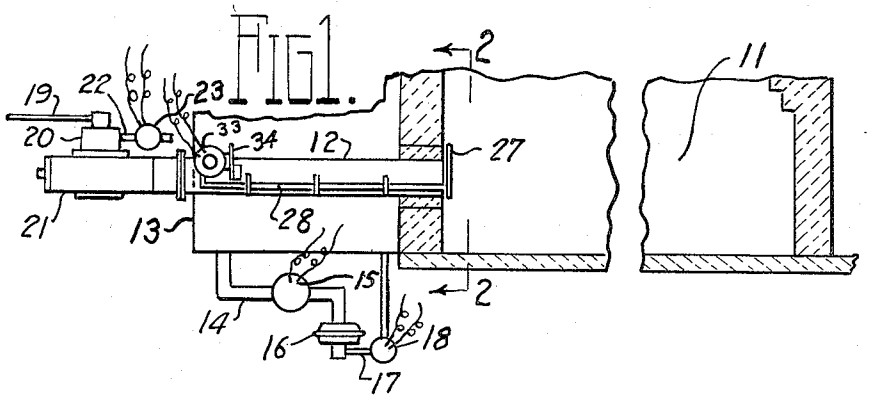
Aug. 14, 1956 G. C. BERGTHOLDT ET AL 2,758,637

CONTROL SYSTEM FOR FURNACE ALTERNATIVELY FIRED BY GAS AND OIL FUELS

Filed March 24, 1953 2 Sheets-Sheet 1

FIG. 1.



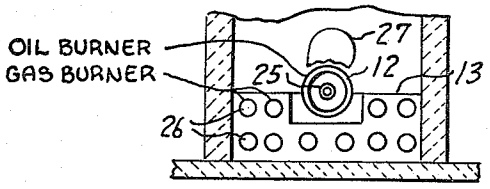


FIG. 2.

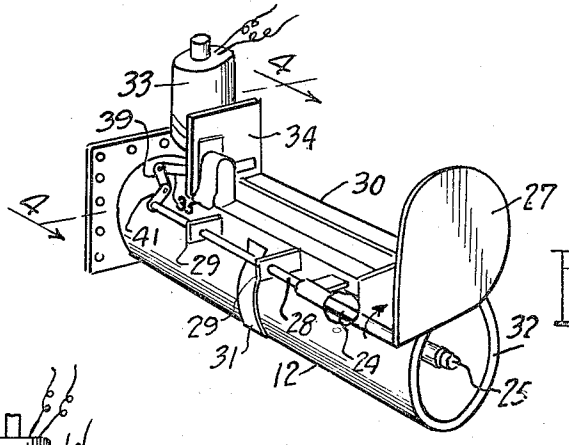


FIG. 3.

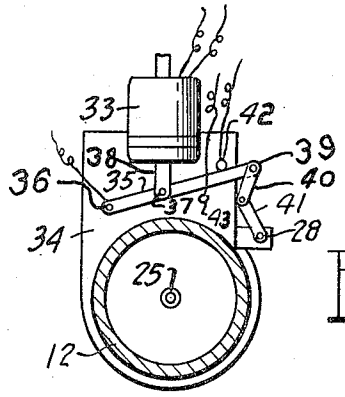


FIG. 4.

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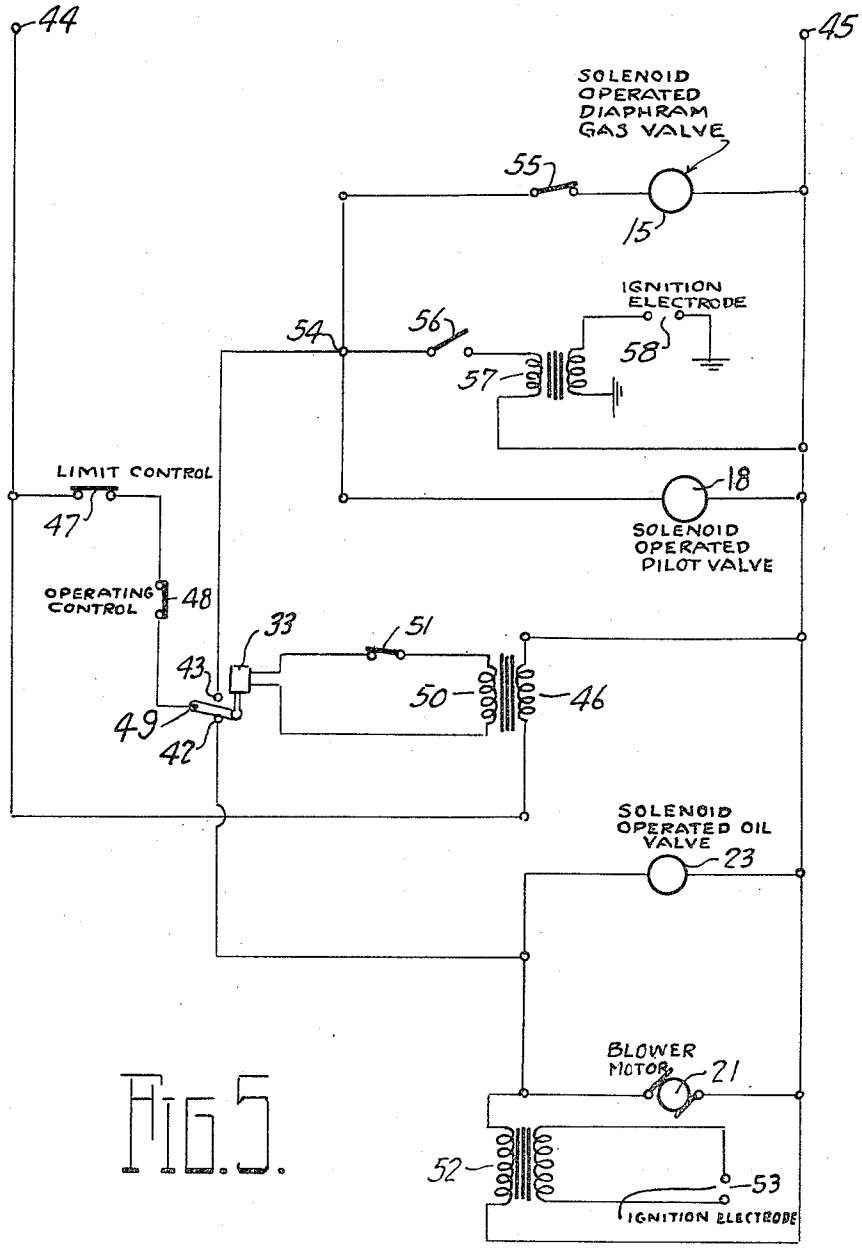


FIG. 5.

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CONTROL SYSTEM FOR FURNACE ALTERNATIVELY FIRED BY GAS AND OIL FUELS

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Application March 24, 1953, Serial No. 344,408

6 Claims. (Cl. 158—11)

This invention relates to a control system for a furnace alternatively fired by oil or gaseous fuel, and, more particularly, to a control system that prevents the build up of carbonaceous material in an oil burner jet supplying oil fuel for combustion in a combustion chamber of such furnace.

In many areas gaseous fuels such as natural gas are appreciably less expensive than oil fuels, so that, from the cost standpoint, it is preferable to operate boilers, furnaces, and other heat-generating units on gaseous fuel. However, it is generally true that gas pressures in supply lines fluctuate substantially, and frequently, particularly during cold periods, are lower than the safe operating pressures for such gas burners. It has been suggested that furnaces, boilers, and other heat generating units be provided with gas burners to be fired when the gas pressure is sufficient to make such firing satisfactory, and also be provided with oil burners to be fired when the gas pressure is too low. However, oil burner jets are provided with a plurality of minute openings through which the oil fuel is atomized into a combustion chamber, and in which some oil clings when such a jet is not firing. In all such furnaces heretofore suggested the oil film clinging in these openings when firing of the oil burner is discontinued is carbonized during firing of the gas burners. After at most a few cycles of firing oil and gas the carbonaceous deposit builds up to such an extent that the oil burner jet can no longer be fired and must be removed from the furnace, boiler, or other heating unit and thoroughly cleaned. After a few such cleaning operations it is likely that the jet will be completely unusable because of damage to the small openings therein caused by such cleaning.

The present invention is based upon the discovery of a control system for use in furnaces designed for alternative firing on gas and oil, which control system has been found in practice completely to avoid the build up of carbonaceous material in the oil burner jet, and, hence, the need for periodic removal and cleaning thereof.

It is, therefore, an object of the invention to provide a control system for furnaces, boilers, and other heating units designed for alternative gas and oil firing.

Other objects and advantages of the present invention will be apparent from the description which follows, and from the accompanying drawings, in which:

Fig. 1 is a schematic representation, in plan view, partially in cross-section, of a furnace or boiler constructed to be fired alternatively by oil fuel or by gaseous fuel;

Fig. 2 is a vertical sectional view along the line 2—2 of Fig. 1;

Fig. 3 is a view in perspective of a portion of the control system of the invention;

Fig. 4 is a view in vertical section generally along the plane represented by the lines 4—4 in Fig. 3; and

Fig. 5 is a wiring diagram showing the control circuits involved in the control system of the invention.

According to the invention an improved control system for a furnace having a combustion chamber, at least one gas burner jet extending into the chamber for supplying gaseous fuel for combustion therein, and an oil burner jet extending into the chamber for supplying oil fuel for combustion therein is provided. The improved control system consists in the combination of a shield surrounding the oil burner jet and extending into the chamber, a baffle for the end of said shield, means mounting the baffle for movement between a first position shielding the open end of the shield, and a second position not obstructing the open end of the shield, means for moving the baffle into the first position, means for moving the baffle into the second position, and means for preventing the firing of the oil burner except when the baffle is supported in the second position.

Referring now more particularly to the drawings, a furnace, boiler, or other heat generating unit having a combustion chamber **11**, a shield **12** for an oil burner jet, and a housing **13** enclosing gas burners is represented schematically in Fig. 1. A gas supply line **14**, equipped with suitable regulating valves **15** and **16**, is provided for supplying gaseous fuel for combustion by the gas burner jets. A pilot line **17** supplies gas for a pilot (not illustrated) through a solenoid operated pilot valve **18**. An oil supply line **19** feeds oil fuel to a pump **20** driven by a blower motor **21**. Oil is pumped from the pump **20** through a conduit **22**, a solenoid controlled valve **23**, and a tube **24** (Fig. 3) inside the shield **12** to an oil burner jet **25**. The relative positions of the gas burner jets, which are positioned in tubes **26**, and of the oil burner jet **25** can be seen in Fig. 2.

Mechanical details of the control system of the invention are shown in Figs. 3 and 4. The shield **12** surrounds the oil burner jet **25** and the tube **24**, forming a housing excluding the tubes **26**. A baffle **27** (see Fig. 3) is welded or otherwise rigidly attached to a shaft **28** journalled in bearings **29**, welded or otherwise attached to a supporting frame member **30** which is rigidly attached as by a strap **31** to the shield **12**. The baffle **27** is represented not obstructing an end **32** of the shield **12**. The baffle **27** is swingable upon partial rotation of the shaft **28** in the direction of the arrow into a position obstructing the end **32** of the shield **12**. In the specific embodiment of the invention illustrated, partial rotation of the shaft **28** is accomplished by limited vertical movement of a stalled motor **33** mounted on a plate **34** welded or otherwise rigidly attached to the frame member **30**. Movement of the stalled motor **33** is transmitted to the shaft **28** (see Fig. 4) through a lever **35** pinned at **36** to the plate **34**, pinned at **37** to the drive shaft **38** of the stalled motor, and at **39** to a connecting rod **40**. The connecting rod **40** is pinned to one end of an arm **41**, the other end of which is welded or otherwise rigidly attached to the shaft **28**. The vertical thrust of the drive shaft **38** of the stalled motor **33** is such that when the motor is energized the baffle **27** is raised to the position shown in Fig. 3, not obstructing the end **32** of the shield **12**. When the stalled motor **33** is not energized the drive shaft **38** moves downwardly a distance sufficient to permit the baffle **27** to drop into obstructing relationship with the end **32** of the shield **12**. In the specific embodiment of the invention illustrated, the baffle **27**, when positioned in such obstructing relationship is spaced about 1 inch from the end **32** of the shield **12**. An enabling switch schematically illustrated by contact **42** (Fig. 4) is activated by the lever **35** when the stalled motor **33** is energized, and a second enabling switch schematically illustrated by contact **43** is activated by the lever **35** when the stalled motor **33** is deenergized.

The essential features of a wiring diagram for operating the control system of the invention are shown in Fig. 5. A post **44** is attached to the energized side of an alter-

nating current source, and a post 45 is connected to the ground side of such alternating current source. Current flows continuously from the post 44 through a primary coil 46 of a voltage reducing transformer. Current can also pass from the post through a limit control 47 which is in the nature of a circuit breaker, and through an operating control 48 opened and closed by conventional control equipment (not illustrated). When the limit controls and the operating control are closed, as illustrated, current flows through them to a post 49, which constitutes a portion of the contacts 42 and 43, represented on the wiring diagram as parts of a single pole double throw switch. The stalled motor 33 is represented in Fig. 5 as energized by a circuit connected to a secondary 50 forming, with the primary 46, a transformer, and with a single throw single pole switch 51 closed to complete the circuit. This is the position illustrated in Figs. 3 and 4 of the drawings. In this position current flows from the post 49 through the contact 42 and energizes the solenoid operated oil valve 23 permitting oil to flow through such valve, through the blower motor 21 to drive a blower (not illustrated) which supplies combustion air for the oil burner 25 and also operates the pump 20 to provide oil for combustion to the burner 25, and to the primary coil of a transformer 52. The secondary coil of the transformer 52 is connected in closed circuit to an ignition electrode 53 which, in the diagram of Fig. 5, is illustrated as operating continuously.

When it is desired to change from oil fuel to gaseous fuel the single throw single pole switch 51 is opened, either manually, or automatically by control equipment (not illustrated), actuated, for example, by a sensing mechanism operated by the gas supply pressure. Opening the single throw single pole switch 51 de-energizes the stalled motor 33 and causes the shaft 38 to move vertically to the other limit of its travel. This movement of the shaft 38 (see Figs. 3 and 4), transmitted through the lever 35, the connecting rod 40, the arm 41, and the shaft 28, moves the baffle 27 into shielding or obstructing relationship with the end 32 of the shield 12, as discussed above. Movement of the lever 35 also opens the contact 42, and then closes the contact 43. When the contact 42 is opened, the solenoid operated oil valve 23, the blower motor 21 and the transformer 52 (Fig. 5) are de-energized.

When the contact 43 is closed current flows therefrom to a post 54, and thence through a normally closed pressure responsive switch 55 and the solenoid operated diaphragm gas valve 15, through a normally closed single throw single pole switch 56 to the primary of a transformer 57, and through the solenoid operated pilot valve 18. One side of the secondary coil of the transformer 57 is grounded, and the other is connected to one side of an ignition electrode 58, the other side of which electrode is grounded.

In operation, when the gas burners are being fired the switch 51 is open and the shield 27 is in its shielding or obstructing relationship with the end 32 of the shield 12, and protects the oil burner jet 25 from radiant heat in the combustion chamber 11. Normal vacuum drawn in the combustion chamber 11 by the gas flame draws air continuously through the blower (not illustrated) which supplies combustion air to the oil burner, and around the shield and positively cools the burner. It has been found in practice that no carbonaceous deposit builds up on the burner 25 even after long repeated operation first on gas and then on oil, in the apparatus of the invention. When the single throw single pole switch 51 is closed, the contact 43 is opened before the baffle 27 is opened, and before the contact 42 is closed. As soon as the baffle 27 reaches a position not obstructing the end 32 of the shield 12, the contact 42 is closed and firing of oil begins if the operating control 48 is closed.

It will be apparent that the apparatus of the invention could be modified so that the contact 43 was closed as soon as the contact 42 was opened, if desired. Various other changes and modifications can be made in the apparatus illustrated and described without departing from the spirit of the claims, as the embodiments of the invention shown and described are intended as illustrative only.

Having described the invention, we claim:

1. In a furnace having a combustion chamber, at least one gas burner jet extending into the chamber for supplying gaseous fuel for combustion therein, a gas-cycle electrical control circuit for regulating the operation of the gas burner, an oil burner jet extending into the chamber for supplying oil fuel for combustion therein, and an oil-cycle electrical control circuit for regulating the operation of the oil burner, the improvement consisting in the combination of a shield surrounding the oil burner jet and having an open end extending into the chamber, a baffle for the end of said shield, means mounting said baffle for movement between a first position obstructing the open end of said shield and a second position not obstructing the open end of said shield, means for moving said baffle into such first position, means for moving said baffle into such second position, gas switch means in the gas-cycle electrical control circuit having an open position breaking such circuit and a closed position enabling the energizing of such circuit, oil switch means in the oil-cycle electrical control circuit having an open position breaking such circuit and a closed position enabling the energizing of such circuit, means to retain said gas switch means in such open position except when said baffle is in such first position, and means to retain said oil switch means in such open position except when said baffle is in such second position.

2. In a furnace having a combustion chamber, at least one gas burner jet extending into the chamber for supplying gaseous fuel for combustion in the combustion chamber, a gas-cycle electrical control circuit for regulating the operation of the gas burner, an oil burner jet extending into the chamber for supplying oil fuel for combustion in the combustion chamber, and an oil-cycle electrical control circuit for regulating the operation of the oil burner, the improvement consisting in the combination of a shield surrounding the oil burner jet and having an open end extending into the chamber, a baffle for the end of said shield, means mounting said baffle for movement between a first position obstructing the open end of said shield and a second position not obstructing the open end of said shield, means for moving said baffle into such first position, means for moving said baffle into such second position, a single pole double throw enabling switch having a first position breaking the gas-cycle electrical control circuit and enabling the energizing of the oil-cycle electrical control circuit, and a second position breaking the oil-cycle electrical control circuit and enabling the energizing of the gas-cycle electrical control circuit, and means to retain said single throw double pole switch in such second position except when said baffle is in such second position.

3. In a furnace having a combustion chamber, at least one gas burner jet extending into the chamber for supplying gaseous fuel for combustion therein, a gas-cycle electrical control circuit for regulating the operation of the gas burner jet, an oil burner jet extending into the chamber for supplying oil fuel for combustion therein, and an oil-cycle electrical control circuit for regulating the operation of the oil burner jet, the improvement consisting in the combination of a shield surrounding the oil burner jet and having an open end extending into the chamber, a baffle for the end of said shield, means mounting said baffle for movement between a first position obstructing the open end of said shield and a second position not obstructing the open end of said shield, means for moving said baffle into such first position, means for moving said baffle into such second position, a single pole double throw enabling switch having a first position

breaking the gas-cycle electrical control circuit and enabling the energizing of the oil-cycle electrical control circuit, a second position breaking the oil-cycle electrical control circuit and breaking the gas-cycle electrical control circuit, and a third position breaking the oil-cycle electrical control circuit and enabling the energizing of the gas-cycle electrical control circuit, means to retain said single throw double pole switch in such first position when said baffle is in such second position, means to retain said single throw double pole switch in such third position when said baffle is in said first position, and means to retain said single throw double pole switch in said second position when said baffle is intermediate between such first position and such second position.

4. In a furnace having a combustion chamber, at least one gas burner jet extending into the chamber for supplying gaseous fuel for combustion therein, a gas-cycle electrical control circuit for regulating the operation of the gas burner jet, an oil burner jet extending into the chamber for supplying oil fuel for combustion therein, and an oil-cycle electrical control circuit for regulating the operation of the oil burner jet, the improvement consisting in the combination of a shield surrounding the oil burner jet and having an open end extending into the chamber, a baffle for the end of said shield, means mounting said baffle for movement between a first position obstructing the open end of said shield and a second position not obstructing the open end of said shield, means for moving said baffle into such first position, means for moving said baffle into such second position, a single pole, double throw enabling switch having a first position breaking the gas-cycle electrical control circuit and enabling the energizing of the oil-cycle electrical control circuit and a second position breaking the oil-cycle electrical control circuit and enabling the energizing of the gas-cycle electrical control circuit, means to retain said single pole, double throw switch in such first position except when said baffle is in such first position, and means to retain said single pole double throw switch in such second position except when said baffle is in such second position.

5. In a furnace having a combustion chamber, at least one gas burner jet extending into the chamber for supplying gaseous fuel for combustion therein, gas control means for controlling the operation of the gas burner jet, an oil burner jet extending into the chamber for supplying oil fuel for combustion therein, and oil control means for controlling the operation of the oil burner jet, the improvement consisting in the combination of a shield surrounding the oil burner jet and having an open end extending into the chamber, a baffle for the end of said

shield, means mounting said baffle for movement between a first position obstructing the open end of said shield and a second position not obstructing the open end of said shield, baffle moving means for moving said baffle into such first position and for moving said baffle into such second position, and baffle control means for selectively energizing the baffle moving means to move the baffle alternatively to such first position or such second position, said gas control means being responsive to the position of said baffle to prevent firing of the gas burner jet when said baffle is in such second position, and such oil control means being responsive to the position of said baffle to prevent firing of the oil burner jet when said baffle is in such first position.

6. In a furnace having a combustion chamber, at least one gas burner jet extending into the chamber for supplying gaseous fuel for combustion therein, a gas-cycle electrical control circuit for regulating the operation of the gas burner, an oil burner jet extending into the chamber for supplying oil fuel for combustion therein, and an oil cycle electrical control circuit for regulating the operation of the oil burner, the improvement consisting in the combination of a shield surrounding the oil burner jet having an open end extending into the chamber, a combustion air blower connected to the shield to deliver air therethrough to the chamber to support combustion of the oil fuel and subject to control of the oil-cycle electrical control circuit, a baffle for the end of said shield, means mounting said baffle for movement between a first position obstructing the open end of said shield and spaced therefrom to allow flow of air between said open end and said baffle under the influence of draft from the chamber and a second position not obstructing the open end of said shield, means for moving said baffle into such second position, gas switch means in the gas-cycle electrical control circuit having an open positon breaking such circuit and a closed position enabling the energizing of such circuit, oil switch means in the oil-cycle electrical control circuit having an open position breaking such circuit and a closed position enabling the energizing of such circuit, means to retain said gas switch means in the open position except when said baffle is in such first position, and means to retain said oil switch means in such open position except when said baffle is in such second position.

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