

CHAPTER 17

Rotary Oil Burner Construction

The construction of this type burner whose basic principles and essential elements were presented in the preceding chapter are here given by showing various details of both the nozzle and cup forms as actually made.

Nozzle Type Burner Construction.—This type of rotary burner is sometimes called a wall flame burner. The burner employs a vertical motor that rotates an oil nozzle or distributor and fan, the oil being projected radially by centrifugal force.

In place of motor drive, some designs have a propeller energized by a blast of air from the draught fan. In either type air and oil are propelled radially from the center of the fire box.

The mixture of air and oil is thrown outward against a target of refractory material which gets red hot and vaporizes the fuel.

Rotary Cup Burner Construction.—An example of cup burner construction is here given in fig. 1 with names of parts in text under the cut. In construction upon a hollow alloy steel shaft, there are assembled the rotor, annular ball bearings, pump driving worm gear, fan and atomizing cup of a type to give flame shape desired to fit the boiler combustion chamber.

Lubrication is constant from oil reservoir below bearings and worm.

A variety of interchangeable cups, as shown in figs. 5 to 11, are available for the various burner sizes. Cups are long to allow centri-

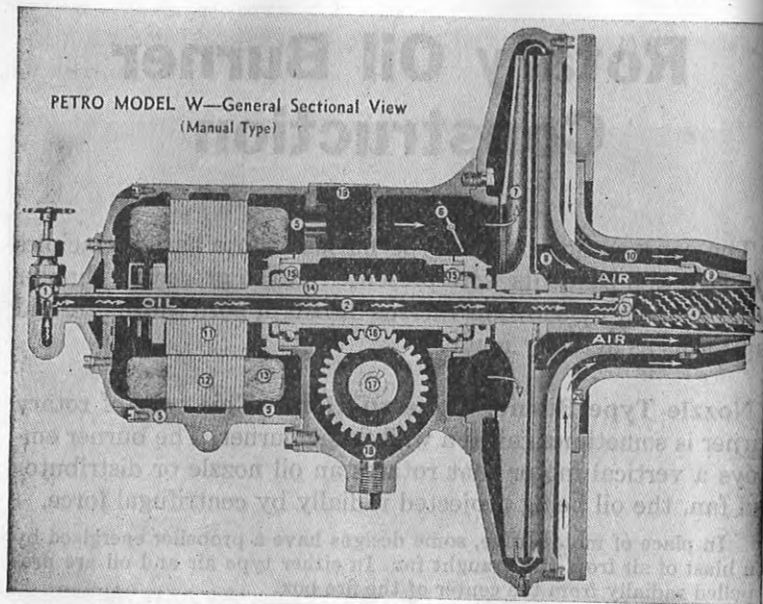
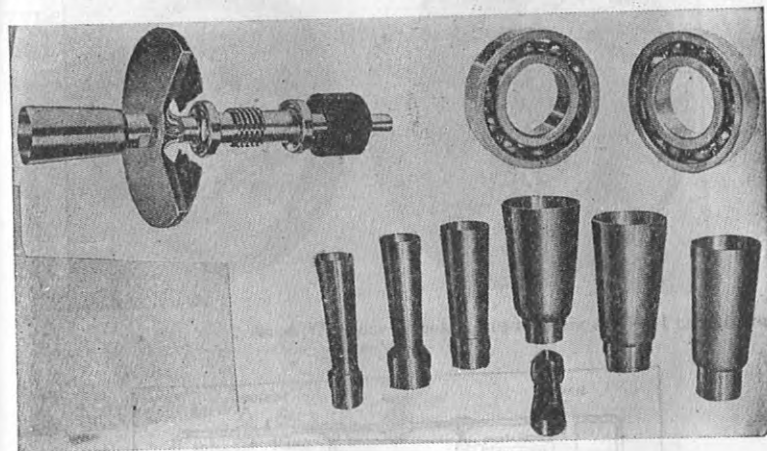


FIG. 1—Sectional view of rotary cup oil burner model W, manual type. 1. Oil metering valve (manual type shown to simplify drawing); 2, stationary oil tube; 3, oil distribution head; 4, rotary distribution cup; 5, motor cooling induced air passages; 6, primary air control; 7, air fan; 8, primary air pass; 9, turbulator air nozzle; 10, induced air to cool burner front plate and sleeve; 11, electric motor armature; 12, field core; 13, field windings; 14, shaft; ball bearings; 16, worm pump drive; 17, worm gear; 18, lubricating oil reservoir; 19, motor wiring junction box; 20, sleeve.

fugal action to create a thin film of oil for uniform distribution from the thin cup rim where primary air and oil meet.

Fig. 12 shows the semi-automatic type burner swung open on hinge also showing mounting plate with bolts to boiler front



FIGS. 2 TO 11—Details (Model W) shaft assembly, ball bearings and rotary cups.

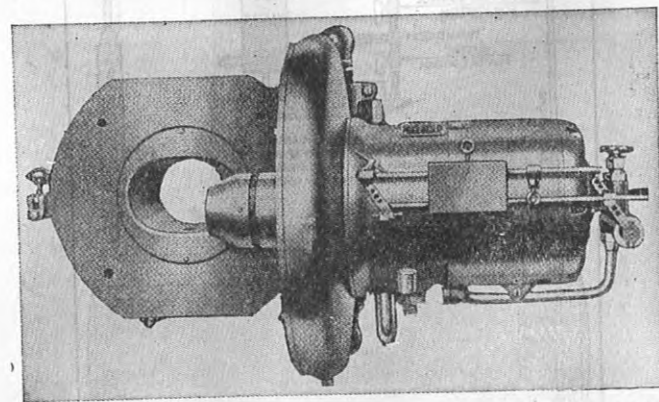
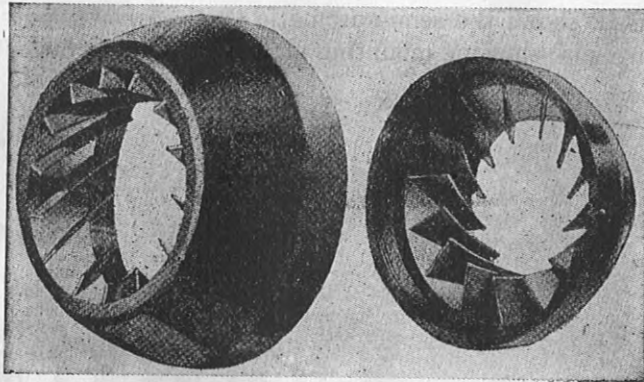


FIG. 12—Mode W semi-automatic burner mounted on hinge showing mounting plate which bolts to boiler front shield which protects nozzle assembly when in firing position.



Figs. 13 and 14—Two views of turbulator for model W, burner.

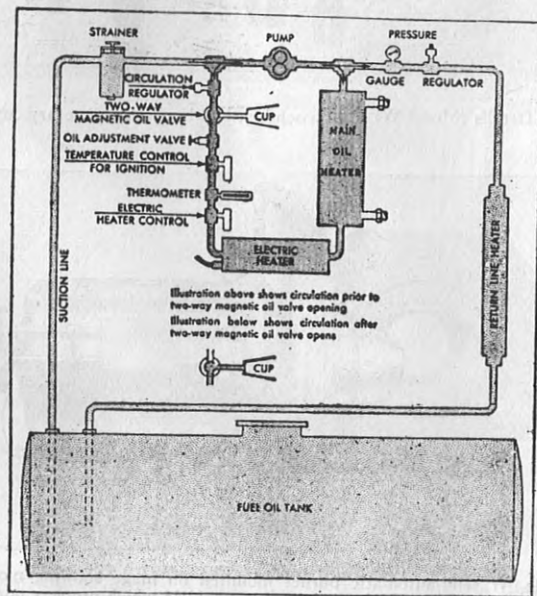


FIG. 15—Diagram of combined electric steam system for pre-heating heavy fuel oil.

Preferred Utilities Model BR Combination Oil-Gas Burner.—This is a horizontal rotary burner of the nozzle mix type. It offers automatic change from one fuel to the other, and is designed for light or heavy oils, and for natural, mixed or L.P. gas. Regulated gas pressure can be as low as 3 ins. on 1050. *B.t.u.* gas of .65 specific gravity. Slightly higher pressure is required on lower *B.t.u.*

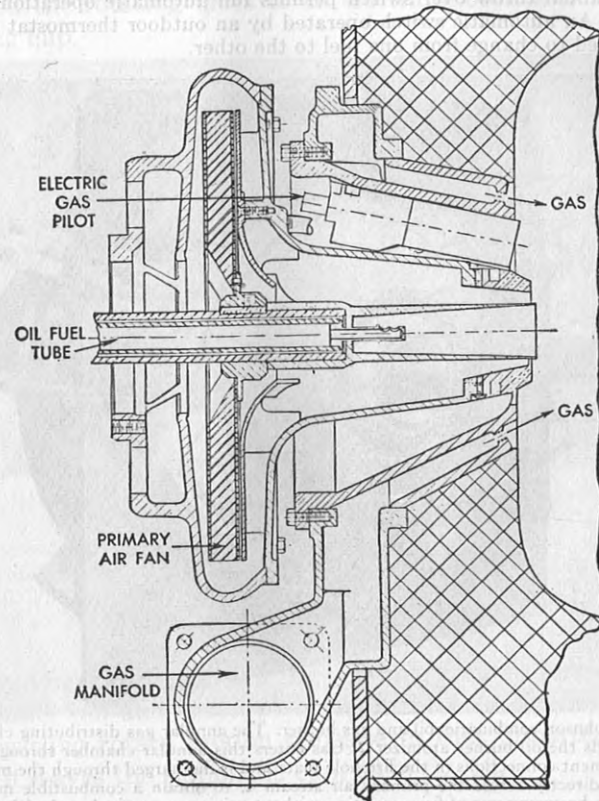


FIG. 15a.—Preferred Utilities Model BR combination oil-gas burner nozzle mix type.

The primary air used to atomize the oil is also used to create turbulence and the mixing of the gas that is discharged from the port around the burner nozzle with the air required for combustion.

A special gear drive assembly that provides manual disconnect of the fuel oil pumps on the burner is standard on #6 oil and available for #5 oil.

A series of gas jets control the flow of gas from the manifold to the circular gas port surrounding the burner nozzle. These jets are factory sized to meet the requirements of the gas to be burned.

A manual throw over switch permits full automatic operation on oil or gas. An automatic switch operated by an outdoor thermostat can be employed to change from one fuel to the other.

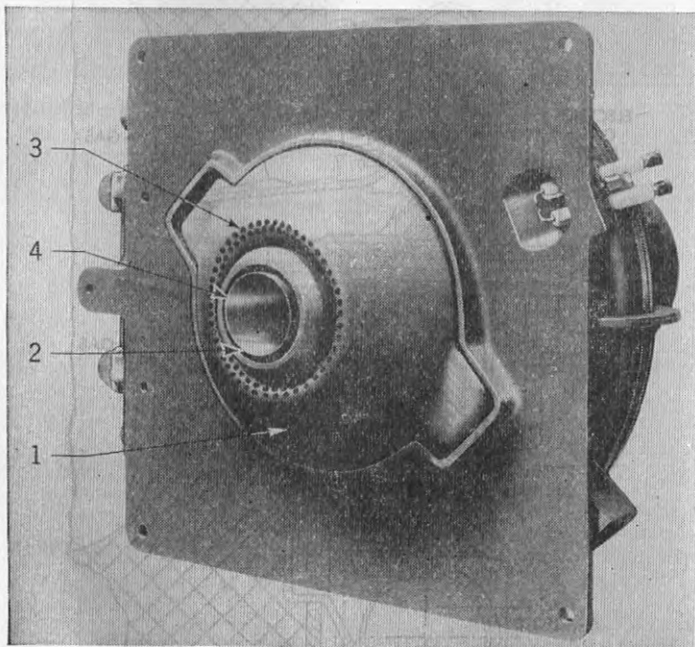


FIG. 15b.—Johnson combination oil and gas burner. The annular gas distributing chamber 1, surrounds the oil burner atomizer 2. Gas enters this annular chamber through rigid and permanent connections in the fire hole plate and is discharged through the multiple orifices 3, directly across the primary air stream 4, to obtain a combustible mixture. Burner can be swung out of firing position without using a gas swivel, and without disconnecting oil or gas pipe lines.

Ray Horizontal Rotary Oil Burners.—They are built to use every available fuel oil from light Diesel oil (C.S.G. No. 2) to bunker C (C.S.G. No. 6).

Ques. Describe the burner unit construction.

Ans. The burner consists of a hollow shaft on which are mounted the rotating units of an electric motor, a fan and a spraying cup.

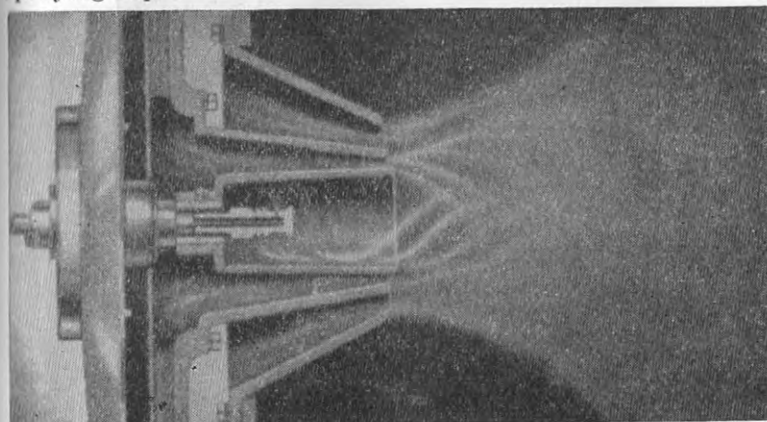


FIG. 16.—Ray angular vane nozzle.

The unit rotates on two ball bearings. A stationary fuel tube within the rotating hollow shaft delivers the fuel oil to the burner cup as in fig. 16. The complete unit is enclosed and the motor is cooled by radiating fins on all but the largest sizes.

Ray Angular Vane Nozzle.—Primary air is furnished by the burner fan and is forced through the angular vane nozzle in a swirling rotary motion opposite to that imparted to the oil as it leaves the rim of the cup, as in fig. 16.

Ques. What is the effect of this arrangement?

Ans. By this means the primary air and the thin film of oil spun off the rim of the cup at high speed are intimately mixed for efficient combustion.

These angular vane nozzles are made in different angulations to shape the flame to fire-box requirements.

Ray Dual Pump and Reservoir.—As shown in fig. 17 there are two constant speed gear type pumps submerged in a reservoir,

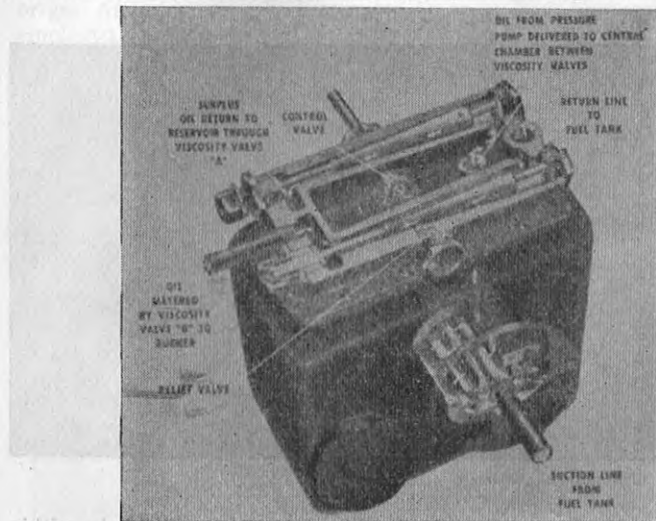


FIG. 17.—Ray dual pump and reservoir.

Ques. Describe the operation of these pumps.

Ans. The primary pump draws oil from the storage tank into the reservoir containing a gallon or more of oil and the secondary pump delivers a constant volume of oil to a special automatic viscosity valve.

The viscosity valve supplies a constant controlled metered volume of oil which is unaffected by changes in the viscosity of the oil. The viscosity valve maintains a uniform oil feeding rate which can be varied by a special regulating valve to meet changing load adjustments.

Preferred Utilities Belt Driven Horizontal Rotary Burner.—These burners are made in capacities of 12 to 175 gallons. The burner has such features as: Dual oil feed pump; "Voluvalve" fuel regulation; electric to gas ignition; air oil control and high speed belt drive, as here described.

Dual Oil Feed.—A one piece reservoir contains two submerged pumps; one for intake, the other for discharge.

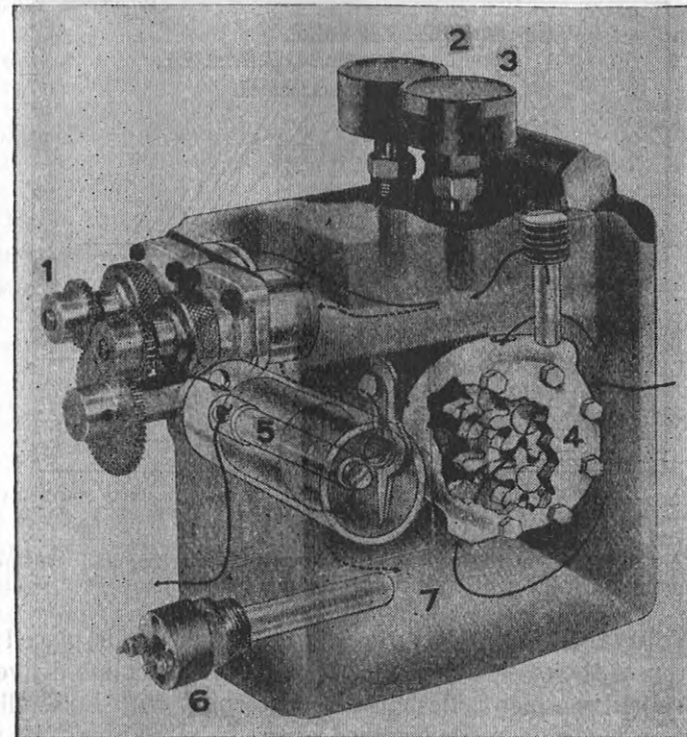


FIG. 18.—Preferred Utilities standard Volu-valve in reservoir. 1, voluvalves; 2, pressure gauge; 3, temperature gauge; 4, pump; 5, equalizing valve; 6, electric heater; 7, reservoir.

Since the discharge pump is always submerged, it maintains a constant discharge volume. An electric heater, also submerged, keeps the oil in the reservoir and cored passages in the burner at the proper temperature at all times for dependable starting.

Below the burner and mounted to it by flange is an oil well containing a line voltage, thermostatically controlled, electric heater. The heater warms the oil consumed by the burner until the external oil supply and oil heating system come into operation. This heater in conjunction with the one in the reservoir keeps all oil in the burner at the proper starting temperature.

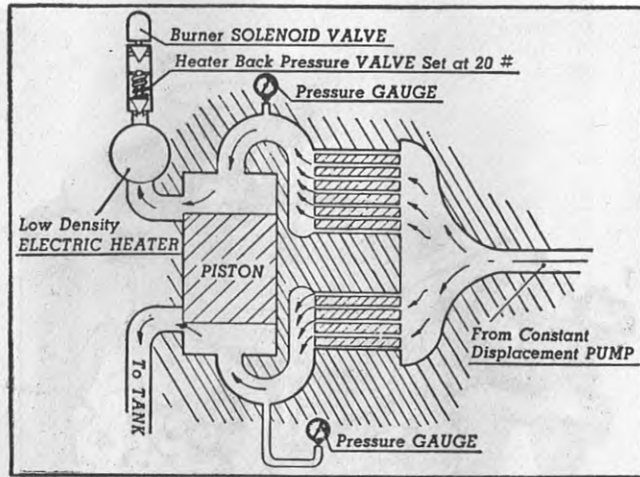


FIG. 19.—Diagram of optional equalizing valve used in conjunction with standard volu valve.

A thermostat in the control circuit prevents starting and continued running until the proper oil temperature is obtained.

“Voluvalve” Fuel Regulation.—This device is placed at the top of the reservoir and consists of a fuel volume delivery control valve which is designed in conformity with Poiseuille’s Law. It meters a predetermined quantity of residual oils regardless of changes in temperature, pressure or viscosity.

Discharge flows through two proportioning valves, one admitting oil to the burner, the other to a return line. Both valves are interconnected through an outside lever so that the ports of one open as the ports of the other close, in exact ratio to the turn of the lever.

A thermometer, pressure gauge and pressure relief valve are built into the “Voluvalve” reservoir.

Electric to Gas Ignition.—An electric to gas ignition pilot with overhead mounting provides a gas enveloped oil spray which speeds up oil ignition and minimizes puff-back starting.

An ignition wire is conducted to the igniter along with a gas line through a common flexible tube bracketed on the front plate. There is no possibility of radio interference. Operation is from a remotely located transformer. Gas is introduced from a remotely located gas valve which opens with the motor circuit. The dependability of this arrangement makes only one large igniter necessary.

High Speed Belt Drive.—The employment of belt drive permits an extra large hollow shaft which provides room for a large diameter fuel tube for oil delivery to the cup.

The cup is driven at 4,700 r.p.m. which gives better spraying especially with the new catalytic residual oils.

The low intake line intake and high return line outlet act primarily to minimize the amount of external piping on the burner, thus permitting oil in the burner assembly to be kept heated during shut down periods.

Burning Heavy Oils.—Although the heavy oils (No. 5 and 6) contain more *B.t.u.’s* per gallon than the lighter oils, and generally cost less, their use has been hampered by their unreliable performance in burners not designed to burn these heavy oils.

The main problem has been to maintain a steady, even flow of oil to the burner head. Heavy oils are subject to wide fluctuations in viscosity. When hot they may flow as readily as stove oil, and when cold may approach the sluggishness of tar.

The viscosity factor is not constant. Heavy oils are residue oils—the left overs after the refining process is completed. Oils obtained at different

times from the same source may contain varying amounts of the viscous elements. It is therefore difficult to control viscosity by means of temperature control, even if it were practical to maintain oil temperature within a very narrow range. Even with thermostatically controlled oil heaters, fluctuations of 10 degrees or more may occur under normal boiler room conditions—a temperature variation sufficient to materially affect the viscosity of heavy oil.

Ques. Mention an important requirement and why important?

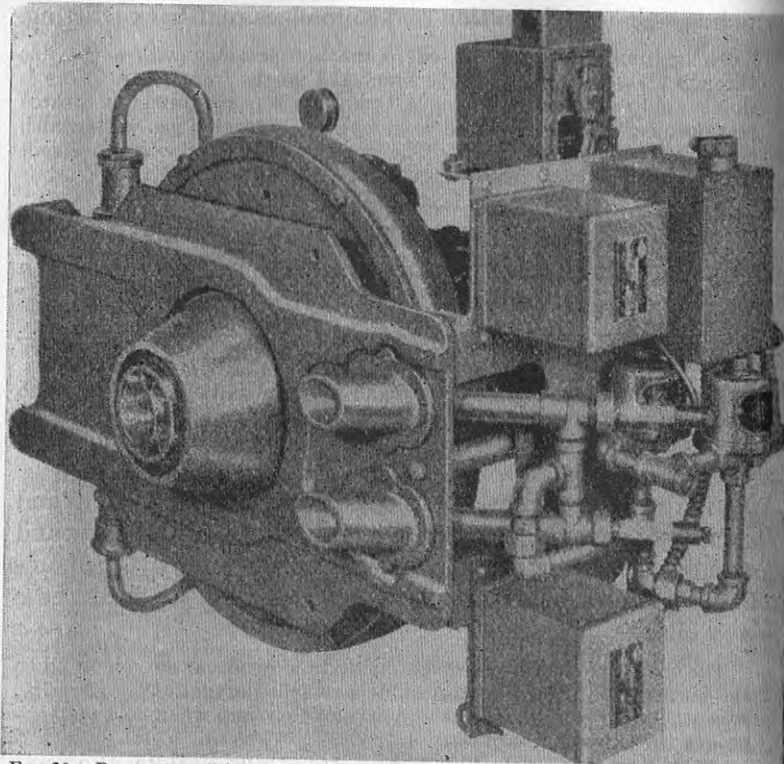


Fig. 20.—Ray rotary oil burner for heavy fuel direct drive type AR-134 illustrating dual ignition.

Ans. Accurate metering of oil to the burner head is very important, as it is obvious that a steady, even flame under perfect control can be maintained only by a steady flow of oil.

Ques. Describe the conventional method of oil control.

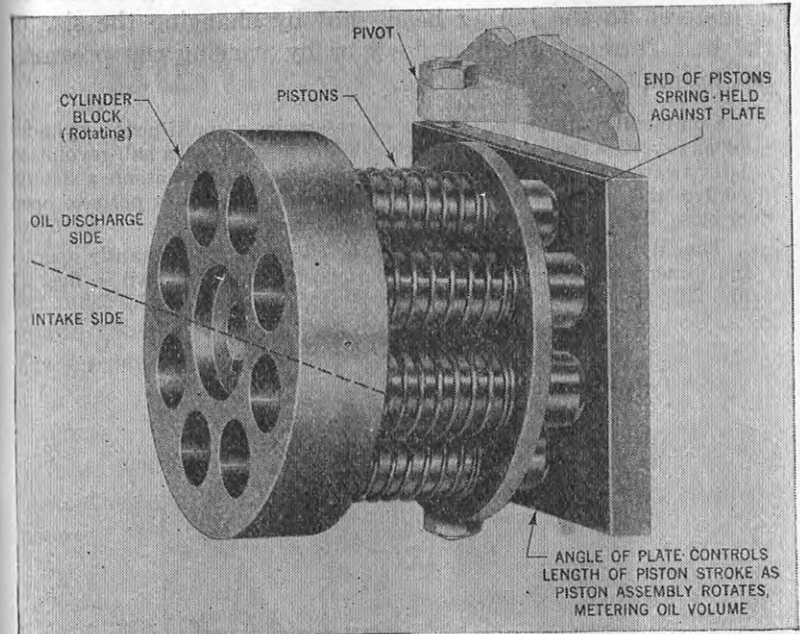


Fig. 21.—Iron Fireman oil volumeter.

Ans. It comprises an adjustable valve or port, often with an automatic device for changing the opening to compensate for changes in viscosity.

Since the viscosity factor is not controllable, it is held that the only reliable means of precision control of oil was to meter it by *volume*.

Ques. What has been done to secure this precision control?

Ans. Various metering devices have been developed by the different manufacturers as here described and known by industrial trade names.

Iron Fireman "Volumeter."—In this feeding device, oil is metered to the burner head—not by changing the size of the hole through which it flows or by varying the pressure, but by multiple piston feeding.

Completely submerged in the oil reservoir, a multi-piston cylinder block revolves, pulling oil into each cylinder in turn, and a half-revolution later ejecting it into the feed line. The multiple cylinders assure a steady, controllable flow of oil. There are no adjustable valves or ports to open or close. The oil feeds smoothly—automatically.

The oil volumeter is submerged in the oil reservoir, constantly operating under an ample head of oil. The construction is shown in figs. 21 and 22.

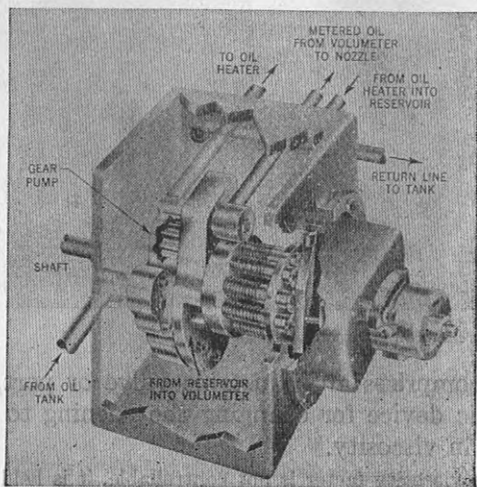


FIG. 22.—Sectional view of Iron Fireman volumeter. The diagrammatic view of the oil reservoir shows circulation gear pump and oil volumeter mechanism. Arrows indicate direction of oil flow in system that provides for oil circulation through indirect steam or hot water oil heater.