April 21, 1959 R. L. BERGMANN 2,882,735

SAFETY PILOT ASSEMBLY FOR BURNERS

Filed April 27, 1951

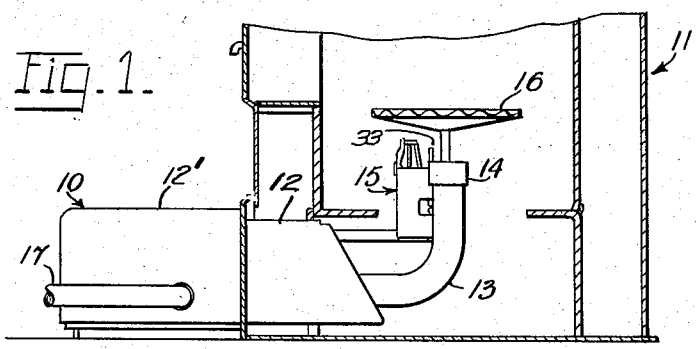


Fig. 1.

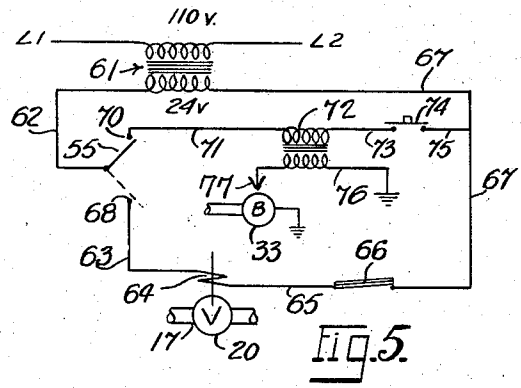


Fig. 5.

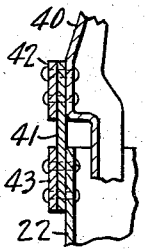
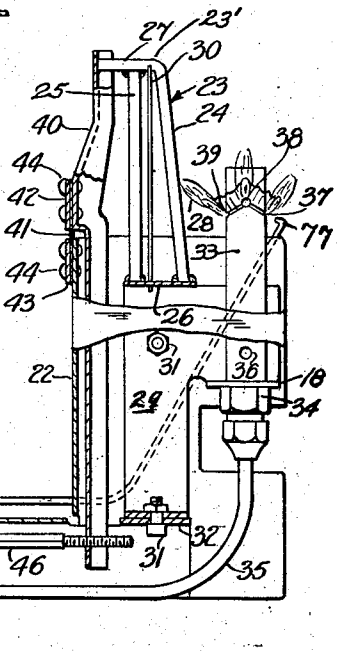


Fig. 6.



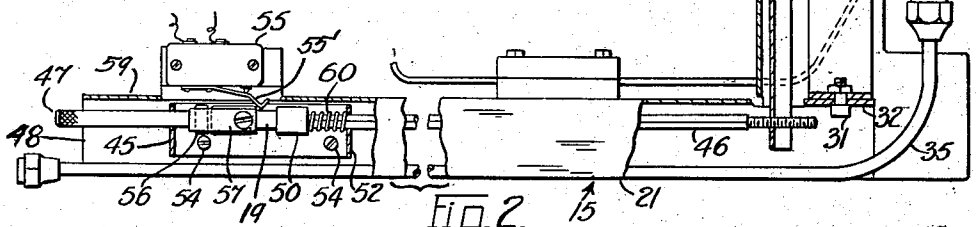


Fig. 2.

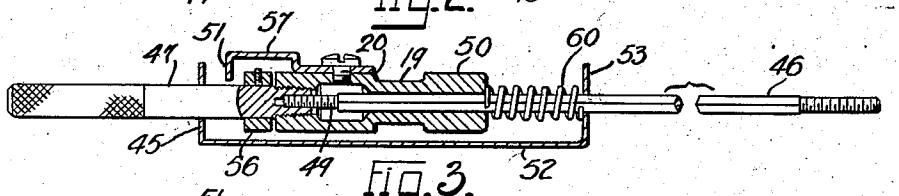


Fig. 3.

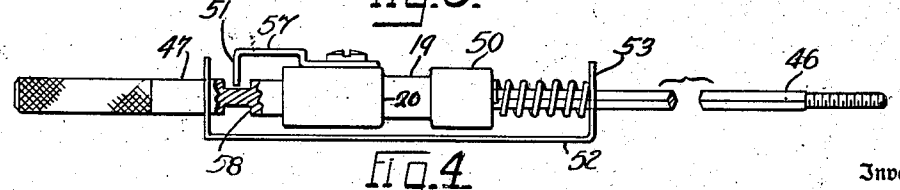


Fig. 4.

Inventor:

R. L. BERGMANN.

By Charles A. Lind

Attorney

United States Patent Office 2,882,735 Patented Apr. 21, 1959

2,882,735

SAFETY PILOT ASSEMBLY FOR BURNERS

Richard L. Bergmann, Columbus, Ohio, assignor to Surface Combustion Corporation, Toledo, Ohio, a corporation of Ohio

Application April 27, 1951, Serial No. 223,338

3 Claims. (Cl. 74—58)

The present invention relates to safety pilots for gas burners and more particularly to a safety pilot which shall be well adapted for use with gas-conversion burners for house heating furnaces. In safety pilots of this type it is desirable that the cycling time, or elapsed time after the pilot flame goes out until the safety function operates, be independent of ambient furnace temperatures, that the cycling time be easily adjustable after the safety pilot is installed in a furnace, and that the apparatus be sturdy and reliable in service. The present invention provides a safety pilot which embodies these features.

For a consideration of what I believe to be novel and my invention attention is directed to the following specification and the concluding claims thereof.

In the drawing:

Fig. 1 shows the improved safety pilot applied to a gas conversion burner for a house heating furnace, only a part of the furnace being shown.

Fig. 2 is a side elevation, with parts in section, of apparatus embodying the present invention.

Fig. 3 is a partial sectional view of a portion of the assembly shown in Fig. 2.

Fig. 4 shows a modification of a detail shown in Fig. 3.

Fig. 5 shows a simplified schematic diagram of an electrical control system for use with the improved safety pilot.

Fig. 6 is an enlarged view of a portion of the apparatus of Fig. 2.

A gas conversion burner unit for an ordinary house-heating furnace 11 is generally indicated at 10 and comprises a casing 12 which extends through the ash-pit doorway of the furnace. The unit also comprises a removable cover 12' over a parts-supporting platform in front of the casing 12. A mixing tube 13 extends through the casing 12 into the furnace chamber for delivering fuel to a burner head 14 positioned in said chamber. A safety pilot 15 is mounted next adjacent the burner head 14 to insure safe operation of the burner. The burner head 14 is shown as of the single-port flame-retention type. Mounted above the burner is a deflector 16 to accelerate combustion and to deflect the burning gases towards the side walls of the furnace chamber. The mixing tube 13 receives gas from means comprising a supply pipe 17 having a control valve 20 (see Fig. 5).

The support for the safety pilot 15 comprises a horizontally disposed frame 21 and an upright bracket 22 mounted on said frame. The safety pilot comprises a thermostat generally indicated at 23, the thermostat comprising an inclined expansion rod 24 having a lateral extension 27, and an upright rod 25, the two rods being welded at their lower ends to a base 26 and welded to each other at their upper ends whereby the assembly forms a triangular structure of three rigid members 24, 25 and 26. An upright heat-shield 30 extends loosely between the two legs or rods 24 and 25 so that heat from a small flame 28 from a pilot burner 33 may selectively heat the expansion rod 24, and by differential expansion

of that rod over the rod 25 causes the top or apex 23' of the triangular structure to move with respect to the base 26, it being understood that the upright rod 25 is flexed about its lower end by said expansion.

The base 26 constitutes the top of a pedestal 29 which is secured by bolts 31 to a shelf 32 forming part of the frame 21. The pilot burner 33 is supported on a shelf 18 on said pedestal 29. A gas-controlling orifice-fitting 34 is threaded into the bottom of the pilot burner 33. A gas-supply tube 35 delivers gas to the orifice fitting 34, and the jet of gas issuing from that orifice draws air into primary air holes 36 in the side wall of the pilot burner 33. The gas-air mixture so formed issues from ports 37, 38 and 39 adjacent the top of the pilot burner, the top being closed. Where a variety of fuel gases are to be accommodated by the pilot burner, the quantity of air entrained by said jet of gas may be varied by varying the size of the primary air holes 36.

The extension 27 of the expansion rod 24 pushes against the upper end of a lever 40 which is fulcrumed intermediate its end on the upright bracket 22 by a relatively thin and short metal strip 41 having sufficient shear strength to bend like a hinge without offsetting, thus giving rise to no lost motion. A flexing length of 0.0625 inch for a steel strip of 0.025 inch thickness has been found to be suitable, giving a ratio of length to thickness in the hinge strip of five to two or 2½/1. Softer materials may require a lesser ratio to operate without offsetting. The hinge strip 41 is secured to the bracket 22 and to the lever 40 by clamping plates 42 and 43 secured thereto as by rivets 44. To the lower end of the lever 40 there is connected one end of a push rod 46, the rod being threaded into the lever 40 to permit the effective length of the rod to be varied for a reason presently appearing. The rod 46 extends through a square hole in an upturned end 53 of a bracket 52 secured as by screws 54 to a side wall 48 of the frame 21, the rod being slidable in said hole but being square so it may not turn therein. The rod also extends part-way through an axial bore in an elongate switch operating member 50, hereinafter sometimes called a cam member, the rod being slidable in said bore but the bore and rod being square so that the member may not turn on said rod. A cylindrical adjusting rod 47 having a knurled knob at one end is turnable in a hole in an upturned end 45 of the bracket 52. The rod is internally bored and threaded to screw on to the adjacent threaded end 49 of the push rod 46 and is externally threaded to extend into a threaded bore in the adjacent end of the elongate member 50. The leads of the internal and external threads on the rod 47 vary a sufficient degree to give a micrometer-type adjustment between the member 50 and the rod 46. Single lead threads of thirty-two and thirty-six threads per inch are suitable for this purpose. In order to prevent the rod 47 from being unscrewed from the rod 46 and from the member 50, the rod may be provided with a fixed collar 56 and the member 50 may be provided with an arm 57 fixedly secured to the latter and having a downturned extension 51 disposed behind the collar to form a stop therefor. Instead of a collar 56 on said rod 47, the body of the latter may have a neck portion as shown in Fig. 4 to provide a shoulder 58 adapted to abut the stop 51 to limit rearward movement of rod 47. A spring 60 between the member 50 and the upturned end 53 of the bracket 52 tends to take up any slack in the connections between the rod 46 and the extension 27 of the thermal element 23.

Mounted on the top side 59 of the frame 21 is a switch mechanism 55 having a spring blade actuating arm 55'. The elongate member 50 is provided with a neck portion 19 wherein the free end of the switch-actuating arm 55' tends to project, the neck portion being provided to

form a shoulder **20** which, upon the member **50** being moved towards the right as shown in Fig. 2, will cause the free end of the said arm **55'** of the switch **55** to ride up on the shoulder **20** and thus actuate the switch **55**.

A spark electrode **77** is secured next adjacent the pilot burner port **37** for initial ignition of the pilot gas. The gas from the pilot burner ports **38** and **39** is ignited from port **37** by a runner flame issuing from the small slots connecting the ports **37, 38** and **39**. The gas from the port **38** is adapted to ignite the main burner **14**, and the gas from port **39** is adapted to warm the expansion rod **24** of the thermal element **23**.

In Fig. 5 a transformer **61** provides 24 volts A.C. to operate an electrical control system for the burner and pilot assembly. A lead **62** runs to the electrical switch **55** which is operated by the switch cam **50**. From a hot contact **68** of the switch **55** a lead **63** connects to a solenoid coil **64** of the gas valve **20** and a lead **65** connects the coil **64** to a room thermostat **66** which is in turn connected by lead **67** to the transformer **61**. A cold contact **70** of the switch **55** is connected by a lead **71** to a spark transformer **72** and thence by lead **73** to a vibrating reed **74** of which only the contact is shown, and which is in turn connected by leads **75** and **67** to the transformer **61**. The spark transformer **72** is connected on the high voltage side to ground by lead **76** and to a spark electrode **77** which is adapted to discharge a spark to the pilot riser **33** next adjacent the pilot burner port **37**.

In operation, when power is supplied to the 24 v. transformer **61**, and the pilot burner is "out," the switch **55** is on its cold contact **70**, and the contact of the reed **74** is closed. A spark is released at the pilot burner port **37** to ignite gas issuing therefrom. Flame from the pilot burner port **39** warms the expansion leg **24** of the thermal element **23** which thereupon moves towards the left to push on the lever **40**. The lever **40** pivots about the hinge **41** and moves the adjusting rod **46** axially to move the switch arm **55'** to its hot position, breaking the circuit to the spark electrode and placing the power circuit to the main gas valve **20** under control of the room thermostat **66** as is conventional. In the event that the pilot flame goes out, the thermal element **23** moves to cold position, and the spring **60** forces the adjusting rod assembly and the lever **40** to follow, thus moving the switch arm **55'** to its cold position and closing the main gas valve **20**.

By virtue of the particular thermal element **23** great power is developed to operate the safety switch **55**, and by proper selection of materials in the thermal element the apex **23'** thereof can be made to move a small distance under a rise in ambient temperature towards closing the safety switch to its hot position, then by the reduced movement from a constant pilot flame at higher ambient furnace chamber temperatures the switch is operated at the same relative point. For example, if in a relatively cold furnace at 100° F. having only the pilot burner operating, and the flame **28** playing on the inclined expansion rod **24**, upon failure of the pilot burner the apex **23'** must move .040 inch to open the contacts of the switch mechanism **55**, and does so in 60 seconds cooling time, then in a relatively hot furnace the same cooling time is desirable for opening those contacts. This can be obtained by using materials in rods **24** and **25** having dissimilar coefficients of expansion such that at a furnace temperature, say, of 400° F., the necessary movement of the apex **23'** is but .030 inch, and since the rate of cooling of the rod **24** is slower in the hot furnace, this may compensate for the shorter movement required to still give a cycle time of 60 seconds from time of pilot failure to time of opening of the contacts of the switch mechanism **55**. It is apparent that, in this example, the apex **23'** of the thermal element has moved .010 inch towards closing the contacts of switch **55** upon raising the furnace chamber temperature from 100° F. to 400° F. with the pilot burner off. In this way constant cycling time, or elapsed time between failure of the pilot and opening of the safety switch **55**, is maintained over a wide range of furnace chamber ambient temperatures. The relatively small movement of the apex **23'** of the thermal element is accurately adjusted in a floating micrometer assembly by turning a single handle, and unintentional over adjustment is made virtually impossible.

Having disclosed my invention, I claim:

1. An adjusting rod assembly comprising an elongate rod having first and second threaded portions at its respective ends, rod means having internal and external threads having the same direction of advance but different leads, the internal thread being adapted to receive the second thread of said rod, a cam member having an internally threaded portion adapted to receive the external thread of said rod means, and said rod and said cam member being non-turnable with respect to each other and the rod extending into a bore in said cam member whereby turning said rod means axially moves the cam member and said rod with respect to the other.

2. An adjusting rod assembly according to claim 1 comprising stop-means for limiting relative axial motion of said cam member and said rod means whereby to provide a fine adjustment limit-means for limiting relative axial movement of said members.

3. An adjusting rod assembly according to claim 1 comprising a bracket having a first hole wherethrough said rod may be slidably supported and a second hole axially aligned with said first hole wherethrough said rod means may be slidably supported, said first hole being non-circular and adapted to support a non-circular portion of said rod whereby to prevent rotation thereof with respect to said bracket, and elastic means acting axially between said cam member and said bracket in a manner tending always to move said cam member axially with respect to said bracket.

References Cited in the file of this patent

UNITED STATES PATENTS

1,819,697	Boudette	Aug. 18, 1931
2,012,503	Gauger	Aug. 27, 1935
2,017,725	Newell	Oct. 15, 1935
2,192,629	Beam	Mar. 5, 1940
2,192,632	Beam	Mar. 5, 1940
2,266,721	Christiansen	Dec. 16, 1941
2,291,805	Denison	Aug. 4, 1942
2,305,243	English	Dec. 15, 1942
2,578,608	Shull	Dec. 11, 1951
2,589,804	Harris et al.	Mar. 18, 1952
2,649,152	Mayer et al.	Aug. 18, 1953