United States Patent

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[15] **3,669,041**

[45] **June 13, 1972**

[54] DOUBLE COMBUSTION FIRING

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[22] Filed: **June 1, 1970**

[21] Appl. No.: **42,066**

[30] **Foreign Application Priority Data**

May 29, 1969 Switzerland 8114/69

[52] **U.S. Cl.**.....**110/18,** 110/10

[51] **Int. Cl.**.....**F23g 5/12**

[58] **Field of Search** .....110/18, 18 C, 18 A, 10; 122/2

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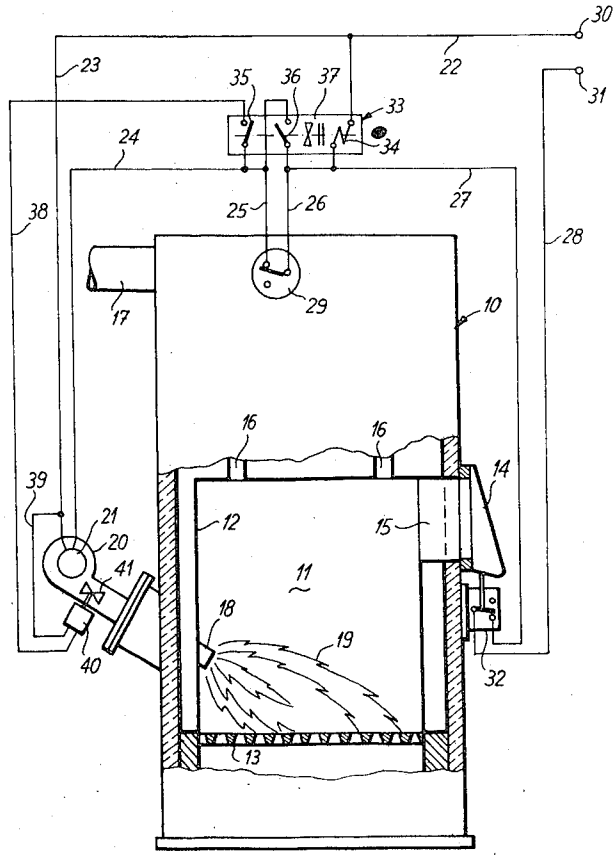
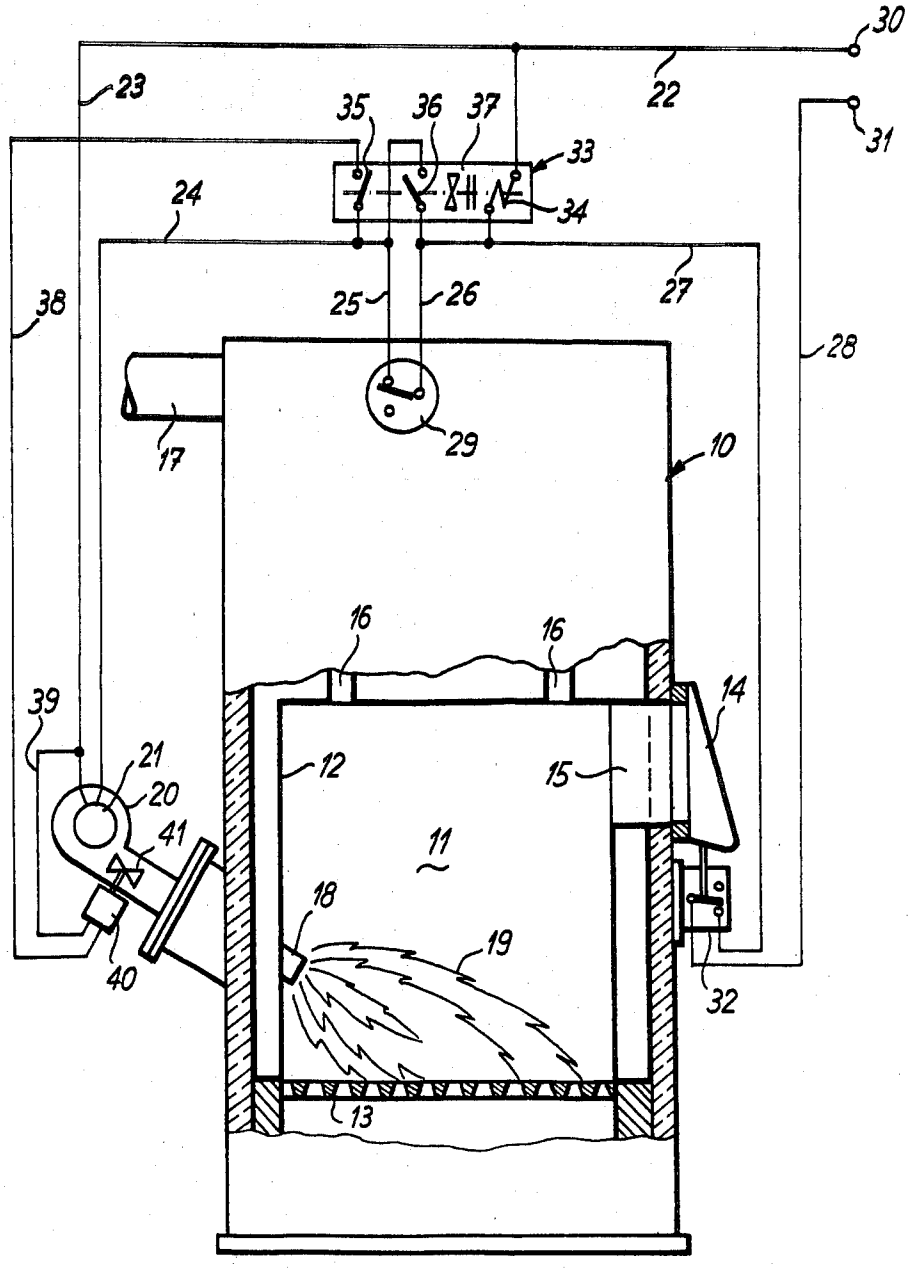
[57] **ABSTRACT**

A double combustion firing for solid and gaseous liquid fuels having a single fire chamber with a burner nozzle directed downwards toward a grate for the support of the solid fuels and having a feed opening for the solid fuels and means connected to the burner for switching on and off from a control circuit operable by the door in the chamber with a control circuit for the burner connected so that when the door of the fire chamber is open the burner will be shut off.

5 Claims, 1 Drawing Figure





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DOUBLE COMBUSTION FIRING

This invention relates to a double combustion firing for solid and for gaseous or liquid fuels.

In a known manner, the double combustion firing has one fire chamber which is limited downwards by a grate for the reception of the solid fuels and a feed opening provided with a door for the solid fuels. Furthermore a burner for the gaseous or liquid fuel discharges into the firing chamber whereby the burner can be switched on and off by means of a control circuit and has been arranged in such a manner that its flame is pointed toward the grate.

A proposal has already been made to use such a double combustion firing also for the burning of kitchen or household refuse, throwing this waste just like other solid fuels, through the feed openings onto the grate of the firing chamber and igniting it subsequently with the aid of the burner and thus to incinerate it. Now however in the case of normal operation of the firing with gaseous or liquid fuel, the switching on and off of the burner is regulated by one or several thermostat switches which react for example to the temperature of a water boiler heated by the furnace to the outside temperature or to the temperature of the waste gases. If, therefore, the solid material thrown into the fire chamber is to be incinerated with the aid of the burner, then in most cases special measures are required in order to be able to place the burner into operation regardless of the pertinent state of the thermostat switch. For this purpose one must, for example, adjust the thermostat switch and then one must wait for the combination of the material thrown into the fire chamber and and subsequently one must reverse the measures taken for starting the burner, for example the thermostat switch which had been adjusted must be put back into its original normal position. If the latter step is neglected, then the otherwise customary fully automatic control of the burner, dependent on the temperature, will be disturbed and as a result overheating and other damage heating occur. If, on the other hand, the ignition and incineration of the above mentioned material, after the material to be incinerated has been thrown into the fire chamber, is left to the switching on of the burner in accordance with its fully automatic, temperature-dependent control, then it may happen that the material thrown in may remain lying there for a relatively long time without its being burned or that it will be destroyed incompletely in the case of a relatively short switching-on period of the burner. This will be the case, for example, whenever the firing heats a central heating boiler and when a relatively high outside temperature prevails. The refuse lying there or the incomplete burning of the material on the grate of the fire chamber is particularly undesirable whenever dealing with kitchen or household refuse, because in that case bad odors and possibly gases harmful to health, can develop.

One must also consider that it can be dangerous to throw combustible material or refuse into the fire chamber whenever the burner just happens to be in operation. For one thing, in that case, sudden explosion-like combustion or detonations may occur, which will frighten the individual throwing in the material or can endanger him. Furthermore, gases harmful to health or smoke may develop and might escape from the feed opening.

A further object of the invention resides in the prevention of the drawbacks described. Accordingly, it is the object of the invention to improve a double combustion firing of the initially mentioned type in such a way that the burner will be placed in operation automatically during a certain period of time each time after material has been thrown into the firing chamber and that the throwing in of the material is possible only when the burner is switched off.

This object has been solved in the case of a burner of the initially described type according to the invention mainly by the fact that, in the control circuit for the burner, a switch has been disposed which can be operated by the door of the feed opening in such a manner that it will place the burner out of operation when the door is open and will place the burner into

operation for a predetermined period of time by means of a time relay after each closing of the door and regardless of whether the burner was or was not in operation prior to the opening of the door.

In case one or several thermostat switches are arranged in the control circuit of the burner, the construction may effectively be such that the time relay will bridge the one or several thermostat switches during the predetermined period of time after each closing of the door of the feed opening. The predetermined period of time mentioned may amount to between 5 and 15 minutes, preferably 10 minutes.

Another problem in the case of the practical operation of a double combustion firing consists in the supply of sufficient combustion air for the solid material that is to be burned, whenever the latter is to be ignited with the aid of the burner and incinerated. For economical reasons, oil and gas burners and the blowers assigned to them are regulated such that the blower will supply just the necessary quantity of combustion air needed by the burner with the least possible surplus. This leads to the fact that, upon burning of solid materials with the aid of the burner, too little oxygen is available, which is followed by an undesirable development of smoke and formation of soot.

In order to avoid this drawback provision has been made in the case of an effective design of the double combustion firing according to the invention, that an element, controlling the supply of fuel or air for the burner, has been connected with the time relay in such a way that it will operate the burner after every closing of the door of the feed opening and during a predetermined period of time with a considerable surplus of air. Preferably, in that case, the surplus of air amounts to about 100 percent.

The special characteristics and further details of the invention and their advantages will become clear from the claims, from the description of a design given by way of example, which will now follow, and from the pertinent drawing in which one design of a boiler equipped with a double combustion firing according to the invention has been shown schematically purely by way of example.

The one FIGURE of the drawing shows the boiler partly in side view and partly in vertical section showing the firing, whereby the electric circuit diagram of the control arrangement for the boiler has been also indicated.

The boiler **10**, shown in the drawing, has been provided with a double combustion firing means **11**. The latter shows a single firing chamber **12** which is limited downwards by a grate **13** for the support of solid fuels. The firing chamber **12** has a feed opening **15** for the solid fuels, provided with a door **14**. From the topside of the fire chamber **12**, pipes **16** for the flue gas lead to a ventilator or exhaust pipe **17** for the smoke, which has been attached to a chimney, not shown. A burner **18** for gaseous or liquid fuel discharges laterally into the fire chamber **12** and has been arranged in such a way that its flame **19** is directed toward the grate **13**. The burner **18** has a blower and fuel pump unit **20**, which can be driven by an electric motor **21**.

The burner **18** can be switched on and off in a known manner by means of an electric control circuit **22** to **28**, in which a thermostat switch **29** has been disposed which brings about an automatic temperature-dependent control of the burner **18**. The thermostat switch **29** may, for example, respond to the boiler temperature or the flue gas temperature in the flue gas ventilator or outlet **17**. Whenever the boiler **10** is part of a central heating system, the thermostat switch **29** may then however respond to the room temperature or the outside temperature. Possibly, several thermostat switches may be available which individually react to various temperatures. The control circuit **22** to **28** has two terminals **30** and **31**, which must be connected to a current supply source, not shown.

In the control circuit **22** to **28**, which has been mentioned, a switch **32** has been inserted between the branch lines **27** and **28**, which can be operated by the door **14** of the feed opening

15, and to be sure, in such a way that upon opening of the door 14, the switch 32 will be automatically opened and as a result thereof, the connection between the branch lines 27 and 28 of the control circuit 22 to 28 will be interrupted. This means that in the case of each opening of the door 14, the burner 18 is switched off automatically whenever it was in operation immediately preceding such opening.

Furthermore, a time relay 33 can be utilized in the control circuit 22 to 28, which has an energizer coil 34, a rest contact 35, an operating contact 36 and an adjustable delay device 37. The latter has been provided such that the contacts 35 and 36 are operated immediately upon energizing of coil 34 and then remain in operation during a predetermined period of time for 5 to 15 minutes, preferably about 10 minutes, after which they return automatically to their starting position. The exciting coil 34 is connected between the branches 22 and 27, so that the current flowing through the coil 34 is controlled by means of the switch 32. The operating contact 36 has been connected in parallel to the thermostat switch 29 in order to be able to bridge the latter. On the other hand, the rest contact 35 has been connected, on the one hand, to a branch line 24 leading to the motor 21 and, on the other hand, by means of a lead 38, to an electromagnet 40 and a lead 39 to the other branch 23 leading to the motor. The electromagnet 40 is connected to a valve 41, which influences the fuel supply for the burner 18 and to be sure such that the quantity of fuel fed to the burner per time unit is about twice as large as it is in the case of the de-energized magnet 40.

The method of use and operation of the firing and function of the boiler described is as follows:

If the firing system is operated exclusively with gaseous or liquid fuel, then the burner 18 is switched on and off automatically and cyclically dependent on the temperature, and in controlled dependence on the thermostat switch 29. The door 14 of the feed opening 15 in that case remains permanently closed, and contacts 35 and 36 of the time relay 33 are in the switching positions as shown. The circuit 38 and 39 of the electromagnet 40 is closed by means of the rest contact 35, so that each time burner 18 is switched on, the electromagnet 40 will also be energized and, as a result thereof, the valve 41 is opened. Therefore, the burner 18 will receive the full quantity of fuel each time it is switched on by means of the thermostat switch 29. At the same time, the air supply for the burner 18 has been adjusted in such a way that the burner will operate with only slight surplus of air.

If the door 14 of the feed opening 15 is opened, then the switch 32 is opened automatically and as a result thereof, the circuit 22 to 28 is interrupted, independently of the switching position assumed by the thermostat switch 29 at that moment. In case burner 18 was still in operation prior to the door 14 being opened, it will immediately be switched off when the door is opened and kept out of operation as long as the door 14 is open. Therefore in the case of an open door 14, solid fuels, for example also kitchen or household refuse, can be thrown in without danger, into the firing chamber 12 through the feed opening 15.

As soon as the door 14 is closed, thereafter, the switch 32 automatically moves to its closed position, as a result of which the circuit is closed by the exciting coil 34 of the time relay 33. As a result thereof, the operating contact 36 of the time relay is immediately closed and the rest contact 35 is opened. The closing of the operating contact 36 brings about a bridging of the thermostat switch 29, so that the circuit 22 to 28 is closed and the burner 18 is placed in operation independently of the position of the thermostat switch 29 and regardless of whether the burner was or was not in operation immediately prior to the opening of door 14. Simultaneously, the now opened rest contact 35 of the time relay 33 will bring about the fact, that the electromagnet 40 is not switched on and that the valve 41 will reduce the quantity of fuel fed to the burner 18 per time unit to approximately half the normal operating quantity. However, the air supply for the burner remains unchanged and therefore burner 18 is now operated with about 100 percent surplus of air. As a result thereof, sufficient oxygen for the combustion of the material thrown into the fire chamber 12, besides the oxygen required by the burner itself, will surely be supplied to the fire chamber. The solid material thrown in consequently will be ignited without failure by the burner 18 and incinerated.

This method of operation of the burner 18 is limited to a predetermined period of time set in the time relay 33. The period of time can be selected for example between 5 and 15 minutes and depends in the first place on the capacity of the fire chamber 12 and on the performance of the burner 18. After the predetermined period of time has run its course, the delay device 37 in the time relay 33 causes the contacts 35 and 36 to assume their starting position again, although the circuit remains closed further by the exciting coil 34. As soon as the operating contact 36 has been opened in the time relay 33, the thermostat switch 29 for the control of the burner is again effective. Simultaneously, the rest contact 35 again closes the circuit through the electromagnet 40, so that the valve 41 will again permit the full quantity of fuel per time unit to flow to the burner 18. Thus the burner is now operated again at normal operation or it is turned off depending on the pertinent position of the thermostat switch 29. Up to the next opening and closing of the door 14 of the feed opening, the firing mechanism therefore operates again exclusively in controlled dependence on the thermostat switch 29.

It is also possible to operate the firing mechanism of the boiler only with solid fuels. For that purpose, the burner 18 is switched off entirely from the supply source by disconnection of the terminals 30 and 31, and a solid fuel is thrown through the feed opening 15 onto the grate 13 of the fire chamber 12 and is ignited by some conventional means or other.

In a variation of the design described by way of example, some other device instead of the valve 41 can be used for the reduction of fuel during the combustion of solid materials, which device will cause a doubling of the air supply at an even fuel supply. Merely the ratio of fuel to air supply is important, whereby a considerable surplus of air of preferably about 100 percent, as compared to normal operation, with the burner 18 alone will be striven for during burning of the solid material.

Although the time relay 33 in the drawing has been illustrated as an electromechanical relay, it may just as well be in the form of an electronic time relay in solid body engineering.

From the description it is clear that the double combustion firing according to the invention offers considerable advantages. By the automatic switching off of the burner 18 each time the door 14 leading to the fire chamber 12 is opened, a danger to the individual is thus considerably reduced or eliminated altogether. By automatic switching on of the burner 18 during a predetermined period of time after each closing of the door 14, one will prevent the material thrown into the fire chamber 12, especially kitchen or household refuse, from remaining there for some time unburned in the fire chamber and, at the same time, producing bad odors. By the automatic operation of burner 18 with approximately 100 percent surplus of air during the above mentioned predetermined period of time, one will surely achieve a perfect burning of the material thrown into the fire chamber 12 without troublesome formation of smoke and odor. Finally, by the automatic transition to the normal burning operation, after the predetermined period of time has run its course, one will guarantee that the firing mechanism or the boiler heated by it will suffer no damage by possible overheating and that the normal operation of the firing with gaseous or liquid fuel will suffer no disturbances by human interference.

I claim:

1. Double combustion firing for solid and for gaseous or liquid fuels with a single fire chamber, comprising a burner nozzle directed downwards toward a grate for the support of the solid fuels, a feed opening in the chamber for the solid fuels provided with a door, and the burner for the gaseous or liquid fuels discharging into the fire chamber, means connected to the burner for switching on and off from a control

circuit and the flame from the nozzle being pointed toward the grate, a switch arranged in the control circuit for the burner which can be operated by the door of the feed opening so that in the case of an opened door, the burner will be out of operation and after each closing of the door the burner will be in operation for a predetermined period of time by a time relay independently of whether the burner was or was not in operation prior to the door being opened.

2. Double combustion firing according to claim 1, in which means are provided to control the fuel or the air supply to the burner and connected with the time relay so that it will operate the burner with an excess of air during the predetermined period of time after each closing of the door.

3. Double combustion firing according to claim 1, in which the surplus of air during the predetermined period of time amounts to approximately 100 percent.

4. Double combustion firing according to claim 1, in which the time relay bridges at least one thermostat switch in the control circuit for the burner during the predetermined period of time after the door is closed.

5. Double combustion firing according to claim 1, in which the predetermined period of time amounts to between 5 and 15 minutes.

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