

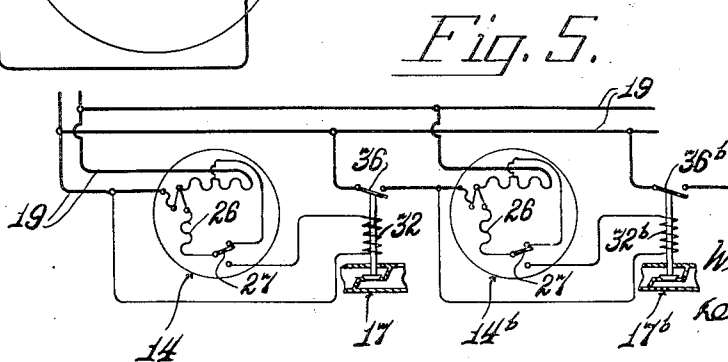
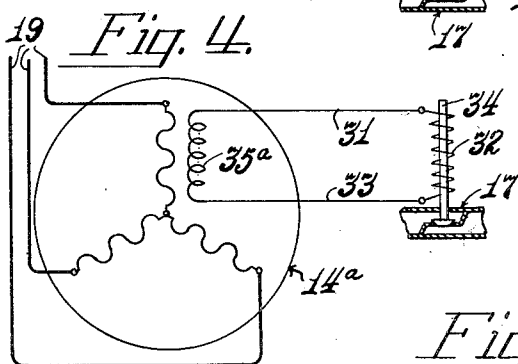
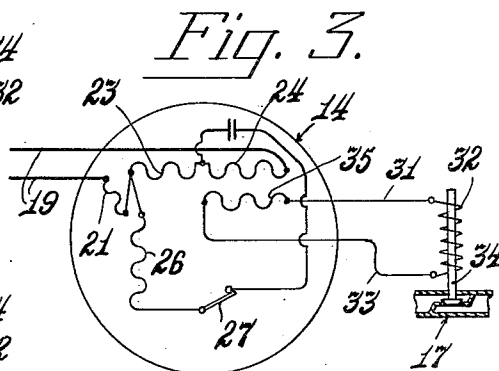
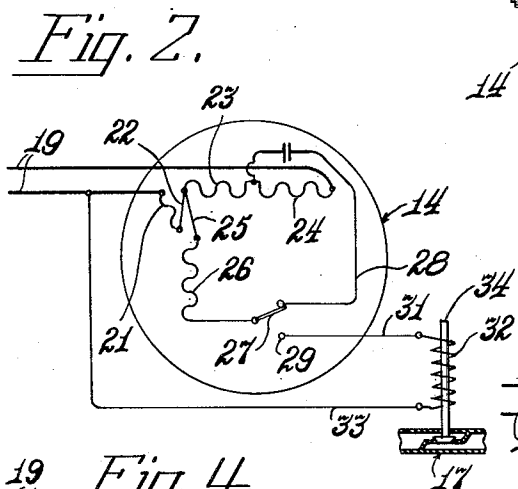
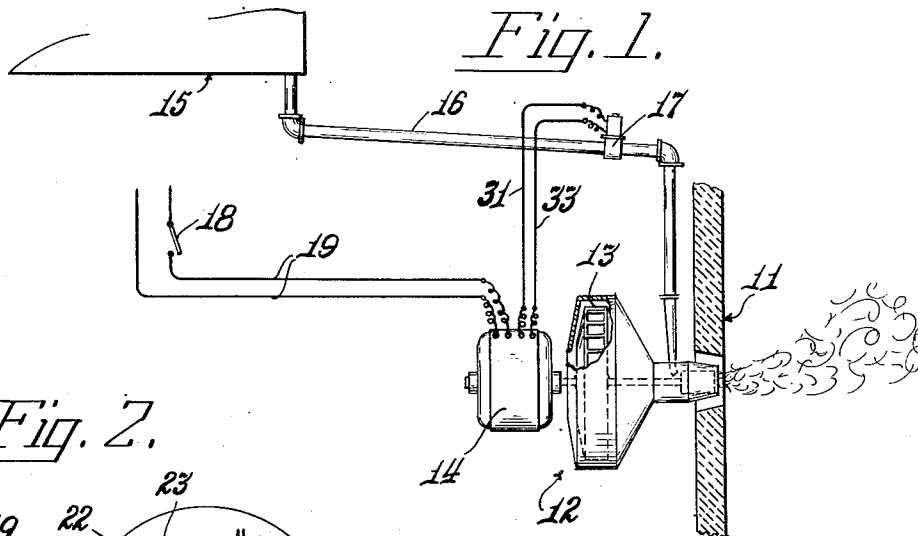
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VALVE CONTROL SYSTEM

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VALVE CONTROL SYSTEM

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3 Claims. (Cl. 158—28)

The invention relates to control systems and more particularly to electrical means to control, automatically, the delivery of fuel to a burner apparatus.

Safe, efficient and economical operation of a gas, oil or coal fired burner apparatus requires that fuel delivered to the burner be mixed properly with air and atomized to insure complete combustion and avoid costly and often dangerous flooding of the fire box with resultant blowing or backfiring and the undesirable accumulation of excessive carbon residue on the burner or within the combustion chamber.

Force feed liquid fuel burners frequently are equipped with pump or valve control means including an air pressure actuated switch operable to initiate and stop delivery of fuel to the burner. At best, such means is very unsatisfactory, due primarily, to different volume and air pressure requirements of different installations and different grades of fuel. In small installations, air pressure often is insufficient to attract the switch. Another objection to air switches is the well established fact that, frequently, such devices fail because of mechanical defects or tampering. Substantially the same objections prevail in burner control systems wherein the fuel delivery is dependent solely upon operation of a centrifugal switch.

The present invention is concerned with the opening of the fuel delivery line after the blower motor has reached its maximum speed and the immediate closing of said line should the motor not only be shut down but even retarded momentarily due to jammed or seized bearings; momentary current failure, or other causes. It further distinguishes from known prior devices in that it includes no air pressure switches and functions wholly independent of any auxiliary burner control mechanism which may be employed to control operation of the whole burner system.

It is therefore, an object of the invention to provide a burner apparatus with an electrical fuel delivery control system which is operable solely upon operation of the burner blower motor at its maximum running speed.

Another object is to provide fuel delivery control means responsive to voltage generated in the blower motor of a burner apparatus.

Another object is to provide an auxiliary winding in an electric motor adapted to be impressed with a voltage generated while said motor is operating.

Another object is to provide electrical fuel de-

livery control means which may be installed in an individual or a multiple system of gas, oil or coal fired burners.

Another object is to provide an inexpensive, positively operating and efficient control for fuel delivery.

The foregoing and such other objects of the invention as will appear hereinafter as the description proceeds will be more readily understood from a perusal of the following specification, in which reference is made to the accompanying drawing; wherein:

Fig. 1 is a schematic view showing a liquid fuel burner installation embodying features of the invention.

Fig. 2 is a wiring diagram showing the fuel control system as incorporated in a single-phase motor.

Fig. 3 is a wiring diagram similar to Fig. 2, showing a modified motor construction.

Fig. 4 is a wiring diagram showing a fuel control system as incorporating a three-phase motor.

Fig. 5 is a diagrammatic view showing the improved fuel control system as incorporated in a bank burner system.

In all figures, like numerals indicate identical parts.

A simple exemplary arrangement of the various units making up one type of installation of an oil fired burner apparatus is illustrated in Fig. 1, in which 11 represents the heating plant or combustion chamber and 12 a conventional liquid fuel burner. The burner illustrated includes a blower 13 operated by a motor 14. Liquid fuel is delivered by gravity to the burner from a reservoir 15 through a fuel line 16 having a control valve 17 therein.

A manually operable switch 18 is provided in one of the power lines 19 leading to the blower motor 14, but it is obvious that operation of said motor may be controlled automatically by conventional stack and room temperature control switches or other limiting or controlling devices, such as is illustrated in my co-pending application Serial No. 237,371, filed October 27, 1938, which may or may not operate in conjunction with a conventional electrically actuated pilot igniter (not shown).

However, the present invention concerns itself primarily with automatic control of the valve 17 so as to delay fuel delivery until the airflow within the burner reaches its required velocity and volume and to prevent delivery of fuel to said burner should the airflow fall or diminish, even momentarily. As illustrated, opening of the fuel

valve is wholly dependent upon operation of the blower motor 14, at its maximum rated speed. Accordingly, should any interruption occur in the operation of the blower motor due to any cause, such as for example, low voltage, jamming of blower, seized bearings, etc., however slight, the flow of fuel is instantly stopped. When the trouble is overcome and the blower again assumes its rated speed, fuel is again delivered. The specific means to accomplish positive control of fuel delivery may vary in different installations although the principle of operation remains the same in each instance.

As best illustrated in Fig. 2, a single-phase 220 volt blower motor 14 is shown. Referring specifically to the wiring commonly employed in a single-phase motor, said motor receives its energy through power lines 19. The current passes through safety fuse 21, lead 22 to running windings 23 and 24. It also flows through lead 25 to a starting winding 26, and out through a centrifugal switch 27 and lead 28 to a point midway between the running windings 23 and 24. Inclusion of the starting winding 26 is necessary to start the blower motor.

When the single-phase motor operates at its maximum rated speed to deliver the required volume and velocity of air to the burner, the centrifugal switch 27 actuates to cut the starting winding 26 out of the motor circuit and the motor continues to operate on the running windings 23 and 24. When the circuit through the starting winding is broken by actuation of switch 27, said winding is cut into an auxiliary closed circuit through said switch making contact at 29. Said auxiliary circuit includes a lead 31, the holding coil 32 of solenoid valve 17, and return lead 33.

Considerable voltage is generated during operation of the motor, which varies with the speed of said motor and this voltage is impressed upon starting winding 26 to energize the closed circuit. When the generated voltage impressed on winding 26 is sufficient to excite the holding coil 32, a flux is exerted upon the armature 34 and the solenoid valve 17 opens and fuel may flow to the burner. The solenoid holding coil 32 is so rated that it is not excited until the blower motor is running at its full speed and thus it generates the maximum amount of voltage. Hence, fuel is delivered to the burner only while the blower motor is operating to deliver the required volume of air to effect atomization of said fuel.

Immediately upon shutting down the burner, either manually, by opening switch 18, or through automatic operation of some electrical control mechanism, the generated voltage drops; the holding coil 32 is deenergized, and the solenoid valve 17 closes. In the case of momentary slowing down of the blower motor, for any cause, the generated voltage impressed on the starting winding 26 falls rapidly and said valve closes and remains closed until the motor again assumes full speed operation.

When the blower motor is shut down, the centrifugal switch 27 therein normally returns to its initial position, again positioning the starting winding in the circuit with the motor running windings. Should said switch 27 stick or lock in position against contact 29, the motor 14 cannot be restarted because the starting winding remains out of the motor circuit. Should current be supplied to the idle motor while said switch is stuck against contact 29, any induced voltage impressed on the starting winding is insufficient to excite the solenoid holding coil 32. Said holding coil can be

excited only by current generated during full speed operation of the motor. In this respect the present mechanism differs materially from at least one known electrical valve control system utilizing a centrifugal switch. In said system, current carried in the motor circuit will open the fuel valve while failing to start the idle blower motor, thus flooding may result from a jammed centrifugal switch.

Fig. 3 shows the wiring of a single-phase blower motor 14, similar to that illustrated in Fig. 2. In this instance the starting winding 26 is not connected in the solenoid holding coil circuit but instead, an auxiliary winding 35 is built into the motor whereby voltage generated during full speed operation of said motor and impressed on winding 35, flows through lines 31—33 to excite holding coil 32 and open the valve 17. This arrangement has the advantage of being entirely independent of actuation of the centrifugal switch 27.

Fig. 4 shows a circuit similar to that illustrated in Fig. 3, wherein an auxiliary winding 35a, built into a three-phase motor 14a, is impressed by generated voltage to actuate the solenoid valve 17 upon full speed operation of the motor.

The improved valve control system readily adapts itself to fuel control for a bank burner system wherein each burner progressively comes into operation and each has an independent fuel line and means to delay fuel delivery until full speed blower operation insures adequate air to atomize the fuel delivered.

Such a system is illustrated in Fig. 5, 14—14b indicating the blower motors and 17—17b the solenoid valves controlling fuel delivery to said burners. For the purpose of disclosure, the electrical system shown in Fig. 2 is illustrated, but it should be understood that the systems shown in Figs. 3 and 4 are equally adaptable.

As illustrated, full speed operation of blower motor 14 causes voltage generated therein to be impressed upon holding coil 32 of valve 17, thus exciting said coil and opening the valve to allow fuel delivery to the first burner. A switch 36 is operatively associated with the armature of coil 32 and is closed upon opening of the valve to close the line circuit to blower motor 14b. When the second blower motor 14b reaches its maximum operating speed, the current generated therein excites coil 32b of the solenoid valve 17b to open said valve and allow fuel delivery to the second burner. A switch 36b associated with solenoid valve 17b is actuated, when said valve opens, to close the line circuit to the blower motor of the succeeding burner, not shown. Obviously, the bank burner system can include any number of burner units, each controlled for progressive starting and delayed fuel delivery. Should any one burner fail, even momentarily, its fuel supply is shut off and the burners following in succession are shut down so that, upon restarting, they are again progressively placed in operation.

It should be self-evident that the system herein described in various adaptations is fool proof and more positive than mechanisms now known which often are dependent upon the extremely variable air pressure or unreliable mechanical devices. Also, small sized burners, such as those for domestic heating plants, have been found to have insufficient pressure to operate known types of air control switches efficiently and such switches, in burners of all sizes, are readily tampered with.

The improved control is, however, tamper

proof and cannot be locked in any position by the operator inasmuch as the windings of the blower motor and of the solenoid valve are rated and matched and cannot be altered.

5 Although exemplary arrangements incorporating the improved control unit are illustrated herein and described in detail, it is to be understood; that, the disclosures are illustrative and not restrictive; and that, certain variations can be made in the system as a whole and in the detail structures of the various parts, such as for example, substitution in a force feed system of a pump motor or a pump motor circuit switch for the valve 17, without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a burner apparatus, in combination, an electric blower motor including a starting winding, a circuit for said motor, a switch operable to close said circuit to operate said motor, a fuel supply line, a solenoid valve in said supply line, an open electric circuit connecting said solenoid valve to said starting winding, and means operative when said motor reaches a predetermined running speed to cut said starting winding out of the motor circuit and into said open circuit, whereby said solenoid is excited by generated voltage impressed on said starting winding during full speed operation of said motor.

2. In a control system for a multiple fired heating plant comprising a plurality of burners each including a motor to operate a blower and a fuel

delivery line, means to close a circuit to one of said motors, a solenoid valve in each fuel delivery line, means to impress a voltage generated upon full speed operation of said one motor to excite the solenoid to open the valve in the respective fuel line, a switch operable upon opening of said valve to close a circuit to a second motor, and means to impress a voltage generated upon full speed operation of said second motor to excite the solenoid to open the valve in the respective fuel line.

3. A control system for a multiple fired heating plant comprising a plurality of burners each including an electric motor to operate a blower and a fuel delivery line, a starting winding in each of said motors, means to close a circuit to one of said motors, a solenoid valve in each fuel delivery line, an open electric circuit connecting said solenoid valves one to the starting winding of each motor, a switch operative upon full speed operation of one of said motors to cut its starting winding out of the motor circuit and into the associated open circuit, means to impress a voltage generated upon full speed operation of said one motor to excite the solenoid to open the valve in the respective fuel line, a switch operable upon opening of said valves to close a circuit to a second motor, and means to impress a voltage generated upon full speed operation of said second motor to excite the solenoid to open the valve in the respective fuel lines.

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