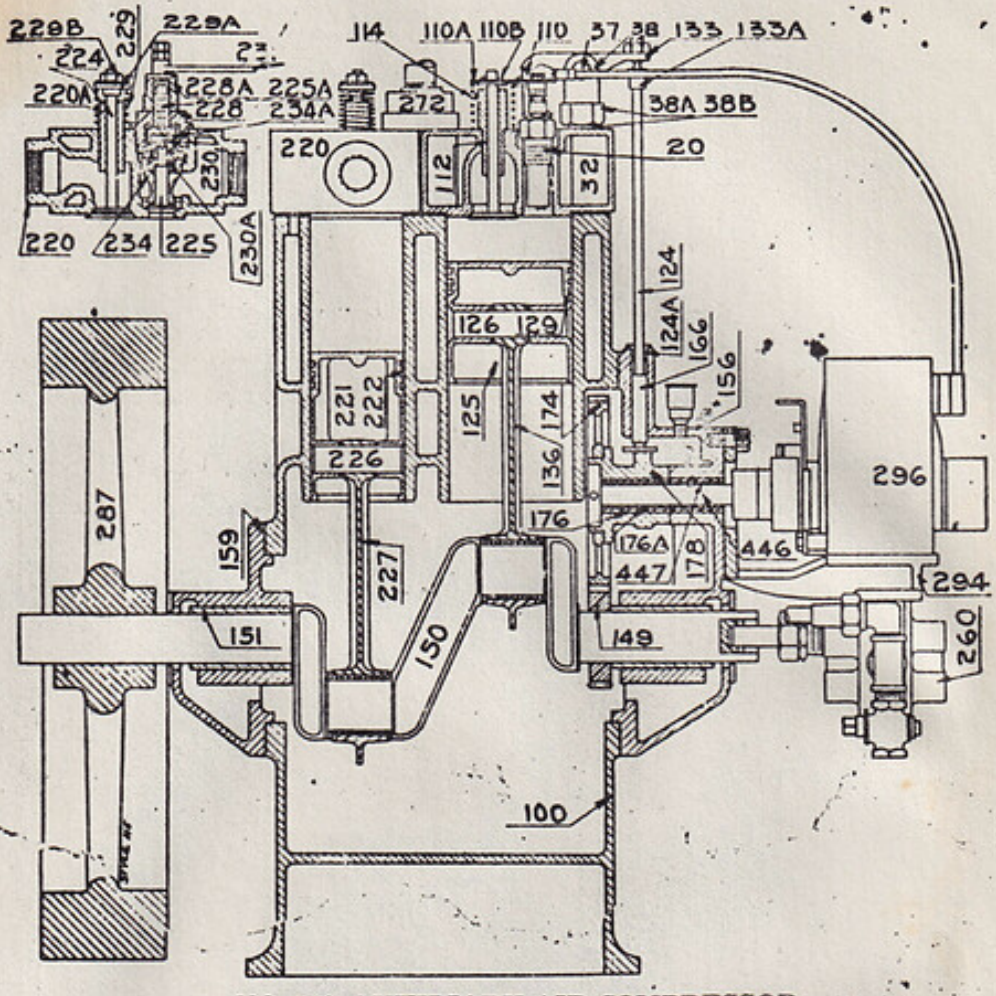
Part No.	Part Name
1109	Governor shaft.
1110	Governor body collar.
1111	Governor pinion.
1112	Governor bearing.
1113	Governor thrust quill bushing
1114	Governor compression spring.
1114A	Governor compression spring collar.
1114B	Governor compression spring collar.
1115	Governor compression spring block.
G1117	Governor control handle, complete: Parts 1117, 1118, 1119, 1124, 1125, 1249.
1117	Governor control handle.
1117	Fuel relief valve handle.
1118	Governor control handle pawl
1118	Fuel relief valve handle pawl.
1119	Governor control handle sector.
1120	Governor spring rack.
1121	Governor spring rack adjusting screw.
G1122	Governor speed control socket and handle complete: Parts 1117, 1118, 1119, 1120, 1121, 1122, 1122A, 1124, 1125, 1249.
GA1122	Governor speed control socket with sector. 1122A.
1122A	Governor speed control socket sector.
1123	Governor control socket bearing.
1124	Fuel relief valve handle pawl spring.
1124	Governor speed control pawl spring.
1125	Fuel relief valve handle pawl spring screw.
1125	Governor speed control pawl spring screw.
1127	Governor connecting rod between forks.
1128	Governor fork.
1128A	Governor vertical shaft.
1129	Vertical shaft lever.
1129A	Vertical shaft lever pin.
1130	Wedge shaft fork.
1131	Wedge fork. *When combined in one casting order Part No. 1130A.
1132	Fuel control wedge.
1132A	Fuel control wedge pin.
1133	Fuel control shaft.
1134	Fuel control shaft bearing.
1135	Fuel control shaft spring.
1136	Fuel control shaft spring clamp
1139	Guard rail.
1140	Guard rail bolt.
1141	Guard rail spacer.
1143	Fuel relief valve handle.
1149	Fuel relief valve handle screw
1170	High pressure union nipple.
1176	High pressure fuel union nut.
1177	High pressure fuel union sleeve.

Part No.	Part Name
HIGH PRESSURE FUEL PIPES	
	Each pipe assembled with nuts and sleeves, Parts Nos. 1176, 1177.
1183	Testing pipe—fuel rail—to spray valve test clamp.
1184	Fuel pipe from relief valve discharge—to pump suction.
1185	Fuel pipe from high pressure fuel pump discharge—to fuel relief valve.
1186	Connecting pipe between H. P. fuel pumps (discharge).
1187	Fuel pipe from fuel pump—to fuel rail.
1188	Fuel pipe from fuel rail—to spray valve.
1189	Fuel pipe from fuel rail—to fuel oil receiver.
1189A	Fuel pipe from fuel oil receiver — to fuel pressure gauge.
G1190	Cylinder relief valve complete: Parts 1190, 1191, 1192, 1193, 1194, 1195, 1199.
1190	Cylinder relief valve body.
1191	Cylinder relief valve stem.
1192	Cylinder relief valve seat.
1193	Cylinder relief valve spring.
1194	Cylinder relief valve spring collar.
1195	Cylinder relief valve adjusting screw lock.
1196	Cylinder relief valve plug.
G1197	Snifter valve complete: Parts 1197, 1198.
1197	Cylinder snifter valve body.
1198	Cylinder snifter valve stem.
1199	Cylinder relief valve adjusting screw.
1200	Fuel rail complete with isolating valves.
1201	Spray valve fuel strainer body
1202	Spray valve fuel strainer stem
1203	Fuel rail clamps.
1204	Spray valve fuel strainer gasket.
1205	Fuel rail isolating valve body.
1206	Fuel rail isolating valve stem.
1206	Fuel oil receiver valve stem.
1207	Fuel rail isolating valve gland
1207	Fuel oil receiver valve gland.
1208	Fuel rail isolating valve gland nut.
1208	Fuel oil receiver valve nut.
1214	Fuel oil receiver.
G1215	Fuel oil receiver valve complete.
1215	Fuel oil receiver valve body.
1216	High pressure fuel oil gauge bracket.
1217	High pressure fuel oil gauge.
G1218	Fuel oil strainer complete.
1218	Fuel oil strainer body.
1219	Fuel oil strainer cover.
1220	Fuel oil strainer grid.
1221	Fuel oil strainer valve.

Part No.	Part Name
1222	Fuel oil strainer stuffing box.
1223	Fuel oil strainer gauze.
1224	Fuel oil strainer cover gasket
1225	Fuel oil strainer cover clamp.
1225A	Fuel oil strainer cover clamp capscrew.
1225B	Fuel oil strainer cover clamp stud.
1226	Fuel oil strainer grid spring.
G1230	Fuel relief valve complete.
1230	Fuel relief valve body.
1231	Fuel relief valve gland.
1232	Fuel relief valve stud.
1233	Fuel relief valve stem valve.
1234	Fuel relief valve seat.
1235	Fuel relief valve stud collar.
1236	Fuel relief valve spring.
1237	Fuel relief valve spring cage.
1238	Fuel relief valve handle bearing.
1238A	Fuel relief valve handle bearing pin.
1239	Fuel relief valve handle adjusting screw.
1240	Fuel relief valve handle plug (lower).
1241	Fuel relief valve stud capnut.
1242	Fuel relief valve fuel fitting.
G1243	Fuel relief valve handle complete.
1243	Fuel relief valve handle cam.
1244	Fuel relief valve handle sector
1245	Fuel relief valve spring plug (top).
1247	Fuel relief valve stud collar gasket.
1248	Fuel relief valve stud gasket.
1249	Governor speed control handle screw.
G1275	Priming pump complete: Parts 1275, 1276, 1276A, 1278 and packing.
1275	Priming pump cylinder.
1276	Priming pump plunger.
1276A	Priming pump plunger nut.
1278	Priming pump cap.
1279	Priming pump plunger eye.
1280	Priming pump plunger connecting rod.
1280A	Priming pump plunger pin.
1281	Priming pump plunger handle
1282	Priming pump plunger handle bracket.
1282A	Priming pump plunger handle bracket spacer.
1282B	Priming pump plunger handle bracket bar.
1282C	Priming pump plunger handle bracket lever pin.

Part No.	Part Name
G1287	Day tank pump complete: Parts 1287, 1288, 1288A, 1289, 1291, 1292.
1287	Day tank pump body.
1288	Day tank pump plunger.
1288A	Day tank pump plunger nut.
1289	Day tank pump plunger eye.
1289A	Day tank pump plunger eye pin.
1290	Day tank pump check valve.
1291	Day tank pump gland.
1292	Day tank pump gland nut.
1293	Day tank pump connecting rod.
1295	Fuel day tank and flange.
1297	Fuel day tank strainer cage and gauze.
1306	Chain sprocket (driver on crank shaft).
1307	Chain sprocket (driven on pump shaft).
1308	Chain shield.
1309	Chain shield cap.
1310	Ball bearing container—blind end.
1310A	Ball bearing container—shaft end.
1311	Driven chain sprocket shaft.
1312	Driven chain sprocket shaft ball bearing.
1313	Silent chain.
1314	Silent chain adjusting screw.
1315	Idler spindle.
1315A	Idler spindle lock nut.
1315B	Idler spindle split ring.
1316	Idler spindle bearing housing.
1317	Idler spindle chain sprocket.
1318	Idler spindle roller bearing complete.
1319	Idler spindle steel cover.
1319A	Idler spindle steel cover screw
1320	Idler spindle roller bearing spacer.
1321	Idler spindle spacer.
1322	Idler spindle spacer washer.
1323	Idler spindle felt washer.
1357	Lubricating oil service tank with flanges.
1358	Lubricating oil service tank collar. Also for fuel day tank
1359	Lubricating oil service tank cover. Also for fuel day tank
1360	Lubricating oil service tank cover plug. Also for fuel day tank.
1362	Lubricating oil service tank strainer cage and gauze.

When ordering parts be sure to furnish Engine Number, as well as Part 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 cap
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
145	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