Aug. 6, 1946. L. F. SPEARE 2,405,243

OIL BURNER

Filed June 19, 1944 2 Sheets-Sheet 1

Fig. 1.

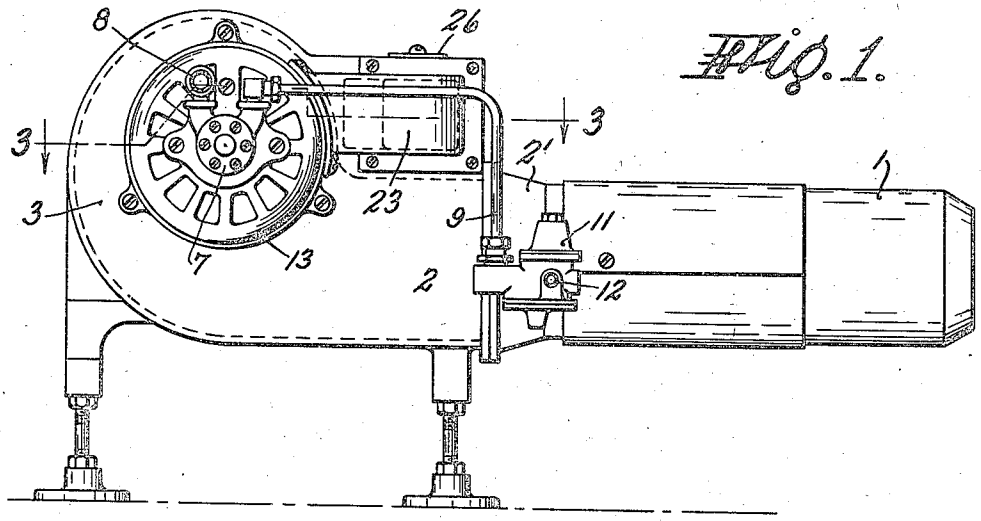


Fig. 2.

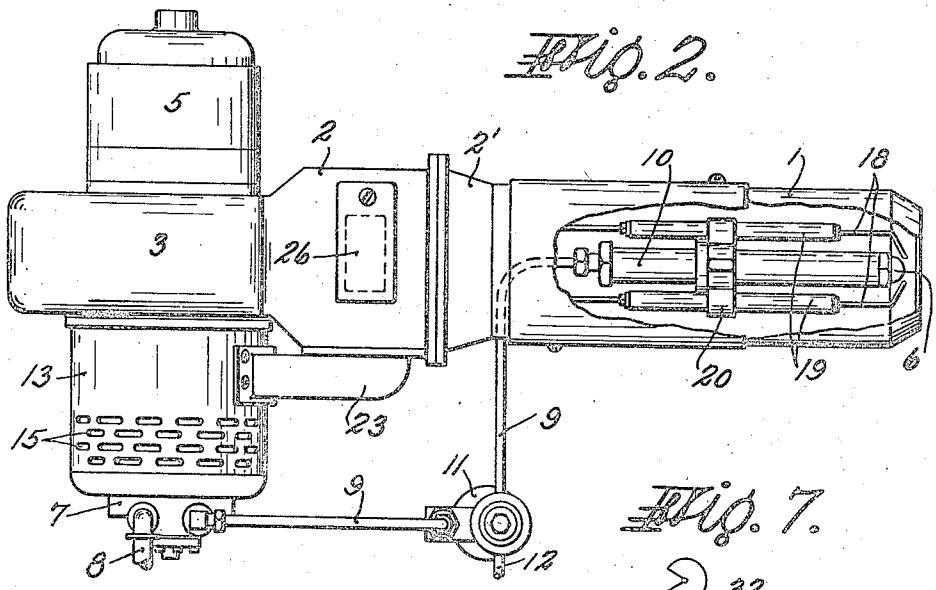


Fig. 6.

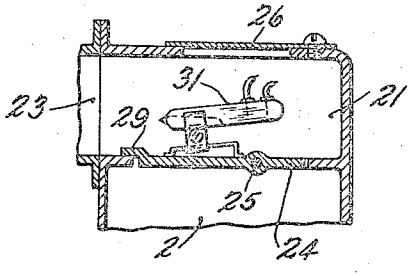
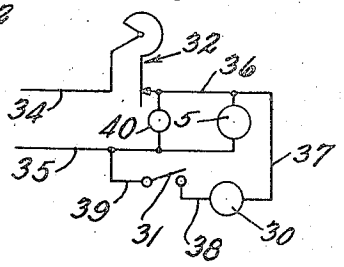


Fig. 7.



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Fig. 3.

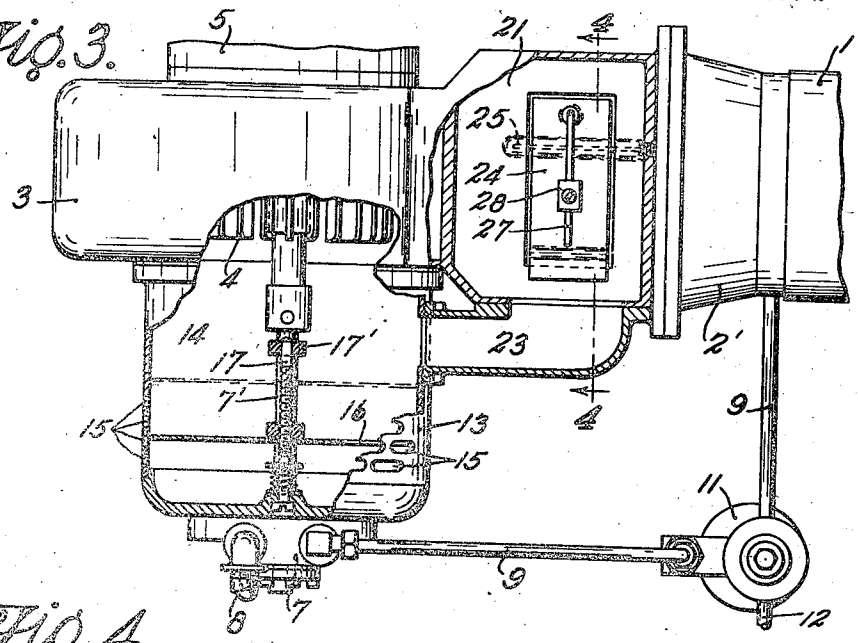


Fig. 4.

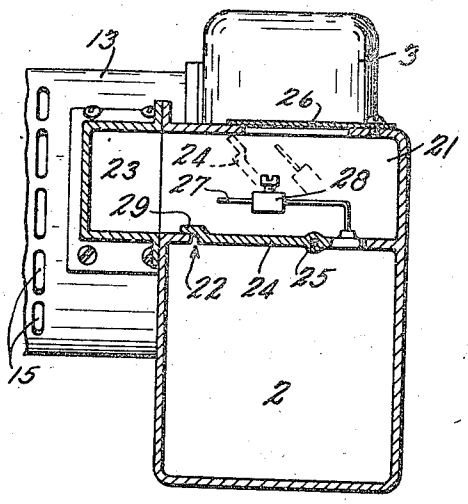
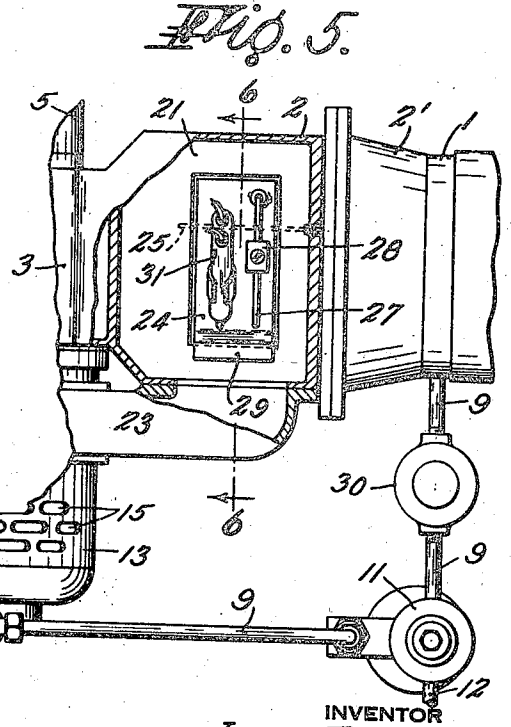


Fig. 5.



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UNITED STATES PATENT OFFICE

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OIL BURNER

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Application June 19, 1944, Serial No. 540,957

2 Claims. (Cl. 158—28)

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This invention relates to improvements in oil burners of the so-called gun type, such as are adapted for use in residential heating and are started and stopped many times each day during the heating season.

A gun type burner utilizes a so-called mechanical or pressure-atomizing nozzle, located near the outlet end of a tube, through which the air for combustion is supplied by a fan, usually driven by an electric motor. The oil is supplied by a pump, also driven by the motor. Oil is admitted under the control of a cut-off valve to the nozzle only after it has been placed under a predetermined minimum pressure sufficient for atomization. This pump is positive in action. Furthermore, it usually has a capacity in excess of normal requirements for combustion and excess oil is bypassed after a certain predetermined maximum pressure has been reached. The fan, however, is not positive in action. Consequently, when the burner motor is started, the pump will place the oil under atomizing pressure before the fan has established flow of air at proper pressure and velocity at the outlet end of the air tube. Poor combustion results and the smoky flame deposits soot in the combustion chamber and passes of the boiler. On stopping of the burner motor, the air flow drops off rapidly and before the cut-off valve closes, the rate of flow of air at the nozzle is too low for the proper combustion.

This invention has for its general object the provision of means for improving combustion conditions during the starting and stopping intervals of operation of a burner of the class described.

The invention has for one particular object to provide in a burner of the class described, means whereby flow of air at the desired pressure and velocity is established at the burner nozzle at an earlier time in the starting period and sustained for a longer time in the stopping period than has heretofore been possible in an ordinary gun type burner.

According to this feature of the invention, a by-pass is provided from the outlet of the fan together with a damper to control the by-pass and the damper is arranged to open when the air supplied to the tube attains the required pressure and velocity. The shutter or air valve associated either with the inlet or outlet of the fan is adjusted to admit to the tube all the air that is needed for combustion when the fan is revolving at some speed less than its normal full speed, say for example, three-quarters speed. The damper is set to open at the required static pressure.

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Accordingly, when the burner motor is started, the fan produces the desired flow of air at an earlier time in the starting period than heretofore and, after the selected predetermined speed has been exceeded, the damper opens and by-passes excess air, maintaining the pressure and velocity of the air supplied to the tube constant. Also, during the stopping interval of the burner the flow of air is maintained for a longer interval. As the fan slows down, the damper moves toward closed position and the air flow to the combustion tube is maintained at the proper pressure and velocity for a substantial part of the stopping interval. By fixing the predetermined speed, at which the damper opens and closes, to correspond with that at which the oil cut-off valve opens and closes, good combustion conditions can be had during the starting and stopping intervals.

As a desirable additional feature, the invention provides an oil control valve, such as an electromagnetically operated valve, connected so as to open only when the damper in the air by-pass opens and to close coincidentally with the cutting off of current from the driving motor. This oil control valve insures that, on starting up the burner, oil cannot be admitted to the nozzle of the burner until air at proper pressure and velocity is being supplied to the burner nozzle and that, on stopping the burner, oil flow to the nozzle will be cut off before the pressure and velocity of the air supplied to the combustion tube decreases below the desired values.

The invention will be disclosed with reference to the accompanying drawings in which—

Figs. 1 and 2 are small-scale side elevational and top plan views respectively of an oil burner embodying the invention;

Fig. 3 is a fragmentary sectional plan view taken on the line 3—3 of Fig. 1 and drawn to a larger scale;

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a view taken similarly to Fig. 3 and showing a modification of the invention;

Fig. 6 is a cross sectional view taken on the line 6—6 of Fig. 5; and

Fig. 7 is a diagram showing electrical connections used with the form of burner shown in Fig. 5.

Referring to these drawings; the invention is shown, by way of illustrative example, in connection with a so-called gun-type oil burner of well known form. The combustion tube is shown at 1 (Figs. 1 and 2), fixed to the outlet end 2 of a fan housing 3, in which is rotatably mounted a fan 4, driven by an electric motor 5. As shown, the

outlet 2 is square in cross section and it is connected to the cylindrical tube 1 by a section 2', which changes from square to circular cross section. The parts 1, 2' and 2 provide an air-supply conduit communicating with the discharge opening of the fan housing. In the outlet end of the air tube 1 there is located a suitable nozzle 6 (Fig. 2), such as a pressure-atomizing nozzle for example, to which oil is supplied by a pump 7, connected by a shaft 7' to the fan and thus also driven by motor 5. The suction pipe for the pump is shown at 8. The outlet of the pump is connected by piping 9 to the nozzle support 10 and thus to nozzle 6. Interposed in this piping is a unit 11 containing a cut-off valve and a by-pass valve of usual or any suitable form. The cut-off valve closes the outlet to the burner nozzle 6 until the oil has reached a predetermined minimum pressure and the by-pass valve subsequently by-passes oil by way of a pipe 12, to any suitable point, such as the tank or the suction side of pump 7, whenever the oil reaches a predetermined maximum pressure.

The adjustment for varying the volume of air entering tube 1 from the fan may be effected in any suitable way and on the discharge as well as on the intake side of the fan. In this particular case, the adjustment is on the intake side. Fixed to one side of the fan housing is a casing 13 affording a chamber 14 in communication with the inlet side of the fan. Openings 15 provide for communication of the chamber 14 with the atmosphere. A valve or damper 16 is mounted for adjustment axially of shaft 7' on which it is slidable, and controls the amount of air that can enter chamber 14 by way of openings 15 to the fan. As shown, the hub of the damper is threaded on a screw 17, having its outer end rotatably mounted in the end of casing 13 and its inner end similarly mounted in a lug 17', depending from the top of the casing 13. The screw is held against axial movement, as indicated in Fig. 3.

The oil is ignited by spark electrodes 18, mounted in insulators 19, in a member 20 which also supports the member 10 and nozzle 6 from tube 1.

This invention provides for a second and venting outlet for the air-supply conduit. Conveniently, this venting outlet may connect with the intake side of the fan, thereby providing a by-pass but this is not essential. The fan housing is constructed to provide a chamber 21 above the outlet 2 and an opening 22 by means of which communication between the outlet 2 and chamber 21 may be established. The chamber 21 is connected by a tube 23 to the inlet chamber 14 at a location between the fan inlet and the innermost position which damper 16 is likely to assume. Controlling the opening 22 is a valve or damper 24 mounted on a pivot 25 located off center as shown. A removable cover 26 provides access to the chamber 23. Fixed to the damper is an arm 27 on which is adjustably mounted a weight 28, tending to hold the damper closed. A lug 29 on one end of the damper cooperates with the base wall of chamber 21 as a stop to prevent counter-clockwise movement (as viewed in Fig. 4) beyond the closed position shown.

The damper or air inlet valve 16 is adjusted to admit all the air that is required for combustion while the fan is revolving at some predetermined speed less than its normal and full speed, such for example as three-quarters speed. The weight 28 is adjusted so that the damper 24 will open after the desired predetermined static pressure of the air in the combustion tube has been attained. When the fan is revolving at full speed it would supply air at a greater rate of flow than is needed except for the by-pass valve or damper 24 which opens as much as is required to maintain the pressure and velocity of the air in tube 1 substantially constant at the desired values. In this way, it is insured that air will be flowing through the tube 1 past the burner nozzle at the desired rate after the motor reaches the selected predetermined speed and thereafter during the remainder of the starting interval, as well as during the normal running interval and during the initial part of the stopping interval. According to former practice, maximum air flow was not reached until the fan attained full speed. With the present invention maximum air flow is secured when the fan reaches 75% of its normal speed and, of course, an even lower speed may be selected, if desired. The object is to get full air flow at or about the time that the oil cut-off valve opens and allows nozzle 6 to emit a spray of atomized oil. The particular speed at which damper 24 opens is a matter of choice, and may be varied as is necessary or desired.

As an added feature of refinement to secure and insure closer coordination between proper oil flow and air flow, a valve 30 is interposed in the oil piping 9 between the cut-off valve and nozzle 6 and is suitably arranged to prevent flow of oil to nozzle 6 until the proper flow of air has been established during the starting interval of operation of the burner and before the air flow drops below the desired rate during the stopping interval of operation of the burner. The valve may for example, be a solenoid valve opening only when the solenoid is energized and remaining open for so long as the solenoid remains energized. The damper 24 may serve, as indicated, to move a mercury tube switch 31 from open to closed position as the damper opens and from closed to open position as the damper closes. The electric circuits are indicated in Fig. 7. The burner motor 5 and the ignition means 40 are connected in parallel in a circuit including the wires 35 and 36. The room thermostat switch 32 is interposed between the wires 34 and 36. The wires 34 and 35 are adapted for connection to a suitable source of electricity. The solenoid valve 30 is in a series circuit which comprises the wires 37, 38 and 39 and is shunted across the wires 35 and 36. The room thermostat switch starts and stops the burner motor in the usual way. Energization of the burner motor will start the pump and fan but, irrespective of when the pump builds up the necessary oil pressure, there will be no emission of oil from nozzle 6 unless and until flow of air at the proper pressure and velocity, and thus at the proper rate, has been established in tube 1. Then, and then only, will damper 24 open. The closing of switch 31 and the opening of oil valve 30 is conditioned on the opening of damper 24. When the burner motor is deenergized, the oil valve 30 will immediately close and cut off the flow of oil to the nozzle before the air flow decreases at all. The continuance of air flow after oil flow is an advantage because of the scavenging effect.

The control of the oil flow by means coordinated with the by-pass valve 24 may be accomplished in any other suitable way and need not necessarily be confined to the use of a solenoid valve located as shown. The important thing is to prevent the oil from issuing from the nozzle except at such times as air at proper pressure and velocity is available at the outlet of tube 1.

It will thus be seen that the invention provides for the improvement of combustion conditions during the starting and stopping intervals of operation of a burner of the type described. With the use of the oil valve, the desired results may be insured so that combustion cannot occur except when there is both a proper flow of air and a proper flow of oil. The burner may be adjusted for a higher CO_2 reading, and thus for materially increased efficiency, when the improvements of this invention are used.

It should also be noted that the coordinated control of oil and air offers insurance against operation of the burner under any conditions which cause less than the normal supply of air. If the air openings **15** become stuffed up with dirt, lint or anything else, or if for any other reason, air at the desired rate cannot be supplied to the combustion tube, then the oil valve **30** will remain closed and prevent combustion.

I claim:

1. In an oil burner, a casing providing a fan housing having intake and discharge openings and a conduit communicating at one end with said discharge opening and having an outlet at its other end, a fan in said housing between said openings, an oil-atomizing nozzle in said conduit, an oil pump connected to supply oil to said nozzle, a motor for driving the fan and pump, said conduit having a second and venting outlet located between the fan and nozzle, a valve for the second outlet for opening and closing the same, and a valve for one of said openings adjustable to vary inflow of air to said conduit and adjusted to admit all the air required for combustion when the fan is revolving at a predetermined speed less than its normal speed and the first-named valve is closed, said first-named valve closing and opening automatically accordingly as the fan revolves below or above said predetermined speed respectively.

2. In an oil burner, a casing providing a fan housing having intake and discharge openings and a conduit communicating at one end with said discharge opening and having an outlet at its other end, a fan in said housing between said openings, an oil-atomizing nozzle in said conduit, an oil pump connected to supply oil to said nozzle, a motor for driving the fan and pump, said conduit having a second and venting outlet located between the fan and nozzle, a valve for the second outlet for opening and closing the same, a valve for one of said openings adjustable to vary inflow of air to said conduit and adjusted to admit all the air required for combustion when the fan is revolving at a predetermined speed less than its normal speed and the first-named valve is closed, and adjustable means for holding the first-named valve closed until the air reaches a predetermined pressure.

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