SECTION IX — ENGINE

1. DESCRIPTION

A. The Diesel Principle.

The Diesel Engine is an internal combustion power unit. Fuel is atomized as it is injected into the cylinders and is ignited by the heat generated by compression of the air within the cylinders. The expanding gases generated by the burning fuel are converted into work in the cylinders of the engine. The principal difference between the Diesel Engine and the conventional gasoline engine is in the method used to introduce and ignite the fuel.

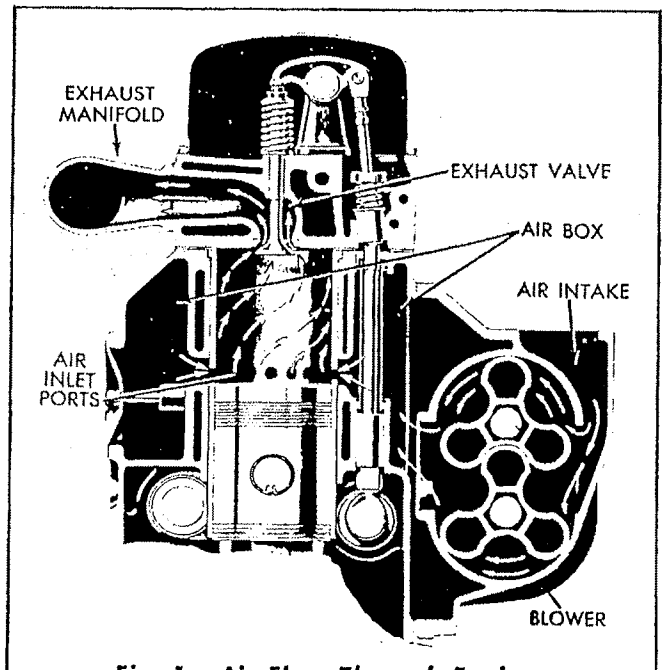

Fig. 1 — Air Flow Through Engine

Gasoline engines draw a mixture of *fuel and air* from the carburetor into the combustion chamber, where it is ignited by an electric spark. In Diesel Engines, air alone is compressed in the cylinder; then a charge of fuel is sprayed into the cylinder, after the air has been compressed, and ignition of the fuel is accomplished by the heat of the compressed air.

The engine in the HD-5 Tractor is a water cooled, 2 cylinder, 2-cycle, Diesel Engine.

B. The Two-Cycle Diesel Engine.

In the 2-cycle engine, intake and exhaust take place during part of the compression and power strokes. A 2-cycle engine, therefore, does not function as an air pump, so an external means of supplying the air is provided. A specially designed blower, bolted to the side of the engine, forces air into the cylinders in order to expel the exhaust gases and fill the cylinders with fresh air for combustion, as shown in Figure No. 2.

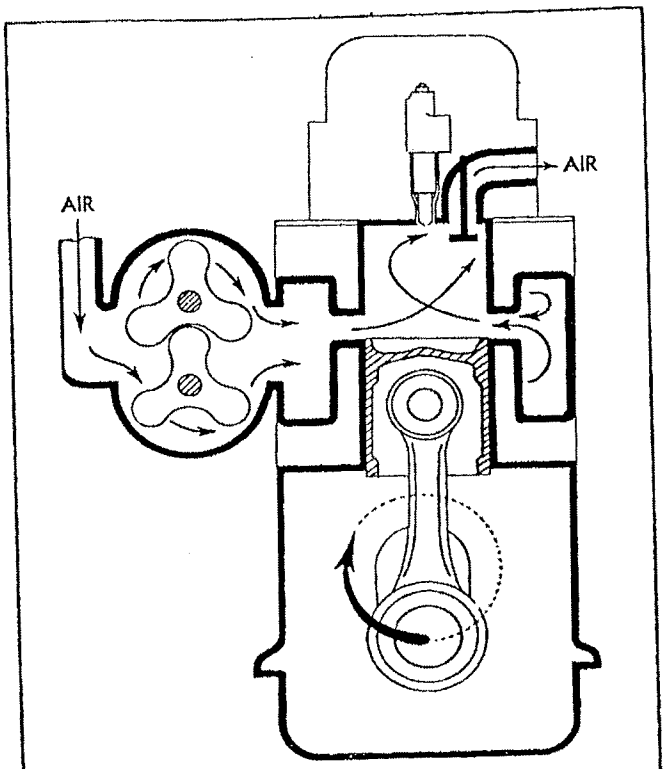

Fig. 2 — Air Entering Through Ports To Combustion Chamber

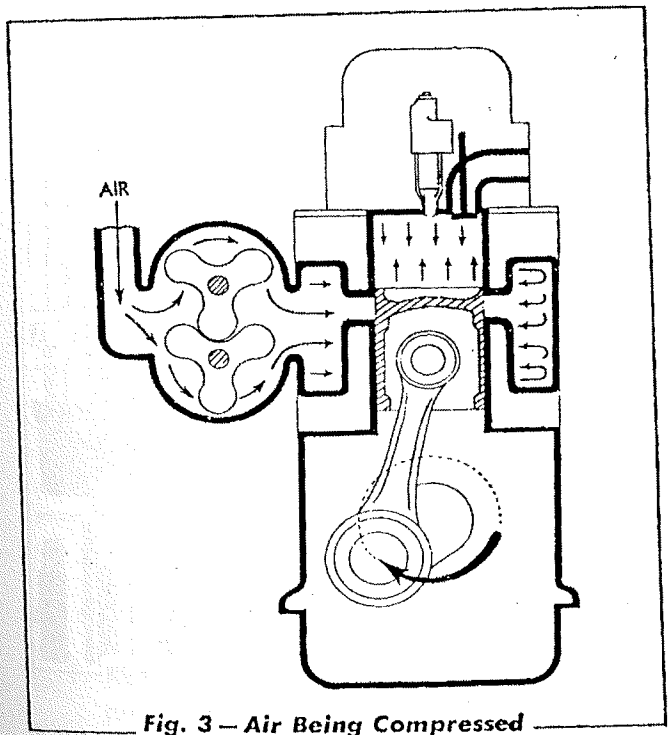

Fig. 3 — Air Being Compressed With Exhaust Valves Closed

A series of ports cut into the circumference of the cylinder wall, above the piston, in its lowest position, admits the air from the blower into the cylinder as soon as the top face of the piston uncovers the ports as shown in Figure No. 2. The flow of air towards the exhaust valves produces a scavenging effect, leaving the cylinders full of clean fresh air

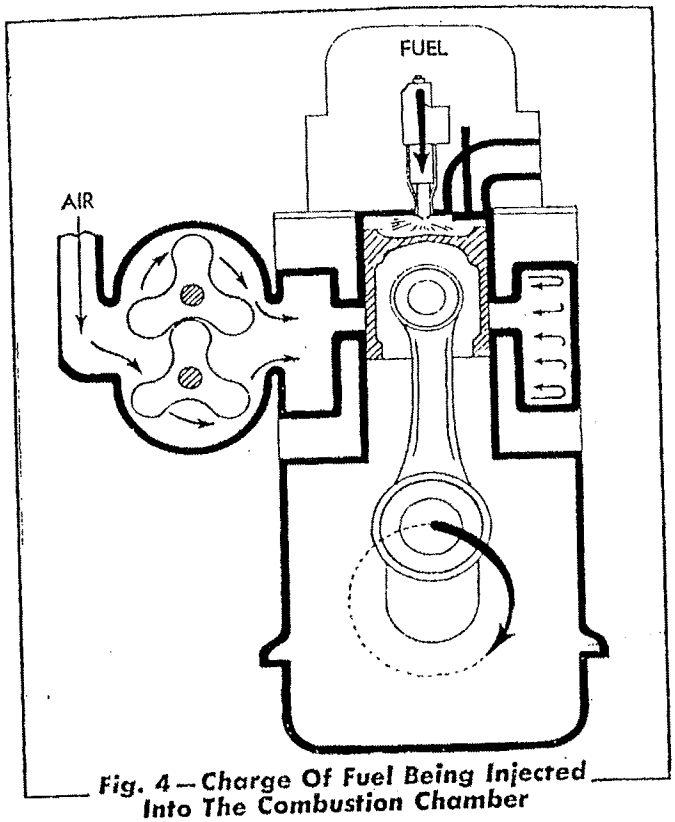

Fig. 4 — Charge Of Fuel Being Injected Into The Combustion Chamber

when the piston again covers the inlet ports.

As the piston continues on the upward stroke, the exhaust valves close and the charge of fresh air is subjected to the final compression, as shown in Figure No. 3. This engine is designed for a highly efficient 16 to 1 compression ratio.

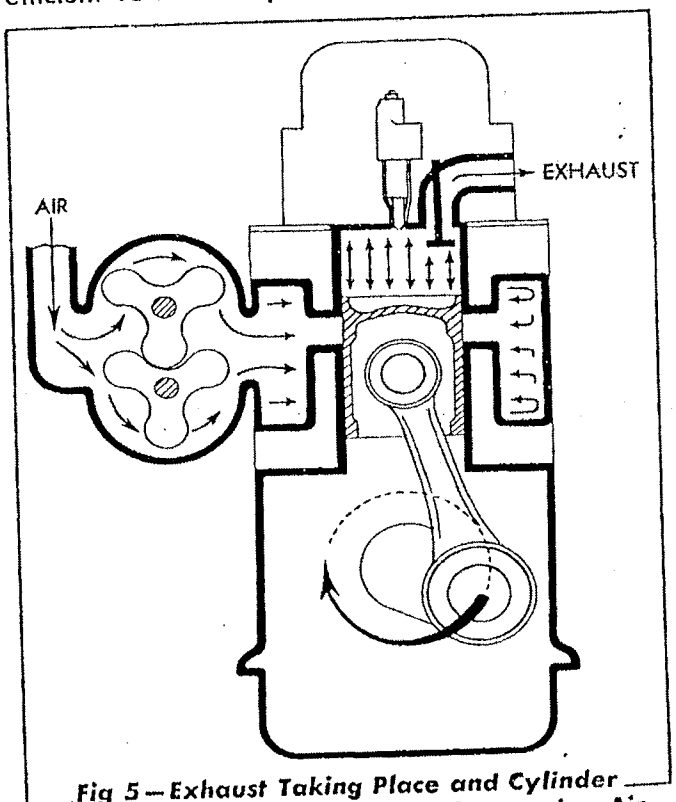

Fig 5 — Exhaust Taking Place and Cylinder About To Be Swept With Clean Scavenging Air

Shortly before the piston reaches its highest position, the required amount of fuel is sprayed into the combustion space by the unit fuel injector, as shown in Figure No. 4. The intense heat generated during the high compression of the air ignites the fine fuel spray immediately, and the combustion continues as long as the fuel spray lasts. The resulting pressure forces the piston downward until the exhaust valves are again opened. As shown in Figure No. 5, the burned gases escape into the exhaust manifold as the downward moving piston is about to uncover the inlet ports.

When these ports are uncovered, the entire cylinder is again swept with clean scavenging air, as shown in Figure No. 2. This entire combustion cycle is completed in each cylinder for each revolution of the crankshaft, or in other words, two strokes; hence, the "2-stroke cycle."

2. CYLINDER HEAD

A. Description.

The cylinder head is a one-piece alloy iron casting which can be removed from the engine as an assembly containing the injectors, guides, rocker arms, and valves. The head is securely held to the upper part of the cylinder block by heat-treated alloy steel bolts.

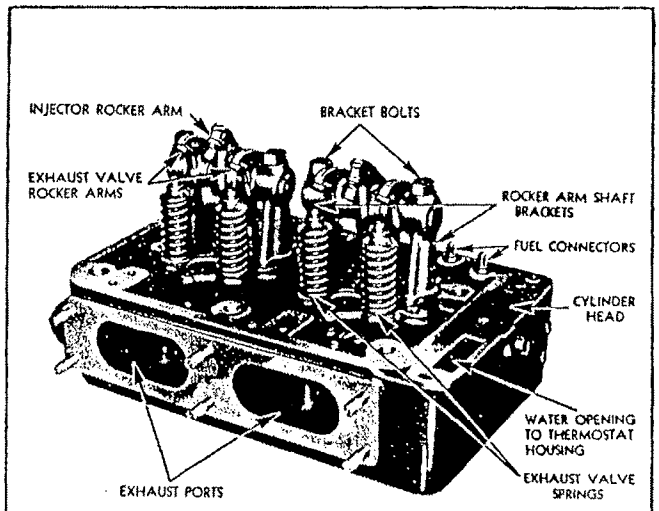

Fig. 6 — Cylinder Head Assembly

Located in the head are two exhaust valves, two valve seats, two valve guides, a fuel injector, and three rocker arms, for each cylinder. One rocker arm operates the injector plunger; the other two operate the exhaust valves. The valve guides are pressed into the cylinder head and hold the valve heads in accurate alignment with the valve seats which are also pressed into the head.

To provide efficient cooling, each fuel injector is inserted into a thin walled copper tube passing through the water space in the cylinder head. The lower end of the copper tube is pressed into the cylinder head and spun over; the upper end is flanged and sealed with a Neoprene seal. The spun-over lower end and the sealed upper end prevent any water leaks around the copper tube.

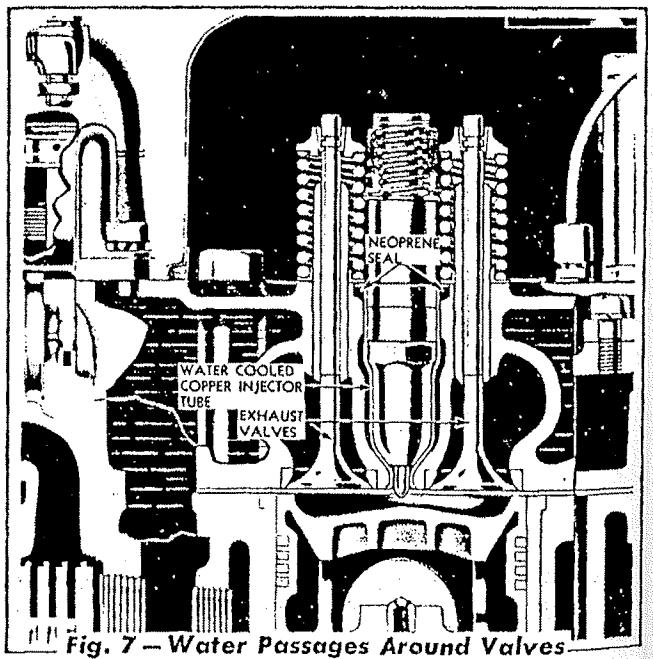

Fig. 7 — Water Passages Around Valves and Injector In Cylinder Head

Two exhaust passages from each cylinder lead through a single port to the exhaust manifold. The exhaust passages, exhaust valve seats, and injector seats are completely surrounded by cooling water.

To seal the compression, a flat laminated gasket composed of steel sheets is installed, between the cylinder head and the top of the cylinder block.