United States Patent [19]

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[11] **3,816,060**

[45] **June 11, 1974**

[54] **SAFETY PILOT ENCLOSURE HAVING FLAME-DIVERTING AIR INLET**

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[22] Filed: **Apr. 23, 1973**

[21] Appl. No.: **353,342**

[52] **U.S. Cl.** **431/350,** 431/80, 431/347

[51] **Int. Cl.** **F23d 15/04**

[58] **Field of Search** 431/347, 350, 80; 239/103

[56] **References Cited**

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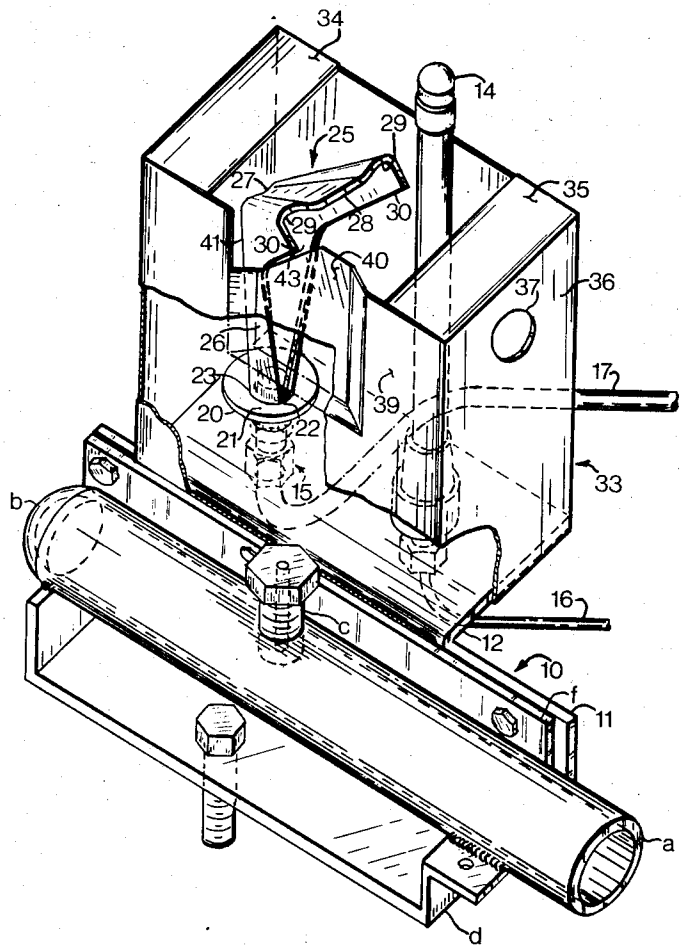
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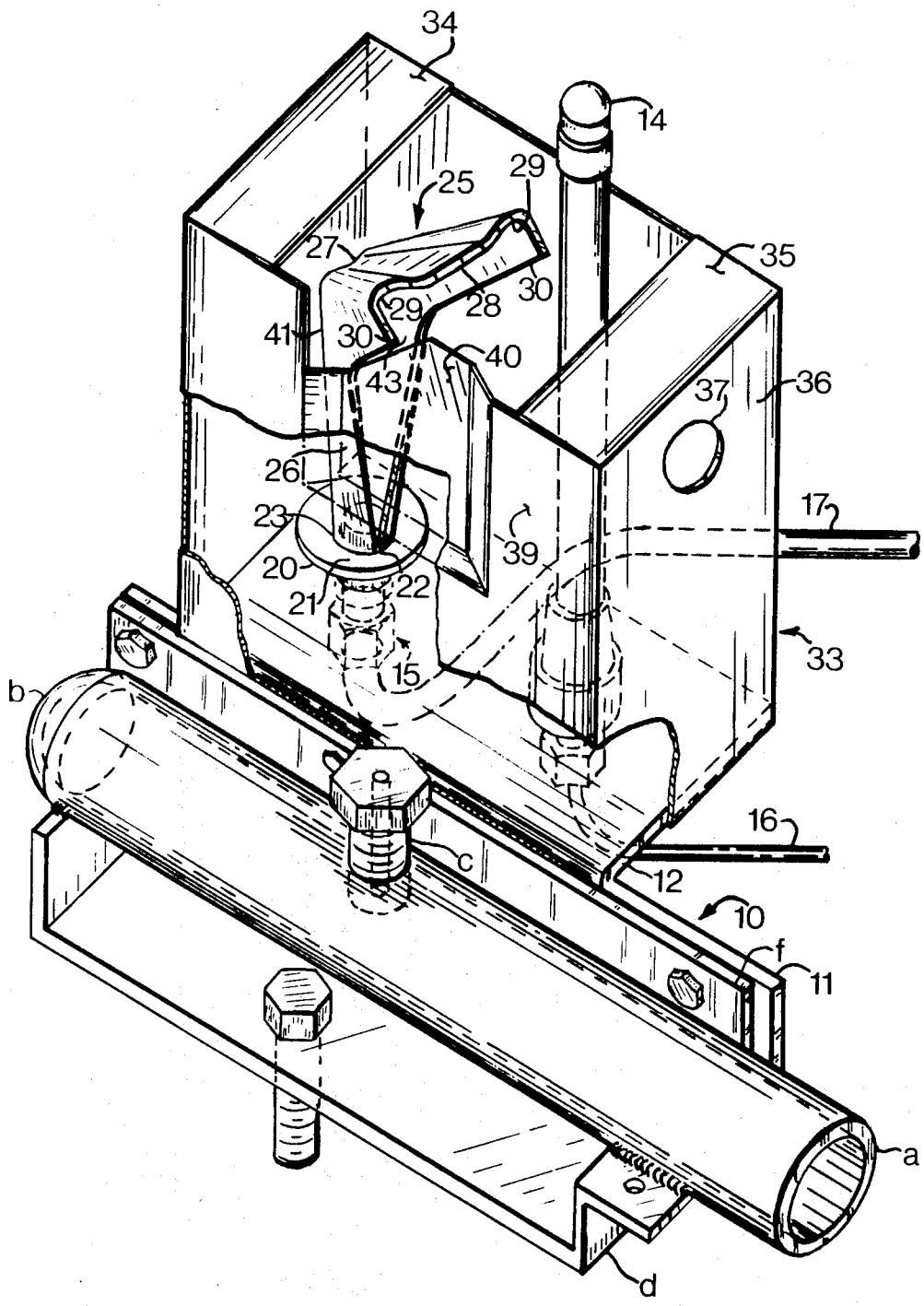
Primary Examiner—Edward G. Favors

[57] **ABSTRACT**

A gust-protecting safety pilot enclosure utilizes a hood which directs the pilot flame in two tongues, one of which heats a thermocouple within the enclosure and the other extends slantingly through the upper portion of the enclosure wall to ignite the main burner. A horizontal air flow opening in the enclosure wall beyond the thermocouple serves, when the pilot flame height is reduced, to divert a portion of the flame from the tongue which extends toward the thermocouple to the tongue which extends toward the main burner, thereby to prefer ignition of the main burner over voltage output from the thermocouple.

7 Claims, 1 Drawing Figure




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SAFETY PILOT ENCLOSURE HAVING FLAME-DIVERTING AIR INLET

BACKGROUND OF THE INVENTION

Conventional safety pilots for gas-fired furnaces and other gas-fired appliances use a safety pilot which both ignites the gas from a main burner and provides heat to a thermocouple which controls a main shut-off valve. With one common type of pilot, the gas supplied to a pilot flame has no air intermixed with it. Instead gas is directed to impinge on a flame-developing hood which slants upwardly above it; surrounding air is here entrained and mixed into the gas, to support combustion. The hood may taper wideningly from a central hood indentation; the flame developed will then extend in a two-tongued fork, one of the tongues directed toward the thermocouple and the other extending angularly outward to ignite the main burner.

It is conventional to protect such pilots by enclosing them in rectangular sheet metal box-like shields, windowed to travel a portion of the pilot flame sideward for igniting the gas from a main burner orifice. The requirements that the pilot flame be shielded and that it light the main burner gas are somewhat conflicting.

One problem is how to assure an adequate voltage drop in the thermocouple output as the pilot flame lowers. A serious danger may arise when the pilot flame is substantially reduced, as happens when a particle of dirt or scale lodges in the pilot burner orifice. In such event the tongue of flame which heats the thermocouple may create a voltage output sufficient to hold open the pilot safety which controls the gas supply, while the tongue of flame directed toward the main burner orifice may be small. If, within four seconds after a switch opens the gas supply to the main burner, the gas flowing from it is not ignited by this second tongue, there may be a serious build-up of gas so that the delayed ignition which follows may be explosive. Accordingly, it is desirable to provide some means whereby, if the pilot flame height is reduced, part of the flame which remains should be diverted from the thermocouple to the main burner.

SUMMARY OF THE INVENTION

The present invention uses a safety pilot including a conventional vertical pilot orifice, a vertical thermocouple spaced therefrom, and a slanting hood whose down-turned edges develop a two-tongued flame, to ignite the main burner and to heat the thermocouple controlling the gas supply shut-off valve. A new sheet metal enclosure is provided whose vertical side walls shield the pilot orifice and at least the lower portions of the hood and thermocouple from horizontal air flow. The side wall between the pilot flame and the main burner orifice has a laterally indented portion with a top edge cut-out through which one down-turned edge of the slanting hood extends, so that the tongue of flame to the main burner may project between them. In an adjacent side wall adjacent to the thermocouple and remote from the pilot gas orifice, a horizontal air flow opening is provided at an elevation corresponding to the elevation within the hood at which the flame develops. If the pilot flame height lowers, air flowing through the horizontal air flow opening into the enclosure serves to cool the thermocouple and divert a portion of the flame from that tongue which extends toward the thermocouple to the other tongue which extends toward the main burner. This diversion of part of the flame toward the main burner favors ignition of the main burner over voltage output of the thermocouple. It offers some assurance that, as the flame height lowers, the thermocouple voltage output will drop as a sufficiently large tongue of flame is still directed toward the main burner. Hence the gas supply will be shut off before the ability of the pilot to ignite the main burner is seriously impaired.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is an enlarged perspective view, partly broken away, of a safety pilot assembly embodying the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The illustrated embodiment of the invention is adapted for use with gas furnaces such as used in mobile homes. A main gas manifold pipe *a* extends horizontally to a domed closed end *b*, near which it has a vertical tapped bore in which a main burner orifice *c* is screwed. As is conventional, gas to the manifold pipe *a* is supplied through a supply tube having an electromagnetic shut-off valve, not shown. The pipe *a* is welded to a welded bracket *d* for support, and is connected by a locating stud *e* to some structure of the furnace. The bracket *d* has a vertical plate *f* to which is attached the safety pilot assembly to be described.

The pilot enclosure of the present invention has an angular base bracket generally designated **10,** including a vertical leg **11** screw-mounted onto the bracket plate *f* as hereinafter described and horizontal leg **12.** The horizontal leg **12** is penetrated by two base couplings, one for a vertical thermocouple **14** and the other for a safety pilot generally designated **15.** A conventional thermocouple connection **16** leads from the base of the thermocouple **14** to such electromagnetic shut-off valve for the gas manifold pipe *a;* the pilot gas supply tube **17** leads from the base of the pilot **15** to a gas supply source not shown. Except for the couplings to the thermocouple **14** and safety pilot **15,** the horizontal base leg **12** of the bracket **10** is preferably imperforate.

Secured onto the horizontal leg **12** above the coupling for the pilot gas supply tube **15** is a pedestal shield **20.** It flares outwardly to a horizontal surface **21** and has a central bore **22** within which is mounted the base portion **23** of a hood generally designated **25.** The lower portion of the hood is open, at the horizontal surface **21,** opposite to the thermocouple **14,** thereabove it flares wideningly outward and then slantingly upward. In its slant and angular position it is directed partly toward the thermocouple **14** and partly outward toward the gas orifice *c.* Its flame-developing portion **26** tapers broadeningly to a tongue-developing portion **27,** which has a broad central indented part **28** and two channel-like portions **29** flanked by downward presented edges **30** of the hood. As is known, such a hood will develop, at the flame-developing portion **26,** a flame by entraining ambient air into the gas which impinges on it; the flame will divide in the tongue-developing portion **27** into two tongues which project through the channel-like portions **29** along and within the edges **30.**

One of the tongues of flame so developed is directed toward the thermocouple **14,** thus in a typical installa-

tion the thermocouple **14** will have a 30 mv. output when heated for a substantial period of time by a pilot flame of normal height; in starting its output must reach about 7 or 8 mv. to open the conventional electromagnetic shut-off valve. Such a shut-off valve will however tend to remain open, when the pilot flame is lowered, even when the thermocouple output is as little as approximately 3 mv. The other tongue of flame, which projects outward, serves to ignite the gas-air mixture above the main burner orifice *c* when the gas supply is turned on, as by such conventional thermostat control, not shown. A problem of the invention is to shield the pilot flame from horizontal gusts, more effectively than with a conventional windowed enclosure, and yet permit this latter tongue of flame to travel toward and ignite gas from the main burner orifice *c*.

In the present invention a sheet metal enclosure generally designated **33** is utilized. It may be formed of stainless steel to substantially rectangular cross-section, so as to fit fairly snugly about the horizontal leg **12** of the base bracket **10** and extend thereabove to a height slightly less than that of the hood **25.** At its upper end, the enclosure **33** has a horizontal lip **34** which extends over a portion of the hood **25** and a second horizontal lip **35,** on the opposite side, which extends toward the thermocouple **14,** leaving a top opening through which project the tip of the thermocouple **14** and the upper portion of the hood **25** as best seen in FIG. **2.**

Beneath the lip **35,** there is provided in the wall **36** adjacent to the thermocouple **14** a horizontal air inflow passage **37** whose diameter may be slightly greater than that of the thermocouple.

The other walls of the enclosure **33** are vertical, save that in the wall **39** which separates the pilot **15** from the main burner orifice *c* there is a pocket-like indented portion **40** extending downward approximately to the mid-level of the enclosure **33.** The wall **39** has a slanting upper edge cut-out **41** through which an edge **30** of the hood **25** projects angularly. Such hood edge **30** rises slopingly, projecting sufficiently through the cut-out **41** to provide a gap **43** through which a tongue of flame may pass. Inasmuch as the gas-air mixture rising from the main burner orifice *c* will spread wideningly into the indented wall portion **40,** such tongue of flame will ignite it. Yet such tongue of flame will be protected from lateral gusts of air by the members described, which in effect provide walls for the gap **43.** The wall **39** also has a downward-projecting margin **45** held between the burner bracket plate *f* and the vertical leg **11** of the pilot base bracket **10,** these parts being secured by machine screws **46.**

The function of the air inflow passage **37** will now be described. When the supply of gas to the pilot **15** is normal the pilot flame will have two substantially equal tongues, one in each of the channel-like portions **29** adjacent to the downward presented edges **30.** The ambient air entering the enclosure, as between the lips **34, 35** augmented by air flowing through the horizontal inflow passage **37,** will be adequate to support such an equal-forked flame.

However, should the gas supply to the pilot **25** be lessened substantially, the air flowing through the air inflow passage **37** will become a more significant portion of the combustion air. Air so flowing past the thermocouple **14** will not only somewhat cool the thermocouple **14,** but will also divert a portion of the available flame from the thermocouple to the tongue which projects through the gap **43** toward the main burner orifice *c*. This unexpected effect has been verified by repeated observations and tests. By so drawing air through the passage **37** in this manner and so diverting the portion of the flame, ignition of the main burner is favored over the maintenance of the voltage output to the thermocouple **14.** Thus if the pilot flame lowers further, the drop in the thermocouple output will shut off the gas supply valve before the tongue of flame through the gap **43** has been reduced to a dangerously low level.

It will be understood that the present invention is adapted for use with various types of gas-fired appliances; and for purpose of adaptation, variations in sizes, capacities and proportions will suggest themselves to persons having ordinary skill in the art.

I claim:

1. For use with gas-fired furnaces and like appliances wherein a safety pilot both ignites the gas from a main burner orifice and provides heat to a thermocouple which controls a shut-off valve to such main burner,

a safety pilot comprising

a thermocouple supported substantially vertically,

pilot gas supply means including a substantially vertical orifice for gas only, the orifice being spaced from the thermocouple in a substantially vertical plane, and

a metal flame-developing hood positioned slantingly above the pilot gas orifice and having downward-flanged edges tapering wideningly outward from a central hood indentation, whereby to develop a two-tongued forked flame,

the hood being positioned at such angle to such vertical plane that one of the hood edges directs a tongue of such flame toward the thermocouple and the other edge extends angularly outward,

characterized in having

a sheet metal enclosure having substantially vertical side walls, whereby to shield such pilot orifice and at least the lower portions of the hood and thermocouple from horizontal air flow,

one of said side walls extending between the pilot orifice and such main burner and its upper portion being presented beneath such angularly outward extending edge of the hood,

further characterized in that a horizontal air flow opening extends through that side wall of the enclosure which is adjacent to the thermocouple and remote from the pilot gas orifice,

whereby, if the pilot flame height lowers, inflow of air into the enclosure through said horizontal air flow opening will divert a portion of the flame from that tongue which extends toward the thermocouple to the other tongue which extends over that side wall of the enclosure separating the pilot flame from the main burner,

thereby to prefer ignition of the main burner over voltage output from the thermocouple.

2. A safety pilot as defined in claim **1,** wherein

the said side wall of the enclosure projects above said outward-extending hood edge and has a cut-out through which said hood edge projects.

3. A safety pilot as defined in claim **1,** wherein

the said side wall of the enclosure projects above said outward-extending hood edge and has a cut-out through which said hood edge projects, and

said cut-out has a sloping edge substantially corresponding to the slope of said hood edge, and
said enclosure side wall beneath said cut-out comprises a laterally inward indented pocket,
whereby to provide a gap through which may project such tongue of flame to ignite the main burner.

4. A safety pilot as defined in claim **1,** wherein
the horizontal air flow opening is located at substantially the elevation of that portion of the hood at which flame develops.

5. A safety pilot as defined in claim **4,** wherein
the enclosure is provided with an upper horizontal lip extending inwardly above said horizontal air flow opening,
whereby to direct inflowing air substantially horizontally toward the thermocouple and impede upward escape of such air.

6. A safety pilot as defined in claim **1,**
further having
a bottom for said sheet metal enclosure, in which the pilot gas orifice, flame-developing hood and thermocouple are mounted,
said bottom being otherwise substantially imperforate, whereby to avoid upward gusts of air through the enclosure.

7. A safety pilot as defined in claim **1,** wherein
the flame-developing hood has a base portion arising from the pilot gas orifice and open opposite to the thermocouple, and wherein
a pedestal shield is provided at substantially the junction of the orifice with the hood, said shield extending substantially horizontally outward from the pilot gas orifice a distance substantially equal to the height thereabove at which the hood develops the flame,
whereby to avoid such upflow of air adjacent to the pilot gas orifice as might so displace the flame upward and extinguish it.

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