April 7, 1931. K. A. MAYR 1,799,758

FUEL BURNING SYSTEM

Original Filed Dec. 17, 1927 2 Sheets-Sheet 1

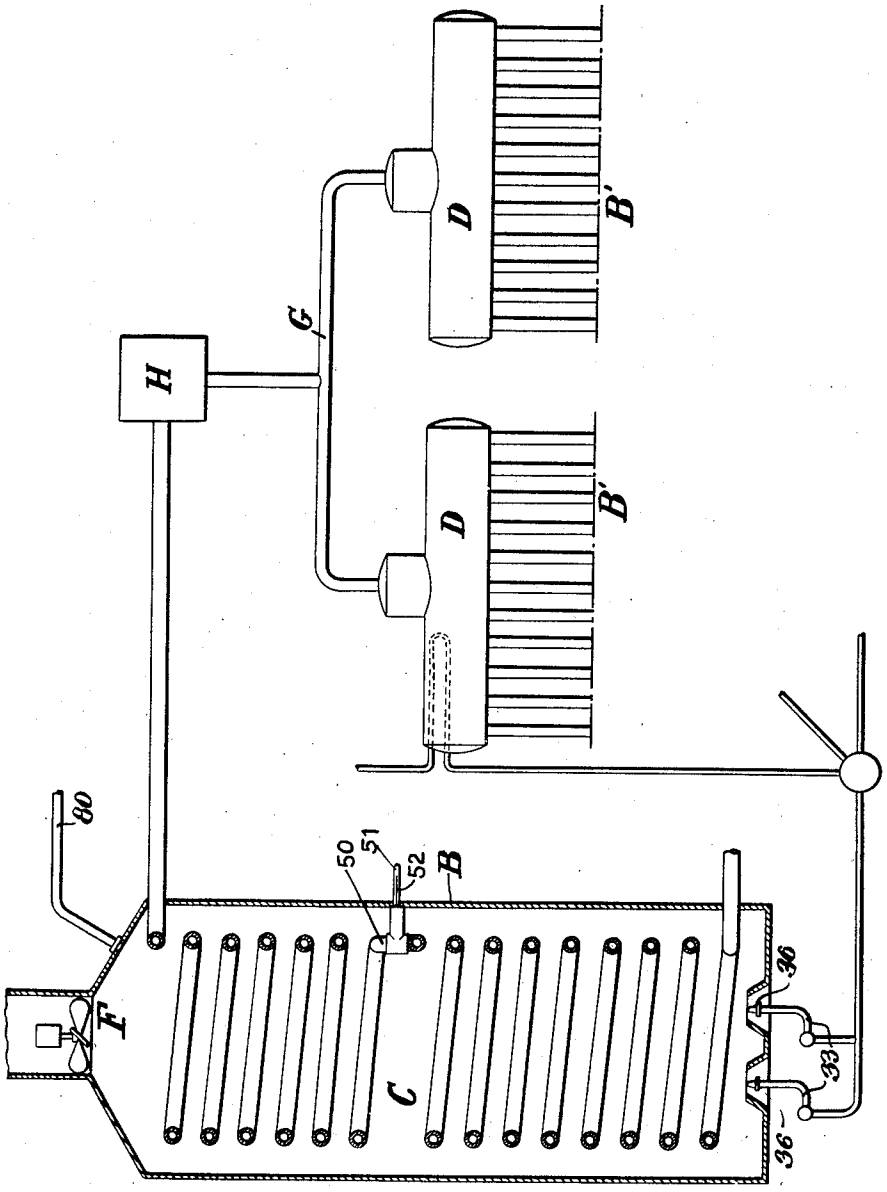

Fig. 1.

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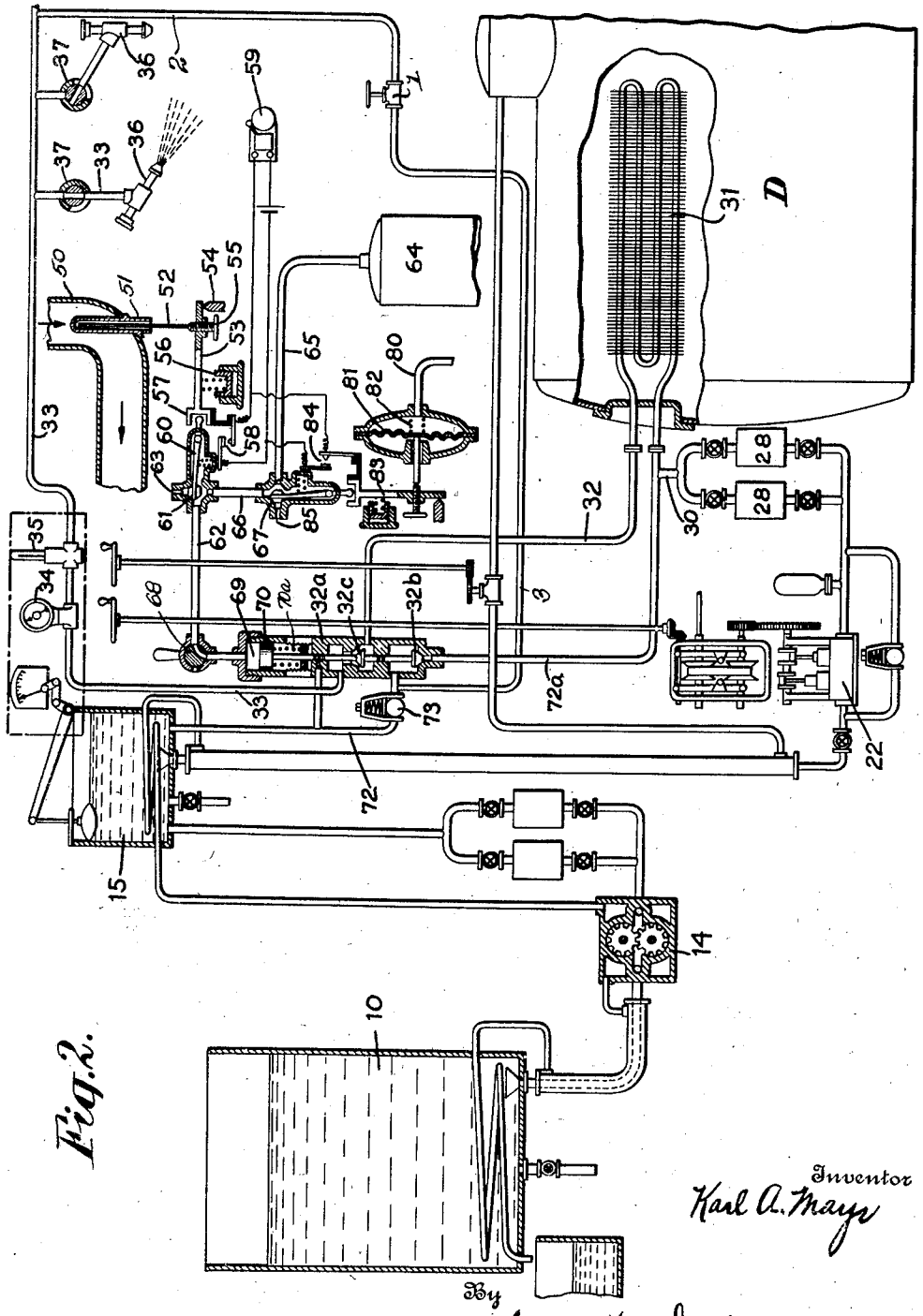

Fig. 2.

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UNITED STATES PATENT OFFICE

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FUEL-BURNING SYSTEM

Original application filed December 17, 1927, Serial No. 240,657. Divided and this application filed May 24, 1928. Serial No. 280,195.

This invention relates to control means for a fuel burning system and the present application constitutes a division of my copending application, Serial No. 240,657, filed December 17, 1927.

The invention has for one of its objects the provision of a novel control or safety device for warning an operator of an improper operating condition and for cutting off the total fuel supply under certain operating conditions where otherwise damage would be incurred.

A further object of the present invention resides in the provision of means automatically brought into operation for shutting off the fuel supply in the event that there is not a proper air supply to the apparatus.

A further object of the present invention resides in the provision of a signal with means for automatically calling the same into operation in the event of an improper air supply.

Other objects and advantages will be hereinafter set forth in the accompanying specification and claims and shown in the drawings, which by way of illustration show one and a preferred embodiment of the invention.

In the drawings,

Figure 1 is a diagrammatic view of a steam plant embodying my improvement.

Fig. 2 shows diagrammatically the fuel supplying system with the various controls.

In more detail, referring first to Fig. 1, B represents a steam generator having a combustion chamber C and a draft inducing fan F. H is a high pressure steam consumer which may exhaust into a low pressure line G which may also receive steam from other low pressure boilers such as B′ having drums D. Suitable burners are indicated at 36 receiving fuel from a line 33.

Referring now to Fig. 2, 10 designates the main supply tank for liquid fuel. A pump 14 withdraws the fuel from this tank and delivers it to a supplemental or auxiliary tank 15. From this supplemental tank fuel is withdrawn by a pump 22 and delivered through a heating coil 31 disposed in the drum D to a pipe or conduit 32. Conduit 32 leads to a control valve generally designated 32*a*. Under normal operating conditions the flow of liquid fuel through this valve is as shown, that is, from pipe 32 to conduit 33. This conduit may be provided with a pressure indicating gauge 34 and a thermometer 35 to show the temperature of the oil. Conduit 33 extends to the burners generally designated 36. The burners may be provided with control valves 37 so constructed that the fuel supplied to the burners will be cut off when the burners are swung out of their normal position. In this way the fuel is automatically shut off to a burner when this burner is swung out of the firebox or combustion chamber C (Fig. 1) when brought out for inspection or repair.

Referring again to valve 32*a*, this valve is provided with valves 32*b* and 32*c* which are so connected with the conduits 32 and 33 and 72*a* and 72 that if the fuel flow through 32 is stopped, for example at 32*c* or 37, a passage is provided from point 30 to the tank 15 through conduit 72*a*, valve 32*b*, loaded spring check or back pressure valve 73 and conduit 72.

Control devices

Provision is made for giving a signal such as an audible signal to the operator in the event that the steam leaving the boiler reaches a certain predetermined temperature. Such a condition would arise with certain types of boilers, that the quantity of fuel supplied is greatly in excess of the water supplied. Such a condition would cause an excessive superheating of the steam.

There is further provided means for automatically shutting off the supply of fuel to the burners entirely in the event that the audible signal is disregarded and in the event that the steam temperature attains a still higher or injurious limit.

Another control which is provided is a control for shutting off the supply of fuel to the burners in the event that there is not a proper air supply to the apparatus. A signal is also called into action in the event that the fuel supplied to the burners is shut off due to lack of air supply. These various controls will now be described, but it will be

understood that the fuel control features of the present invention are not limited to oil fuels nor to the particular supply system herein described.

Referring again to Fig. 1, 50 is one of the tube connections between such sections of the boiler where a high temperature rise of the steam flowing therethrough would first be noticeable. This section 50 is provided with a thermostat 51 of any desired form. Such thermostat is here shown as comprising a tube of a material having a high thermal coefficient of expansion. Fastened to the upper end of this tube is a rod 52 formed of a material with a different and lower thermal coefficient of expansion. Disposed adjacent rod 52 is a lever 53 fulcrumed at 54 and carrying a screw 55 so as to be adjustable in the lever with respect to rod 52. The lever 53 is normally spring pressed by an adjustable spring 56 so that part 55 is kept in contact with rod 52 and this spring 56 also keeps lever 53 in contact with its fulcrum. One end of lever 53 is provided with a lost motion forked connection 57 which connection carries one of a pair of contacts 58 disposed in an alarm circuit to audible signal 59. Upon expansion of tube 51, contacts 58 will close and cause audible signal 59 to sound. Upon a further movement of the fork 57 such fork will contact with a spring pressed lever 60 carrying on it valve 61. The normal position of valve 61 is as shown, but in the event of excessively high temperature conditions it is shifted to lower position to connect a conduit 62 to atmosphere through port 63. 64 designates a suitable supply of compressed air. This compressed air normally is in communication with conduit 62 through conduits 65 and 66, valve 67 being in the position shown. Conduit 62 in turn leads through a two-way valve 68 to a cylinder 69. Within the cylinder is a plunger 70 which is provided with an adjustable spring 70*a*. The plunger 70 is normally held in the lower position as shown by the pressure of the air from tank 64. However, upon the opening of 62 to atmosphere, valve 61 will shut off the air supply from the conduit 66 and will release the pressure of the air within the cylinder 69. Thereupon plunger 70 will move upwardly under the impulse of its spring and shift valves 32*c* and 32*b* from the position shown to upward position. By this action the fuel flowing through conduit 30 will be diverted into a conduit 72 and directed back to the supplementary supply tank. In this way the supply of fuel to the burners will be cut off. To prevent the pressure on the fuel being wholly released, which might cause volatilization of the fuel in coil 31 or in other parts of the system, a loaded valve 73 is provided to maintain a pressure upon the fuel irrespective of its diversion back to the supplementary supply tank.

It will be understood that valve 73 is set for a relatively lower pressure than that of the normal operating pressure of the burners.

When the pressure in the system beyond the filters 28 (i. e. in 30, 31, 32, 33, etc.) raises to an excessively high point which might occur for example when all burners are shut off, this excessive pressure acts on the area of valve 32*b*. This causes an opening of said valve as well against the air pressure in chamber 69 and the oil then flows to tank 15 through conduit 72.

For circulating and recirculating the oil to warm the fuel lines in starting up the plant, valves 32*b* and 32*c* are in the position as shown. Hand operated valve 1 which is normally closed is, during the warming up period, opened. The oil then circulates as follows: through heater 31, conduit 32, valve 32*c*, conduits 33, 2, 3 and 72 back into tank 15.

The means for cutting off and diverting the fuel flow in the event of failure or insufficiency of air supply will now be described.

80 in Figs. 1 and 2 designates a pipe which leads to a gas duct of the boiler which is readily susceptible to changes in draft or air supply. With proper running conditions there will be a considerable vacuum induced in pipe 80 which will maintain a diaphragm 81 in the position shown and against the tension of spring 82. Upon a certain degree of lowering or complete failure of this vacuum diaphragm 81 will move to the left under the influence of its spring and will actuate a lever system generally designated 83. The details of this lever system are substantially the same as heretofore described in connection with valve 61. Eventually movement of this lever system 83 will close contacts 84 and cause the audible signal 59 to sound and this movement will finally and subsequently also shift valve 67 from the position shown to an opposite position so that the compressed air supply from 65 will be shut off and so that conduit 66 will be connected to atmosphere through port 85. The ultimate effect will be the same as before, viz. that the fuel will be diverted from the burners back to the supplementary supply tank.

The control devices just described are emergency devices. It is not the intention that these devices act as operating controls for the normal supply of fuel to the burners. They are intended to come into action in the event of inattention of the operator.

The control and signal which is attained under excessive temperature conditions of the produced steam, forms the subject matter of my co-pending application filed May 24, 1928, Serial No. 280,194.

What I claim is:

1. A fuel burning system including fuel supplying means, a combustion furnace to which fuel is supplied, means controlled by improper draft conditions in the furnace for

controlling the fuel supplying means for entirely cutting off the fuel supply when such conditions occur in the furnace, an emergency signal, and means for automatically calling the said signal into action to warn the operator of conditions which will subsequently automatically bring about a cutting off of the fuel supply.

2. A fuel burning system including a combustion furnace, means controlled by draft conditions in the furnace for first giving a signal of improper draft conditions, and means controlled by the aforesaid means for subsequently shutting the fuel supply to the furnace if the warning is disregarded.

In testimony whereof I hereto affix my signature.

KARL A. MAYR.