CHAPTER 14

High Pressure Domestic Burners

Burners of this type are properly called *sprayers* because they *spray* the fuel instead of vaporizing it.

Ques. What is the criticism of the term oil burner and why?

Ans. It's a misnomer, because the alleged oil burner doesn't burn the fuel, but only prepares it for burning.

Ques. How does it prepare the oil?

Ans. By spraying it and mixing it with the proper amount of air for combustion.

Ques. What is an atomizing burner or atomizer?

Ans. A misnomer, used ignorantly and sometimes *intentionally* (by salesmen) for a sprayer.

Ques. Why is it a misnomer?

Ans. It gives the impression that the burner actually breaks up the fuel into atoms; although very good hot air sales talk, nothing could be more ridiculous as it is very far from the truth.

Ques. What does an alleged atomizing burner really do?

Ans. It breaks up the liquid fuel into very minute liquid particles or globules, that is, it separates a jet of liquid into a finely divided spray resembling "liquid dust".

The term "atomizer" is a misleading term and should never be used.

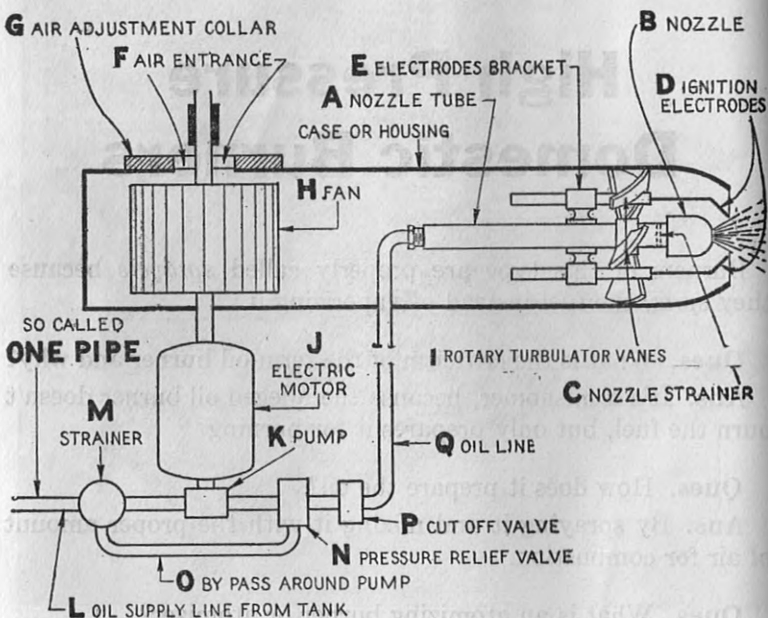

FIG. 1—Elementary high pressure domestic burner showing essential parts.

Elements of a High Pressure Sprayer Burner.—The essential parts of the burner proper or those parts within the casing as shown in fig. 1 are: **A**, nozzle tube: **B**, nozzle; **C**, nozzle strainer; **D**, ignition electrodes; **E**, electrodes bracket; **F**, air entrance; **G**, air adjustment collar; **H**, fan; **I**, rotary

turbulator vanes. Outside the casing are: **J**, motor; **K**, oil pump; **L**, oil supply line; **M**, strainer; **N**, pressure relief valve; **O**, by pass; **P**, cut off valve; **Q**, oil line to nozzle.

This comprises the essentials for the alleged "one pipe system."

The so-called two pipe arrangement is shown in fig. 2. Both terms are ridiculous because two pipes are required in both cases, that is, the second pipe is either a by pass line around pump, or return line to tank. The electrical control system is not as yet considered.

How a High Pressure Sprayer Burner Works.—The elementary diagram fig. 1, is intended to show plainly the rela-

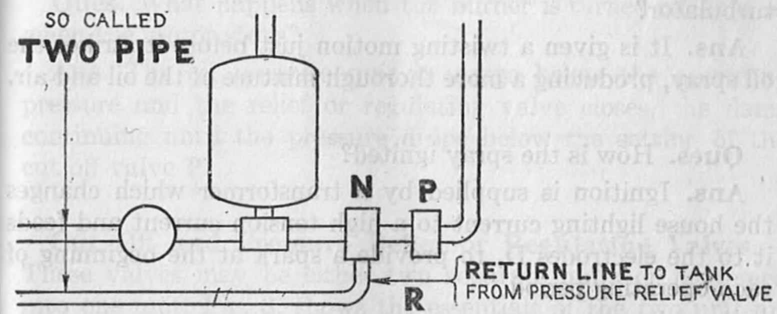

FIG. 2—Detail showing the so called two pipe ystem. Compare with fig. 1. The author considers the terms one pipe and two pipe ridiculous as there are two pipes in each system. *By pass* and *tank return* would be better as they are self defining.

tion of the different parts of a burner to give a clear understanding of its operation.

Ques. How is the fuel delivered to the nozzle?

Ans. Fuel is drawn through a strainer from the storage tank by a pump **K**, and forced under 100 lbs. per sq. in. pressure past pressure relief valve **N**, and cut off valve **P**, through oil line **Q**, and fine mesh strainer **C**, to nozzle **B**.

Ques. What is the action in passing through the nozzle?

Ans. The fuel is broken up and sprayed in a very fine mist.

Ques. How is the spray mixed with air?

Ans. The air supply is drawn in through the case opening **F,** and forced through the draught tube portion of the casing by the fan **H.** This air mixes with the oil spray after passing through a set of vanes **I,** called a turbulator.

Ques. What is the result of passing the air through the turbulator?

Ans. It is given a twisting motion just before it strikes the oil spray, producing a more thorough mixture of the oil and air.

Ques. How is the spray ignited?

Ans. Ignition is supplied by a transformer which changes the house lighting current to a high tension current and feeds it to the electrodes **D,** to provide a spark at the beginning of each operating period.

Ques. Describe the starting cycle.

Ans. When the motor circuit is closed (automatically by room temperature control later described) the motor **J,** starts turning the fan and the pump. At the same instant, the ignition transformer produces a spark at the electrodes ready to light the oil air mixture.

Ques. Describe the oil feed control.

Ans. Pump **K,** (fig. 1) pumps oil from the tank and through strainer **M.** Its flow is controlled by an oil cut off valve **P,**

which prevents oil passing to the nozzle unless the pressure be high enough to atomize the oil (60 lbs. approx.).

The pump however, pumps oil much faster than it can be discharged through the nozzle at that pressure, so the oil pressure continues to rise very fast between the pump and the nozzle.

When the pressure begins to rise above the normal operating pressure (100 lbs.) a pressure relief valve **N,** opens and allows the excess oil to flow through by pass line **O,** to inlet line, as in the so called *one pipe* system, fig. 1, or to flow through a second or return line **R,** fig. 2, to the storage tank.

Evidently the pressure relief valve **N,** in either system maintains the oil at the correct operating pressure.

Ques. What happens when the burner is turned off, that is, when the motor stops?

Ans. The oil pressure quickly drops below the operating pressure and the relief or regulating valve closes, the flame continuing until the pressure drops below the setting of the cut off valve **P.**

Cut Off and Pressure Relief or Regulating Valves.—These valves may be either two separate units or combined into one unit. Fig. 3, shows the essentials of the two unit arrangement. These are as shown, simply elementary mechanisms to illustrate basic principles. The cut off needle valve is shown with spring inside of bellows, and the pressure relief (mushroom) valve with exposed spring. In the cut off valve arrangement the spring acts against oil pressure on the head of the bellows (tending to collapse it); in the pressure relief valve, the spring acts against the oil pressure which acts on the lower face of the mushroom valve (tending to open it).

Ques. How does it work?

Ans. When the pump starts and the pressure in the line rises to about 60 lbs. (depending upon the spring setting) this pressure acting on the head of the bellows overcomes the resistance of the spring causing the cut off valve to open. Since the pump pumps more oil than the nozzle can discharge the pressure quickly rises to 100 lbs., overcoming the resistance of relief valve spring and causing the valve to open. This allows excess oil to by pass or return to the tank according as the system is respectively so called, one or two pipe.

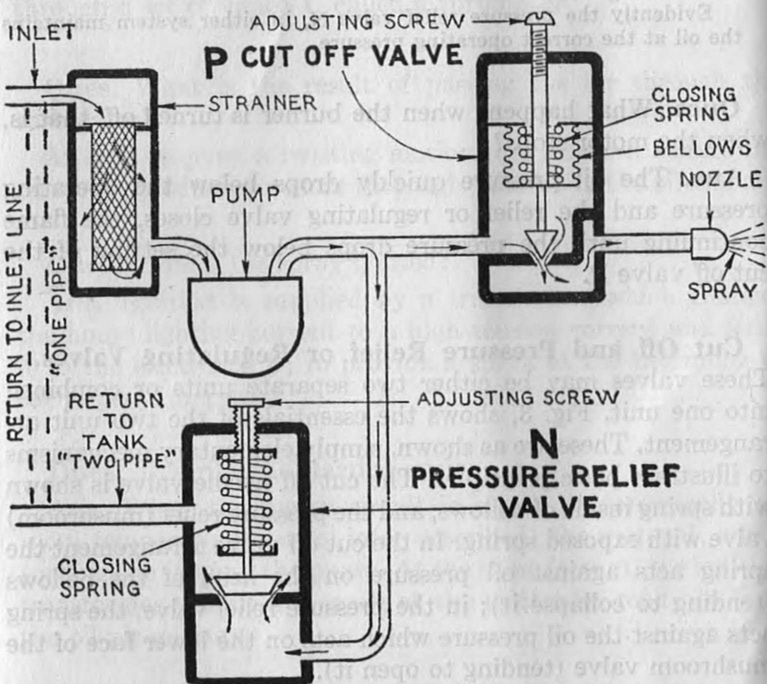

Fig. 3—Elementary sectional view of separate unit cut off valve and pressure relief valve showing also strainer, pump and piping.

Ques. How high does the relief valve open?

Ans. Only high enough to maintain the working pressure constant at 100 lbs.

Ques. What happens when the burner is turned off?

Ans. The oil pressure quickly drops and the pressure relief valve closes. However, oil will continue to discharge from the nozzle until the pressure drops below the cut off valve setting when the cut off valve closes and stops the nozzle discharge.

Ques. How is any remaining pressure trapped by the closing of the cut off valve equalized?

Ans. A passage to the return line is provided by a small slot cut in the seat of the mushroom valve.

The letters **P** and **N** correspond to **P** and **N** in figs. 1 and 2.

Combined Cut Off and Pressure Relief Valves.—Usually the cut off and relief valves **P** and **N,** of fig. 3 are combined in a compact cylindrical casing, as in fig. 4.

Here the two valves are attached to a common stem having attached a flange, which comes in contact with a stop when moved upward by the pressure of the valve actuating spring.

The position of the stop limits the valve movement to proper maximum lift. A piston, free to move in the cylindrical casing has an opening in its head which forms the valve seat for the pressure relief valve. The strong piston spring tends to move the piston downward and close the pressure relief valve and then the cut-off valve.

Ques. How does the mechanism work?

Ans. When the pump starts and the pressure in the cylinder below the piston rises to about 60 lbs. (depending upon the piston spring setting) the piston rises and also the two valves N and P, until the valve flange contacts with the stop.

At this instant the cut off valve is fully opened, allowing oil to flow to the nozzle, the pressure relief valve being still closed. Since the nozzle does not have sufficient capacity to discharge all the oil that is pumped by the pump the pressure below the piston will continue to

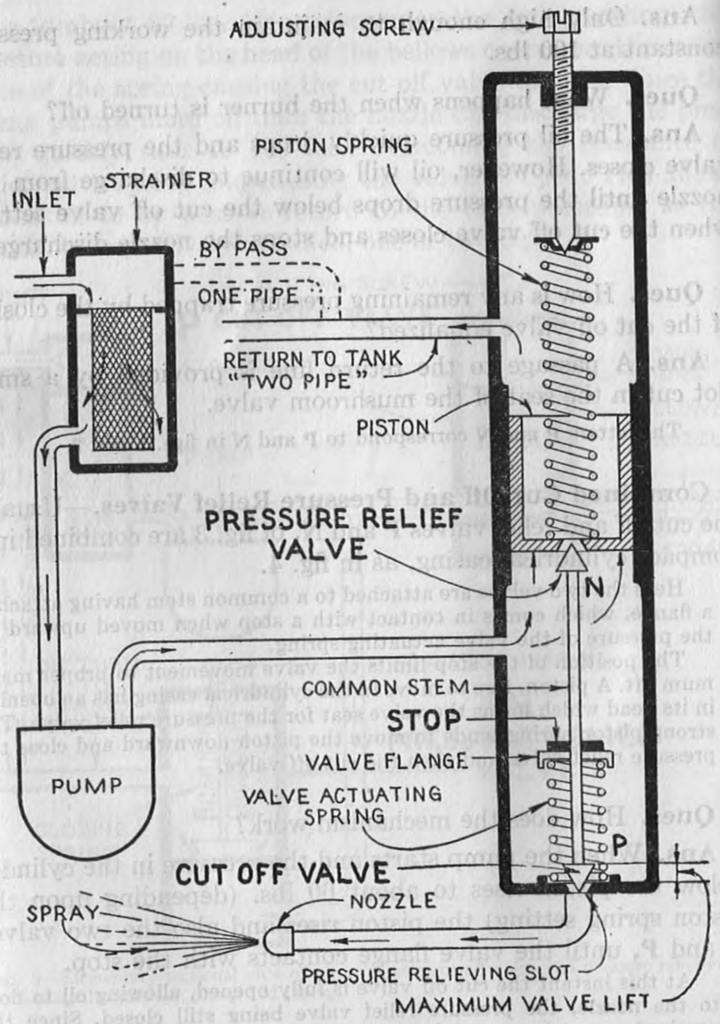

Fig. 4 — Elementary sectional view of combined unit cut off valve and pressure relief valve showing also strainer, pump, and piping.

rise (above 60 lbs.) which will cause the piston to rise further and open the pressure relief valve by withdrawing its seat from the valve N.

The pressure builds up very rapidly, the upward movement of the piston being governed by the spring setting, the standard setting being 100 lbs. oil pressure. In other words the pressure which acts against the resistance of the spring is held constant due to the frictional resistance of wire drawing through the pressure relief valve.

As long as the pump maintains 100 lbs. pressure (or setting pressure) excess will be allowed to "by pass" or return to the tank according as the system is respectively so called one or two pipes, thus maintaining constant pressure.

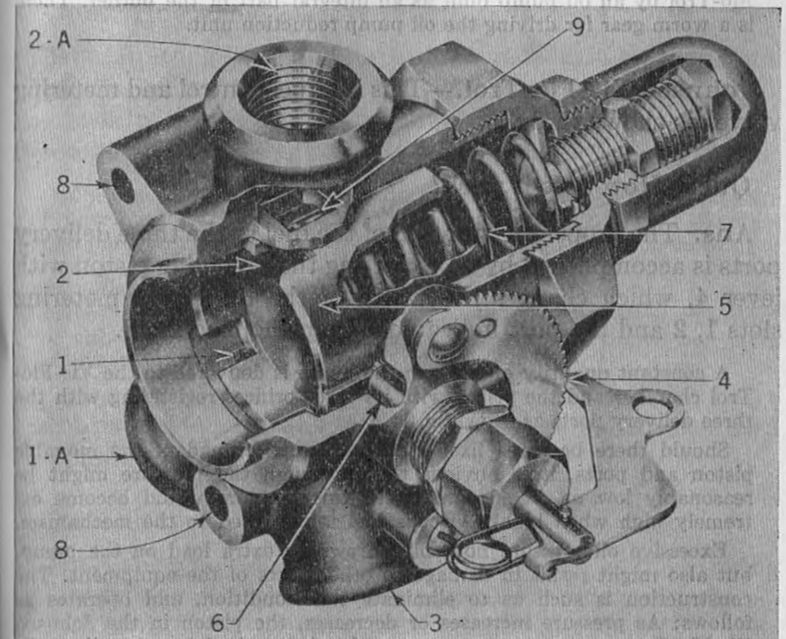

Fig. 5.—Johnson Vis-Flo-Trol fuel control and metering valve. *The parts are:* 1. Orifice oil supply to fire; 1a, pipe connection oil supply to fire; 2, orifice oil return to storage; 2a, pipe connection oil return to storage tank; 3, pipe connection-by pass; 4, oil regulating lever and quadrant; 5, movable spring loaded, ported piston; 6, eccentric pin and groove for adjustment of piston ports; 7, spring with locked pressure adjustment; 8, mounting holes; 9, relief port—permitting free piston movement.

Johnson Rotary Fuel Oil Burner.—Fuel oils from the lighter viscosities up to and including number 5 U. S. Standard may be burned efficiently and economically in the 30-AV without pre-heating, therefore the user is not handicapped by fuel shortage or changing fuel oil markets.

The construction is such as to give oil and air in the correct amount at all times. Air is supplied by the motor and fan, built as an integral part of the burner.

Fuel oil feed to the burner is supplied automatically through the Vis-Flo-Trol by an oil pump built as an integral part of the burner. There is a worm gear for driving the oil pump reduction unit.

Johnson Vis-Flo-Trol.—This is a fuel control and metering valve, as shown in fig. 5.

Ques. How does it work?

Ans. The proper distribution of the fuel to the three delivery ports is accomplished by hand setting the revolving piston with lever 4, which changes the width of the respective metering slots 1, 2 and the port indicated by pipe connection 3.

A constant quantity of oil from the pump is delivered to the Vis-Flo-Trol chamber and the piston with its three orifices registering with the three delivery ports as shown in fig. 5.

Should there be three fixed metering ports instead of the movable piston and ports, it is obvious that although the pressure might be reasonably low on free-flowing fuels, this pressure would become extremely high when highly viscous fuel is delivered to the mechanism.

Excessive oil pressure not only throws an extra load on the pump, but also might result in damage to other parts of the equipment. The construction is such as to eliminate this condition, and operates as follows: As pressure increases or decreases, the piston in the Johnson Vis-Flo-Trol moves to whatever position is required to pass all of the oil delivered by the pump, at the same time keeping the oil pressure within the desired range.

When a highly viscous fuel is delivered to the valve chamber, the pressure tends to increase, but simultaneously with the increase in pressure, the piston moves back, increasing the size of the ports. The result is only a slight increase in pressure.

Ques. How is the oil flow adjusted?

Ans. By a lever on the Vis-Flo-Trol being moved from shut to open on the notched quadrant. Each notch gives a variation in flame (hardly perceptible to the naked eye) by automatically changing the width of orifices in the piston.

Ques. How about back pressure?

Ans. In using low viscosity fuels there is little back pressure regardless of the flow. However, with fuel such as number 5, the back pressures vary considerably with viscosity changes, due to temperature changes or from a change in the rate of flow.

The design of the Johnson Vis-Flo-Trol is such that when back pressure is developed in the fuel oil line to the fire, the back pressure in the other two ports is automatically changed to correspond. This applies both to back pressure caused by oil viscosity changes or the change in flow as the fire is adjusted from its minimum to maximum. Thus, with the valve there is a constant flow of fuel at all times to the fire, regardless of either an increase or decrease in pressures caused by changes in viscosity or rate of flow to nozzle.

Johnson Electric Gas Ignition.—This combination is used on Johnson type 30-AV burners.

Ques. How does it work?

Ans. The gas is only used for a fraction of a minute during each starting cycle. When the burner starts, the ignition transformer furnishes an electric spark in the path of the gas. The gas, passing the spark, is ignited and the flame ignites the oil.

With the fire established, spark and gas are promptly shut off. If manufactured or natural gas be not available, equally satisfactory operation may be had with compressed gas in containers.

Combustioneer Straight Line Air Delivery.—This method is designed to deliver air to the fan and from the fan in a straight line.

Air is metered to the full width of the blower wheel in order to provide a uniform amount for delivery through the blast tube to the combustion point.

Triple Velocity Air Delivery.—By means of the design of

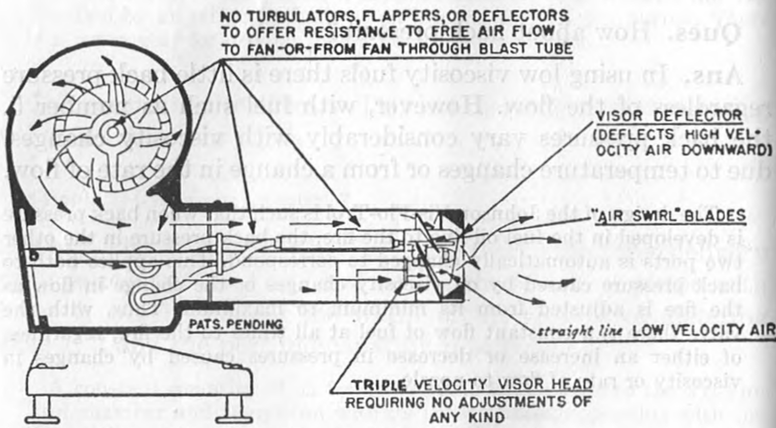

FIG. 6.—Combustioneer oil burner showing triple velocity air delivery.

the burner head three separate air streams are delivered to the combustion point of the oil spray to get most efficient combustion. See fig. 6.

Combustioneer Visor Head.—This head is so designed as to deflect high velocity air downward and this in turn lowers the 80° cone oil spray holding the flame in a horizontal position. This heats the walls of the heat exchanger at their lowest point. The entire heat exchange is heated. See fig. 8.

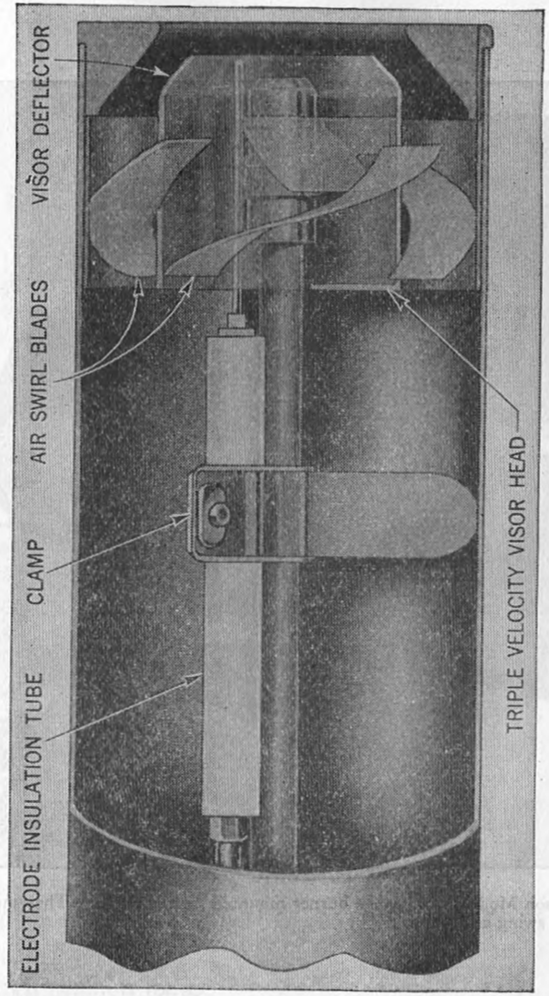

FIG. 7.—Combustioneer visor head.

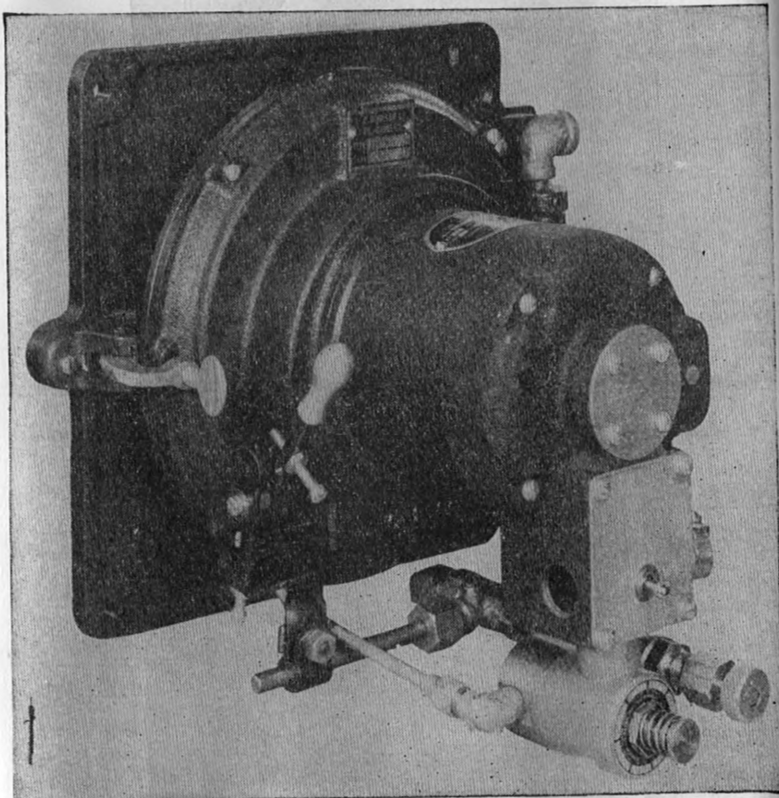

FIG. 8.—Johnson Model B-OH range burner mounted for right swing. They may be either right or left swing as desired.