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Safety-Control Mechanism for Fuel-Burning Devices

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My invention relates to automatic fuel burning devices and more particularly to safety control means therefor.

One of the objects of my invention is in the provision of electrical safety control mechanism for fuel burning devices, operating to prevent energization of the burner immediately after cessation of normal operation.

Another object of my invention is in the provision of electrical safety control mechanism for automatic fuel burning devices, adapted to prevent the projection of fuel mixture into the combustion chamber when said combustion chamber is at a temperature sufficient to cause an unnatural ignition of the fuel mixture.

Yet another object of my invention is in the provision of electrical safety control mechanism adapted to prevent the burner from operating too frequently and for too short intervals.

Still another object of my invention is in the provision of electrical safety control mechanism that prevents the immediate commencement of operation of the burner after a so-called "surge" on the line.

A further object of the invention is in the provision of a fuel circulating chamber having a float control connection with the electrical circuit, and adapted to automatically cut out the burner upon a failure of fuel flow or upon overflow of the fuel.

Other objects of my invention will appear in the following specification, taken in connection with the annexed drawings, in which—

Fig. 1 is a side elevation of the fuel burning device, or rather the mechanical portions thereof, showing the manner of installation in the combustion chamber, as well as the assembly of the portions removed from the combustion chamber.

Fig. 2 is a vertical sectional view showing in detail the arrangement of the circulating chamber and spark timing mechanism and safety mechanism in connection with the fuel supply.

Fig. 2A is a view with no sections removed showing the right hand upper corner of Fig. 2, the contact button in contacting position.

Fig. 3 is an even more complete detail showing of the automatic fuel control mechanism, and

Fig. 4 is a view showing diagrammatically the electrical circuits included in the device.

Before referring to the drawings for the purpose of description, it might be said that the fuel burning device disclosed in the present instance is merely of a type developed and manufactured by applicant, and that any of the numerous types of fuel burning devices might as well be disclosed, inasmuch as the subject-matter of the present invention is directed to the safety control features and could be applied to any class of fuel burners.

Again, with respect to the objects of the present invention, it might be said that the well known and so-called domestic fuel burners of today are automatically controlled, this word "automatic" referring in the trade to fuel burning devices used for heating purposes and located ordinarily in the formal furnace of the home, said fuel burning devices having their operation controlled by a switch mechanism controlled by a thermostat sensitive to temperature conditions located at some point in the house or structure that is to be heated. In other words, the temperature of the house controls the activity of the burner, and no manual effort is necessary under normal and natural conditions.

There are many advantages in the fact that these burners are now automatically controlled, but one disadvantage remains, which would not and did not attend the use of manually controlled burners. This disadvantage or weakness of the automatic burner has to do with its safety, as there is no person present when the device starts its operation, or as a matter of fact, at any time during the operation of the burner. Specifically, with respect to the present safety control mechanism, I will say that if the burner were not automatically controlled and were started by hand, the operator would be there to see...
whether the burner started and whether it was properly ignited. He would be able to determine whether it would be safe to start the burner, having in mind at this time, whether the furnace, or rather the combustion chamber thereof, was at a high temperature and capable of causing an unnatural ignition of the fuel mixture projected therein. In the present case, I deal with the safety feature above referred to, namely, the possibility, in an automatically controlled burner, of projecting a fuel mixture into a hot furnace. However, other advantages also attach to the type of safety control as set out in the objects of the present invention.

It is well known in the trade that with the projection of the normal fuel mixture into an excessively hot furnace, an unnatural ignition will many times take place, the same being nothing more nor less than an explosion, whether it be called a "puff" or "flareback". The blowing off of the doors of furnaces, and in many instances, the wrecking of same, and even the burning of houses, has been caused by just this weakness in the automatically controlled burner, since the automatic feature took away the safeguard of manual presence.

As said before, it is the object of the applicant in the present instance to provide a mechanism that safeguards against any such accident, as well as to provide other advantages coincident with said mechanism.

Referring to the drawings, I have shown in Fig. 1 a fuel burning device of the so-called rotary cup type, wherein an atomizing cup 10 is driven by a formal electric motor 11, through friction mechanism, generally referred to as 12, the cup member being mounted upon a shaft 13, supported in suitable bearings, etc. Means for supplying fuel to the atomizing cup through the pipe 17 past a control valve 18, thence through pipe 19, and finally to the jet 20, said jet delivering directly into the rotary cup member 10. A by-pass for excess fuel is taken care of in a manner to be later described, inasmuch as this by-passed fuel is used in connection with the control mechanism, and it being the object at the present time merely to describe the general burner structure and manner of assembly. Ignition of the fuel mixture discharged from the periphery of the rotating cup 10 into the combustion chamber C is effected by a formal sparking mechanism or electrode 21 located adjacent the periphery of said cup.

Again, referring to the circulating fuel chamber, I find said chamber supplied by gravity from a large storage tank (not shown), located usually at a distance from said chamber, and at an elevation slightly thereabove through a pipe 22. Means for regulating the flow of fuel to said circulating chamber is effected by float control valve mechanism, including a float 23, pivotally attached as at 24 to one of the walls of the circulating chamber, the lever portion 25 of said float member having a spring tensioned sliding connection 26 with the formal valve 27 controlling the flow of fuel through the pipe 22. This spring tension sliding connection 26 permits lowering of the float member to open the valve, as well as the closing of the valve upon the proper fuel level being reached, with still a possibility of upward movement of the float in case the chamber should receive an oversupply of fuel due to some accident, for instance sticking of the valve 27.

Mechanism later to be described in connection with the electrical circuit of the device is controlled by the movement of this float member to effect stopping of the burner in case of a failure or overflow of fuel in the circulating chamber.

Now, with regard to the by-passing of unused fuel by the needle or control valve 18, I find said fuel passing through the pipe 19 and thence into a passageway 29 having exit through restricted openings 30, 31 and 32, to an auxiliary chamber 33, a float chamber 34 and a return pipe 35 respectively. The by-passed fuel, in other words, has a possible flow into the float chamber, the auxiliary chamber and the return pipe, with the result that the gradual filling of the float chamber 34 causes the float member 36 therein to be raised. Upon the float member 36 attaining its highest elevation in the float chamber, the fuel occasional such rise will then overflow through the port 37 into the return pipe 35, and thence to the circulating chamber 15. The movement of the float 36 is utilized to move the formal mercoid switch member 38 from a closed to an open position, this movement being effected through a stem 39 attached to the float member, said stem having the spaced lugs 40 providing attachment means for the lever arm 41 controlling the movement of the bulb 38 containing the formal contacts 42 and mercury 43 therein.

It might be stated at this time that although the electrical circuits have not yet been traced, the raising of this float member and the opening of an electrical circuit, due to the movement of the before-described levers, operates to stop the sparking of the electrode adjacent the periphery of the rotating cup, the same being accomplished at a suitable and determinable time after the initial commencement of operation of the burner. Also the raising of this float member simultaneously controls another electrical contact through the extension of the stem 39, and...
its operative engagement with the spring tensioned contact member 44 and strip 45.

To more fully describe the operation of the float in connection with these contact members, which provide the safety control means, it might be said that the lug 46 upon stem 39 operates when the float is in its lowered position during inactivity of the burner to hold the contacts 44 and 45 together, in other words, in a closed position. Following upon the initial upward movement of the float chamber, the spring tensioned contact 44 is permitted to move away from the stationary contact 45, hence immediately opening the circuit therethrough. In order that the float 36 may be lowered, the oil in the chamber 33 and 34 may pass through the restricted opening 32 and down the return pipe 35. Some of the oil may also return through the pipe 28.

To further describe the physical structure, without including its connection in the electrical circuit, which will be described later, a rod 47 is attached at 48 to the lever 25 of the float member, said rod extending through the return pipe 35 and eventually passing through a ferrule 49 and contact button 50. A lug member 51 is attached to the projecting end of said rod and another lug 52 is attached to said rod at a point just below the ferrule 49. This ferrule 49 has a slight frictional connection with an insulated plate member 53 suitably attached to a supporting frame 54 mounted upon the upper end of the float chamber. The button 50 is grasped upon its concave sides by opposed tensioned contact members 55 and 56, hence providing a knock-out switch adapted to be controlled by the movement of the rod member 47.

Obviously, a lowering, or rather absence of fuel in the circulating chamber 15 will result in the downward movement of the float, hence a downward movement of the rod 47 with the result that the lug 51 will abut the button 50, and finally force it from its spring tension engagement with the contact members 55 and 56, thus opening the electrical circuit therethrough. Similarly, an overflow of fuel in the circulating chamber will result in the upward movement of the rod 47 with a consequent abutment of the lug 52 against the lower end of the ferrule 49 with a resultant upward movement of the ferrule and consequent displacement of the button 50, as shown in Fig. 3, thereby opening the electrical circuit through said switch.

Turning to Fig. 4 of the drawing, I find a diagrammatic lay-out of the electrical circuits making up the automatic feature of the burner. In this view, the electrical circuits are shown in connection with the physical portions of the burner so that it may be readily understood just how the safety mechanisms actually operate. It might also be said that generally the arrangement of electrical wiring is substantially that used in practically all automatic oil burning structures, wherein a high and low voltage circuit is used. In view of the fact that this method of electrical wiring is in general use, I have shown my safety mechanism in connection therewith.

Although, as said before, the electrical circuits are almost formal, they will be described in detail. The motor, previously described as 11, uses a high voltage current, usually 110 volts, and the 110 volt wires are appropriately marked 110, the line connections from the street being marked L. A formal switch member has been designated S, and is of the manually operable type. The 110 volt circuit as shown, leads first through a relay switch, later to be described, and thence directly to the motor, as well as to a spark coil 87, which furnishes current to the sparking device 21, previously described, through the wires 110. It might also be noted at this time that this high voltage current to the sparking device is adapted to be interrupted by the opening of the circuit through the switch member 38, the same being operated by the by-passed fuel also described.

Although in the present instance, a sparking device operating on a high voltage current is used, it is obvious that such sparking device might readily be used in connection with a low voltage current, similarly adapted to be opened by operation of a formal switch member controlled by the by-passed fuel. The relay switch controlling the high voltage or 110 volt circuit, is shown at 58, and this relay 58 has its operation controlled by a low voltage circuit created by a formal transformer 59. A magnet 60 adjacent the relay is in the low voltage circuit and the energization of said magnet or release thereof makes or breaks the 110 volt circuit and hence starts or stops the operation of the fuel burning device and portions operating simultaneously therewith. The means directly controlling the operation of the relay switch 58 and hence starting and stopping of the fuel burning device are a formal room thermostat shown at 61 and a so-called pressurestat usually located on the boiler of the furnace described as 62. The room thermostat located in the dwelling to be heated is sensitive to temperature conditions, and is set usually to operate within a few degrees. In other words, if the temperature of the dwelling goes down to the low point, the burner goes on, and after the dwelling has been heated to a temperature a few degrees higher, the burner goes off, the movement of the room thermostat either energizing or deenergizing the magnet in the relay to open or close the high voltage circuit. The pressurestat, or more commonly called boilerstat, is also in the low voltage circuit with the room thermostat, and is in the nature of a
safety guard to shut off the burner in case 
boiler pressure becomes too high. In other 
words, even though the dwelling temperature 
was below the normal high point, and the 
burner running, the pressurestat would shut 
it off, if the boiler pressure was above a safe 
point.

In describing the wiring in the low voltage 
circuit, this wiring will be referred to in the 
terms normally used in the trade, there being 
three main wires in the low voltage circuit, 
namely, the red wire, the white wire and the 
blue wire. When the temperature of the room 
is below the point set on the room ther- 
mostat, contact is made between the blue and 
white wires at the screw point 68 shown on 
the thermostat. This will energize the mag- 
net 60 and cause the arm to go forward 
against the magnet, making contact on the 
110 volt line at points Z—Z which I have in- 
dicated, and also making contact at X, which 
connects the red wire so that when the blue 
wire is broken by my safety switch 44 mount- 
ed above the spark timing device, the burner 
will continue to run, the circuit or shut 
through which the current flows comprised 
of the red and white wires. The white wire 
is always connected except when broken by 
the room thermostat or the button throw-out 
switch 50. In other words, the blue wire 
is a starting wire and there must be contact 
between the contacts 44 and 45 before 
the burner will start, and following; whenev- 
er the burner is stopped, it cannot be started 
thereafter until the float member 36 has re- 
turned to its lowest position, thereby 
again making contact between the points 44 
and 45 and closing the circuit in the blue wire.

As explained before, the object of the pres- 
ent invention is to prevent in any manner 
the commencement of operation of the burner 
after an initial cessation, at least for a pre- 
determined period. This period of time 
in the present structure, is determined by the 
time the float member will take to return from 
it topmost position to its lowestmost posi- 
tion. Mere mechanical changes in structure 
may vary this interval although with the 
structure as disclosed herein, at least five min- 
utes will be taken for the by-pass fuel to flow 
out of the auxiliary chamber 32 and the float 
chamber 34. By lengthening the float cham- 
bers obviously a longer interval of time may 
be readily had.

With the above described structure, any 
surge upon the line will prevent further op- 
eration of the burner until this time interval 
has elapsed. Likewise, any shutting off of 
the burner when the combustion chamber is at 
an exceedingly high temperature will result 
in the impossibility of turning the burner on 
either manually or by room thermostat 
or pressurestat action until this interval has 
elapsed which will be sufficient to permit a 
slight cooling of the furnace and such cooling 
as will prevent an unnatural ignition or ex- 
plosion of the fuel mixture that is projected 
into the combustion chamber thereafter.

In Fig. 4 it may be also seen that the white 
wire includes the fuel safety throw-out 
switch. In other words the button switch 
50 is included therein in such manner that 
should the fuel supply fail or should there 
be an overflow thereof then the rod member 
47 would operate, through its lug members, to 
force the button 50 from between the contact 
strips 55 and 56, thereby cutting out the 
burner and preventing further operation 
thereof until manual re-setting of said but- 
ton switch was effected.

In view of the detailed disclosures and de- 
scription of the operation of the safety mecha- 
nisms throughout the specification, no fur- 
ther description of the operation of the 
burner is thought necessary.

What I claim is:

1. In a fuel burning device, comprising an 
electrically operated means for projecting an 
atomized fuel mixture into a zone of ignition, 
safety control mechanism for delaying the 
energization of the burner after cessation of 
operation for a substantial interval of time, 
including a main electrical circuit containing 
therein the said electrically operated means, 
a relay for opening and closing said main 
circuit, a secondary circuit for actuating said 
relay, a switch member therein normally 
closed to permit commencement of operation 
of the burner, a third circuit having a con- 
nection with the relay and being closed there- 
by simultaneously with the main circuit, 
whereby said switch member may be opened 
thereafter without stopping the burner, a 
float mechanism controlled by the accumula-
tion of fuel induced by burner activity, and 
a connection between the float mechanism 
and switch member capable upon movement 
of the float caused by the fuel accumulation 
induced by burner activity of opening said 
switch and thereafter holding same open un- 
til the float has moved to its subsided position 
upon the cessation of burner activity.

2. In a fuel burning device, comprising an 
electrically operated means for projecting an 
atomized fuel mixture into a zone of ignition, 
a main circuit for controlling said electric- 
ally operated means, safety control mecha-
nism for preventing immediate re-ignition 
of the burner following a cessation of ac-

divity, including a relay for opening and clos- 

ing said main circuit, a secondary or start- 
ing circuit for the burner having a switch 
member therein controlling the closing of 
said main circuit by the relay, thereby con- 
trolling the commencement of operation of 
the burner, a shunt on said secondary circuit 
having a connection with the relay and being 
closed thereby simultaneously with the main 
circuit, whereby said switch member may be 
opened following said activity without stop-
ping the burner, means for holding said
switch member in an opened position during
activity of the burner including a float mech-
anism controlled by the fuel accumulation
induced by burner activity, said float mem-
ber operating when moved by the fuel accu-
mulation to open said switch and thereafter
to maintain the same in an open position un-
til the fuel accumulation stops and the float
has subsided to its normal position.

3. In a device as defined by claim 2, a tem-
perature responsive mechanism in said shunt,
said temperature responsive mechanism con-
trolling the making and breaking of the cir-
cuit in said shunt.

In testimony whereof, I have hereunto
affixed my name.

CARL B. CHANDLER.