

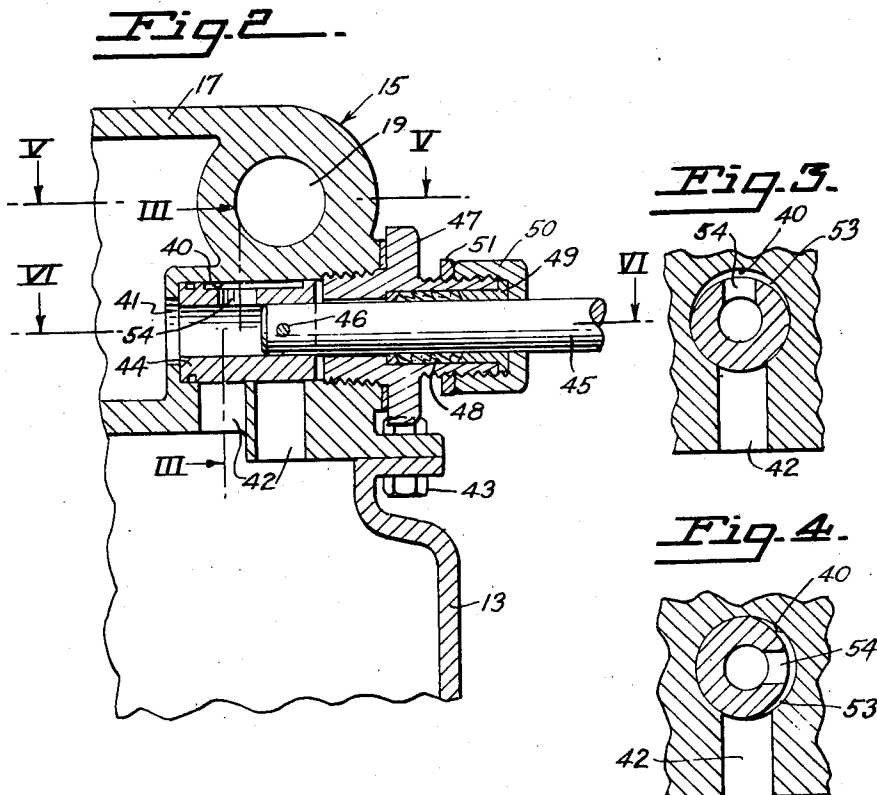
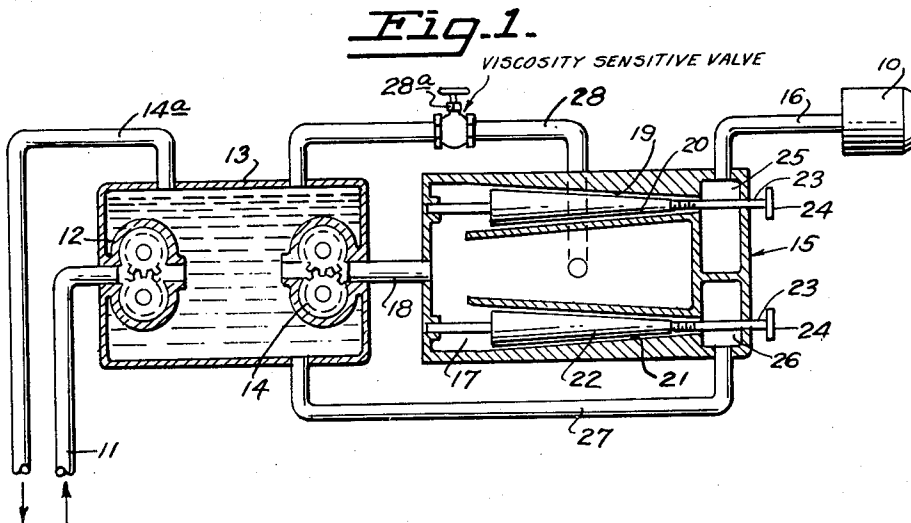
May 31, 1949.

R. B. PLASS
BURNER CONTROL SYSTEM, INCLUDING A
VISCOSITY SENSITIVE BY-PASS VALVE

2,471,541

Filed Jan. 28, 1946

2 Sheets-Sheet 1



INVENTOR.
RAYMOND B. PLASS
BY *Charles M. Fryer*
ATTORNEY

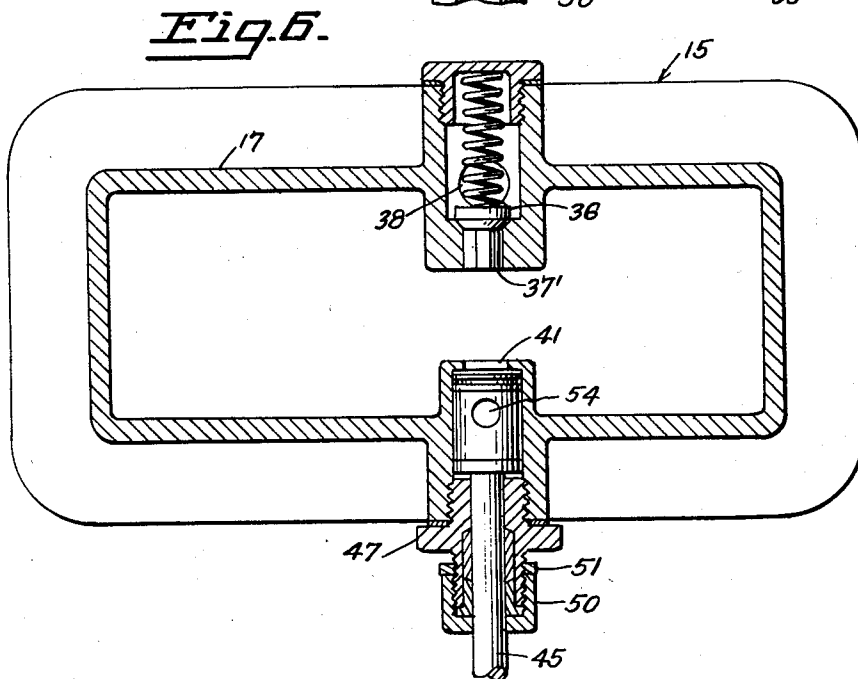
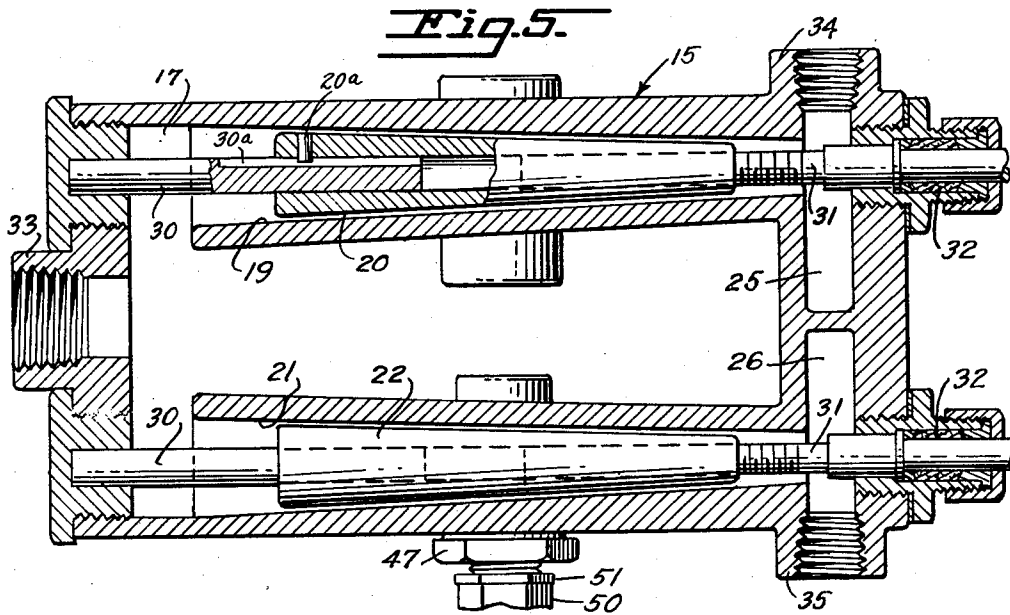
May 31, 1949.

R. B. PLASS
BURNER CONTROL SYSTEM, INCLUDING A
VISCOSITY SENSITIVE BY-PASS VALVE

2,471,541

Filed Jan. 28, 1946

2 Sheets-Sheet 2



INVENTOR.
RAYMOND B. PLASS
BY *Charles M. Fugate*
AT TORNEY

UNITED STATES PATENT OFFICE

2,471,541

BURNER CONTROL SYSTEM, INCLUDING A
VISCOSITY SENSITIVE BY-PASS VALVE

Raymond B. Plass, Berkeley, Calif., assignor to
Ray Oil Burner Co., San Francisco, Calif., a
corporation of Delaware

Application January 28, 1946, Serial No. 643,896

1 Claim. (Cl. 158—36.3)

1

This invention relates to burner control systems and particularly to systems of the kind used for controlling the delivery of oil to an oil burner or the like.

In such systems a burner tip is employed for directing fuel oil into the fire box of the furnace where it is mixed with air and ignited to cause combustion. It is customary to pump the oil from the source of supply to the burner tip and the pump employed should be of greater capacity than the maximum requirements of the burner to insure a full and adequate supply of fuel at all times and under all conditions. It is common practice, therefore, to operate the delivery pump at constant capacity and to bypass a part of the oil delivered by the pump back to its source in order to regulate the rate of flow to the burner. Ordinary valves have been employed for controlling the ratio of oil delivered to the burner tip and through the bypass but it has previously been discovered that they are unsatisfactory under normal operating conditions. For example, the viscosity of the oil changes with changes in temperature which are bound to occur under furnace room conditions and as viscosity, pressure, and the diameter and length of tubes or conduits through which a liquid flows all effect its rate of flow, the ratio between the oil flowing to the burner tip and that flowing through the bypass was subject to change with variations in temperature. This resulted in a varying flame size at the burner tip.

In order to correct the difficulties which arose because of the unstable viscosity of fuel oil under normal operating conditions, a so-called viscosity valve has been developed which embodies a pair of Poiseuille tubes of variable dimensions. The oil from the pump is delivered through these tubes, one of which communicates with the burner tip and the other with a bypass conduit. When the tubes are adjusted to effect a proper ratio between the quantity of oil flowing to the burner and the quantity of the oil flowing through the bypass, the ratio remains constant notwithstanding variations in viscosity of the oil. Such a viscosity valve is fully disclosed and its function clearly set forth in the patent to Neubauer, No. 2,037,994, for Apparatus for metering fluids, issued April 21, 1936.

When such a viscosity valve is employed, the fuel oil delivery pump delivers its full capacity of oil at all times and the proper proportion of such oil is directed to the burner tip for the desired maximum flame size regardless of variations in its viscosity. It is at times desirable,

2

however, to reduce the flame size to the burner and this has been accomplished by providing an auxiliary bypass from the pressure side of the pump back to the source of supply and employing a regulating valve to control flow through this bypass. To reduce the flame size, the regulating valve is opened to bypass some of the oil before it passes through the viscosity valve.

It is now known that the use of any conventional regulating valve for the purpose just described results in an unstable flame size when the viscosity of the fuel oil is subject to variation. This is explained by the fact that the flame size depends upon the rate of the oil flow to the burner tip and the rate of oil flow depends upon the quantity of oil that is being bypassed back to its source before it reaches the burner. Thus, if the regulating valve in the bypass is set to establish a given flame size and the viscosity of the oil changes, the proportion of the oil bypassed to that flowing to the burner tip will not remain constant because of the difference in the flow characteristics of the bypass valve and the viscosity valve.

It is an object of the present invention, therefore, to provide a burner control system capable of being set to establish any desired flame size and to maintain said flame size constant notwithstanding variations in viscosity of the fuel oil delivered to the burner. A further object of the invention is to provide a burner system having full viscosity control of all oil delivered to the burner and all oil returned to its source for the purpose of controlling flame size at the burner tip. A still further object of the invention is the provision of a quick acting regulating valve having viscosity control characteristics. Further and more specific objects and advantages of the invention are set forth in the following specification wherein reference is made to the accompanying drawings in which one form of the invention is exemplified.

In the drawings:

Fig. 1 is a schematic illustration of a burner control system of the kind in which the present invention is employed;

Fig. 2 is a vertical sectional view through a regulating valve having viscosity control characteristics and embodying the present invention;

Fig. 3 is a fragmentary view taken on the line III—III of Fig. 2 illustrating the regulating valve in a closed position;

Fig. 4 is a view similar to Fig. 3 illustrating a different position of the valve;

Fig. 5 is a horizontal sectional view of a viscosity

valve unit taken on the plane of the line V—V in Fig. 2; and

Fig. 6 is a similar view of the same valve unit taken on the plane of the line VI—VI of Fig. 2.

The burner control system illustrated schematically in Fig. 1 comprises a burner tip 10 which is disposed in the fire box of a furnace or the like (not shown) and to which oil and air are delivered in a conventional manner to produce a combustible mixture. The rate of flow of oil to the burner tip 10 is the factor which determines the size of the flame in the fire box and it is to the control of such rate of flow that the present invention is directed. The oil consumed at the burner tip 10 is supplied from a source, not shown, through a pipe 11 through which it is drawn by a pump 12 for delivery into a reservoir 13. An overflow tube 14a forms a communication between the reservoir 13 and the source of supply to prevent the building up of excessive pressure in the reservoir. A pump 14, which like the pump 12 may be disposed within the reservoir 13, is employed for supplying oil to the burner tip 10 and the oil is so supplied through a viscosity valve unit generally indicated at 15 and a pipe or conduit 16. The viscosity valve unit 15 may be of the type disclosed in Patent No. 2,037,994 hereinabove referred to and is herein schematically illustrated as comprising a hollow case or chamber 17 to which oil is supplied by the pump 14 through a conduit represented at 18. The capacity of the pump 14 is preferably considerably in excess of the maximum requirements of the burner 10 and, therefore, only a portion of the oil flows to the burner through a tapered port 19, the capacity of which is controlled by an adjustable tapered plug 20. The remainder of the oil flows through a similar tapered port 21 having a corresponding adjustable tapered plug 22. Each of the plugs 20 and 22 are supported for longitudinal adjustment with relation to the tapered ports in which they are disposed by means illustrated in Fig. 1 as threaded rods 23 provided with handles 24.

The oil which passes through the port 19 is transmitted through a chamber 25 to the conduit 16 which leads to the burner and the oil passing through the port 21 flows through a separate chamber 26 into a conduit 27 which communicates with the reservoir 13. This arrangement is such that the tapered openings 19 and 21 with their corresponding adjustable plugs 20 and 22 provide in effect a pair of Poiseuille tubes by means of which the ratio of oil passing to the burner and flowing through the bypass pipe 27 will be maintained constant notwithstanding variations in its viscosity. Through the arrangement thus far described, it is possible to maintain a constant flame of any given flame size at the burner tip 10.

In order to reduce the flame size, the bypass line 28 is provided for communication between the interior of the viscosity valve unit 15 and the reservoir 13 or source of supply. An ordinary regulating valve has heretofore been employed in the position occupied by the viscosity sensitive valve indicated at 28a to control the rate of flow through the bypass line 28 so that the amount of oil bypassed to its source through the line 27 could be adjustably supplemented for controlling the rate of flow to the burner tip 10. When any ordinary type of regulating valve is employed with the line 28 the flame size of the burner tip is properly controlled so long as the viscosity of the oil is maintained constant. In the event of variation of the oil viscosity, however, a greater or lesser quantity of oil would be bypassed through

the line 28 and consequently the rate of flow to the burner would change and the flame size would likewise undergo an undesirable change.

The present invention provides a regulating valve to be employed in the bypass line 28 having viscosity control characteristics so that it functions according to the laws which govern the functioning of the viscosity valve units in the ports 19 and 21 so that the ratio of oil flowing to the burner tip 10 and flowing through both of the bypass lines 27 and 28 remains constant regardless of variations in viscosity. The regulating valve employed for this purpose is best illustrated in Figs. 2, 3 and 4 which, with Figs. 5 and 6, illustrate a preferred form of valve as it is employed in a commercial embodiment of the viscosity control unit diagrammatically illustrated at 15 in Fig. 1.

Referring to Figs. 2, 5 and 6, the unit 15 is illustrated as a substantially rectangular case enclosing the tapered tubular ports 19 and 21 which contain the adjustable plugs 20 and 22. Each of the plugs 20 and 22 are, as illustrated in Fig. 5, mounted for sliding movement along guide bars 30 and are longitudinally adjustable by threaded stems 31 which project through suitable stuffing boxes indicated at 32 to the exterior of the unit where they may be rotatably adjusted to establish the desired setting of the plugs with relation to the tapered interiors of the elongated ports 19 and 21. A pin 20a as shown in the tapered plug 20 extends into a slot 30a in the guide bar 30 to prevent rotation of the plug 20 during its adjustment by the threaded stem 31 and a similar structure (not shown) is employed in the plug 22. An inlet port 33 is provided at one end of the casing for connection with the supply conduit 18 illustrated in Fig. 1 and outlet ports 34 and 35 are provided for connection with the conduits 16 and 27, respectively, as shown in Fig. 1. A spring loaded relief valve 36 as illustrated in Fig. 6 may also communicate with the interior of the chamber to relieve excessive pressure therein through suitable outlets 37 and 38.

Also communicating with the interior of the viscosity control unit 15 is a regulating valve, corresponding to the valve 28a in Fig. 1, having viscosity control characteristics and illustrated in detail in Figs. 2, 3, 4 and 6. This valve comprises a cylindrical chamber 40 here shown as formed in a suitable enlargement in a side wall in the unit 15 and having an end port 41 which communicates with the interior of the unit 15. An elongated slot or a closely spaced pair of circular ports 42 form a communication between the side wall of the cylindrical chamber 40 and the source of supply of fuel oil. In Fig. 2 of the drawings, the reservoir 13 is illustrated as a casing disposed beneath and connected with the unit 15 as by flanges and bolts 43. This represents a convenient commercial construction though it is to be understood that the ports 42 which communicate directly with the reservoir 13 in this manner could as well be connected with a remotely positioned reservoir by a conduit as represented at 28 in Fig. 1. Within the cylindrical valve chamber 40 is a substantially cylindrical hollow plug 44 to which a stem 45 is secured as by a pin 46. The stem 45 extends through a bonnet fitting 47 which contains conventional packing 48 held in place by a gland 49, packing nut 50 and lock nut 51 to enable the stem 45 to be rotated by any suitable control means from the exterior of the casing. Rotation of the stem 45 effects rotation of the valve member 44 in its cylindrical casing 40. This valve member, as best illustrated in Figs. 3 and 4, has

5

a cut away portion 53 on one side thereof which is formed on an arc slightly eccentric with relation to the cylindrical valve member itself to provide an elongated relatively flat tapered space between the valve member and its cylindrical casing 40. A port 54 is formed through the hollow valve member to communicate between this space and the interior of the valve member which in turn communicates through the port 41 with the interior of the unit 15. Therefore, by rotation of the valve member 44 through the medium of its stem 45 it may be adjusted from a closed position as illustrated in Fig. 3 to an open position as illustrated in Fig. 4 wherein the tapered space formed by its cut away side 53 registers with the bypass ports 42 and permits the flow of oil from the interior of the case 15 back to its source. The space between the casing 40 and the cut away portion 53 of the valve member, however, provides an elongated tapered restricted passageway through which the oil must flow as it bypasses through the regulating valve and this passageway corresponds in its effect with the Poiseuille tube type valves provided at 19 and 21. The effective length and dimensions and therefore the flow restricting characteristics of the tapered passageway so formed is also adjustable because of the fact that rotation of the valve element 44 varies the distance between its port 54 and the bypass ports 42 through which the oil flows and at the same time varies the cross-sectional area of the oil passageway. Consequently, the restrictive effect of this passageway may be varied at will and the regulating valve is thus afforded viscosity sensitive characteristics comparable with the other two valves which control the flow of oil to the burner tip. Therefore, when the regulating valve is adjusted to establish a desired flame size, the flow of oil to the burner tip and the size of the flame will remain constant even though the temperature and viscosity of the oil are changed.

The particular construction of the regulating valve herein disclosed has been found desirable

6

particularly in the combination shown and provides a quick acting readily adjustable valve having viscosity control characteristics which is simple in construction and operation, though it is to be understood that the present invention is not intended to be limited by the structure shown as various modifications in construction and arrangement of the several parts herein disclosed may be made, all within the scope of the present invention as it is defined by the appended claim.

I claim:

A burner control system comprising a source of fuel oil, an enclosed chamber, a pump for delivering oil from said source under pressure to said chamber, means for communicating part of the oil under pressure in the chamber to a burner, means for bypassing part of the oil from said chamber to the source, apparatus in said chamber for restricting flow through both of said means to regulate the flow substantially in compliance with Poiseuille's law, an auxiliary bypass for reducing flow to the burner, said auxiliary bypass extending between the source of oil and a point in said chamber containing said flow regulating means, and a regulating valve in said auxiliary bypass in close proximity to the connection of said bypass with said chamber, and similar flow restricting apparatus in said regulating valve.

RAYMOND B. PLASS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,653,492	Cadwell	Dec. 20, 1927
1,899,396	Ray	Feb. 28, 1933
2,006,865	Lake	July 2, 1935
2,037,994	Neubauer	Apr. 21, 1936
2,317,427	Worth	Apr. 27, 1943