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 three or four 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 bubbles. 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 crank bearing and enter the connecting rod. The connecting rod is drilled hollow and is fitted with a check valve at its lower end, (which checks any attempt of the oil to return back 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.
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.