Sept. 20, 1949. P. L. BETZ 2,482,238

GAS BURNER WITH THERMOCOUPLE

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Fig. 1a.

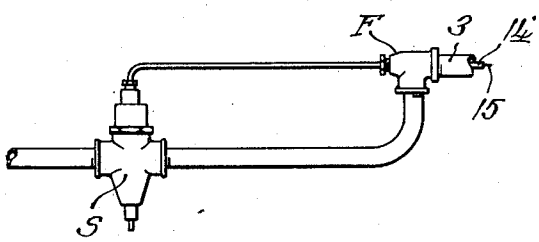

Fig. 1.

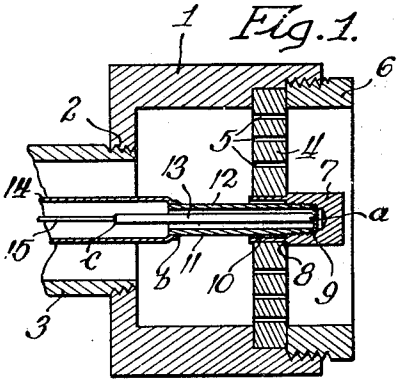

Fig. 2.

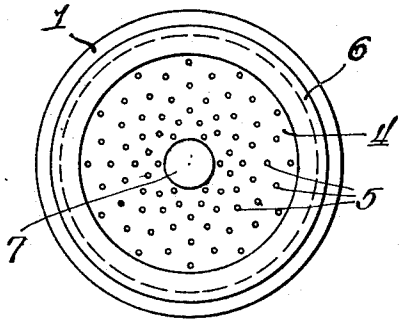

Fig. 3.

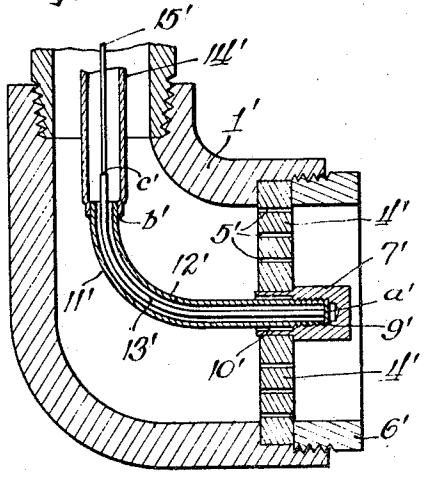

Fig. 4.

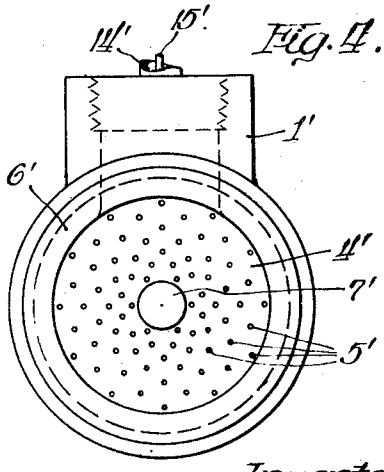

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Fig. 5.

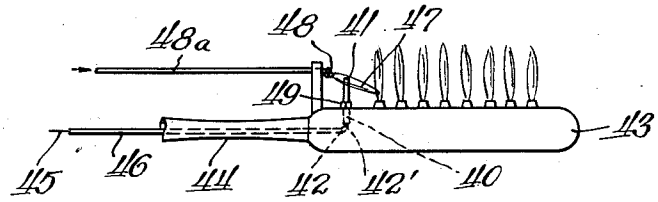


Fig. 6.

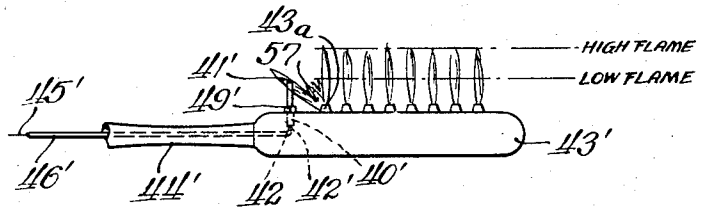
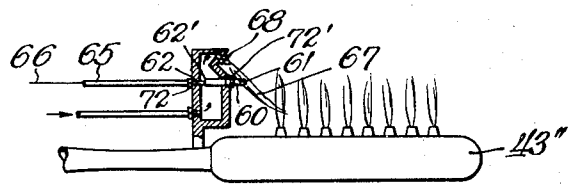


Fig. 7.



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UNITED STATES PATENT OFFICE

2,482,238

GAS BURNER WITH THERMOCOUPLE

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4 Claims. (Cl. 136—4)

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This invention relates to thermoelectrically operated safety devices, and more particularly to the application of the thermocouple of such devices to a flame at a gas burner.

In the patent to Sebastian Karrer, No. 2,097,838, granted November 2, 1937, for "Safety device for gas burners," one method of presenting the thermocouple to the pilot flame is indicated. Here the "hot" junction is subjected to a flame inside the burner compartment, and the "cold" junction is subjected to room temperature existing outside the burner compartment.

Another method of applying the thermocouple of a thermoelectrically operated safety device is indicated in the patent of Paul L. Betz and Sebastian Karrer No. 2,156,235, granted April 25, 1939. Here the "cold" and "hot" junctions of the thermocouple are inside the burner compartment, and, in the absence of a pilot flame, are subjected to the ambient temperature within the burner compartment.

The present invention provides still another method of applying the thermocouple of a thermoelectrically controlled device such that, upon extinction of the flame at the "hot" junction, both "cold" and "hot" junctions are forcibly cooled by unignited combustible gas mixture.

One of the main objects of this invention is to provide forced cooling for the junctions of a thermocouple so that upon extinction of the flame at the "hot" junction, the junctions rapidly attain substantially the same temperature.

Further features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 2 is a sectional view illustrating the application of a thermocouple to a straight type of burner head in accordance with the present invention;

Figure 1A is a more or less diagrammatic view, on reduced scale, illustrating the fuel supply pipe for the burner head shown in Figure 1 and the safety shutoff valve in the fuel supply pipe;

Figure 2 is an end view of the burner head shown in Figure 1;

Figure 3 is a sectional view indicating the application, in the manner of Figure 1, of a thermocouple to an angular type of burner head;

Figure 4 is an end view of the burner head shown in Figure 3; and

Figures 5, 6, and 7 are fragmentary and more or less diagrammatic views illustrating further embodiments of the present invention.

The embodiments of the invention shown in the

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drawings are illustrative of preferred constructions as applied to particular devices. While these applications are described in considerable deail, it is to be understood that this is for purposes of illustration only. Other relationships between the thermocouple and the pilot burner and/or main burner are contemplated within the scope of the present invention.

Referring to Figures 1, 1A and 2 which illustrate the application of a thermocouple following the present invention to a straight type of burner head, a burner casing is indicated at 1. This casing 1 has a threaded aperture 2 to receive a fuel supply pipe 3. A burner face plate is shown at 4 having ports 5, and is held in place in any suitable manner as by means of an externally threaded retaining ring 6. If desired, however, burner face plate 4 may be welded in position in casing 1.

A metal plug 7 is positioned in the burner face plate 4. As illustrated, plug 7 has a shoulder 8 which abuts plate 4 when in position. Plug 7 may be applied to the burner face plate 4 in any suitable manner, as by welding, threading, or, as illustrated, by means of a driving fit. Plug 7 is bored out with bore holes of two diameters. One bore, indicated at 9, is of suitable diameter to be threaded to receive the threaded end of a thermocouple 11, and the other bore, indicated at 10, is of larger diameter so that plug 7 does not touch thermocouple 11 except at the threaded extremity.

In Figure 1, the thermocouple 11 consists of a tubular metal thermo-element 12 enclosing an inner metal thermo-element 13 which is welded or joined at *a* to the closed end of the thermo-element 12. The two thermo-elements 12 and 13 are of different thermoelectric characteristics. The junction of elements 12 and 13 at *a* is the "hot" junction of the thermocouple. The "cold" junctions are located at the junction *b* of the thermo-element 12 and lead member 14, and at the junction *c* of thermo-element 13 and lead member 15. The "cold" junctions are located inside the burner head or immediately adjacent thereto. A straight thermocouple is shown in Figure 1.

In operation, the flame at ports 5 in burner face plate 4 is modulated between two rates of gas flow, one being the full flame in which the flame cones project some distance from the surface of plate 4 and the other being the pilot flame in which the flame cones are quite short. In both cases, heat from the flames at burner face plate 4 flows to the protruding portion of plug 7 and

is conducted to the "hot" junction of thermocouple 11. Leads 14, 15 of the thermocouple are connected to the operating winding of a suitable safety device indicated at S, and the thermoelectric current maintains the said safety device in the "on" or energized position. Should the flames at burner face plate 4 be extinguished, the "hot" junction *a* of the thermocouple will be cooled by the unignited air-gas mixture issuing from burner ports 5, and the "cold" junctions *b* and *c* will be cooled by the relatively cool air-gas mixture flowing to burner ports 5, thereby resulting in a decay of the thermoelectric current and the safety device will move to the "off" or deenergized position.

The safety device may be generally of the type shown and described in the Karrer, and Betz and Karrer patents identified at the beginning of this specification, or of any other suitable or preferred form. Where it is desired to shut off the supply of fuel to the burner when the flames at the burner face plate 4 are extinguished, the safety device may be placed in the fuel supply pipe 3 leading to the burner, as shown at S in Figure 1A, or in any other suitable or preferred manner. The thermocouple leads may be brought out of the fuel pipe 3 for connection with the safety device by means such as a gas-tight compression fitting indicated at F.

The embodiment of the invention shown in Figures 3 and 4 is the same as the embodiment shown in Figures 1 and 2 except that instead of a straight thermocouple as in Figure 1, the thermocouple 11' is bent to conform to the angular type of burner head to which it is applied. The outer thermo-element 12' may be of tubular form as in the preceding embodiment of the invention, or of any other suitable form. The remaining parts in Figures 3 and 4 are designated by primed reference characters corresponding with the reference characters in Figures 1 and 2, and the operation is the same as described in connection with Figures 1 and 2.

In the above, the particular construction described embodies the present invention as regards the forced cooling of the "hot" and "cold" thermojunctions for the case where the pilot or holding flame is the low flame of the gas burner. The "hot" junction *a* is not in direct contact with the flames, there being interposed the plug 7 through which heat is conducted to the "hot" junction. Other relationships between the thermocouple and the pilot and/or main burner flames are contemplated within the scope of the present invention. Some of these other arrangements will be covered by the following description.

Referring to Figure 5, a thermocouple indicated at 40 has a "hot" junction at 41 and "cold" junctions at 42, 42'. The main burner 43 is provided with a suitable gas supply tube 44 through which the leads 45, 46 of the thermocouple extend. The pilot burner 48 is provided with a gas supply tube 48*a*. The hot junction 41 is heated by a pilot flame 47 and, upon extinction of the flame, unlighted gas issuing from pilot burner 48 cools the "hot" junction 41 and gas flowing to the burner 43 cools "cold" junctions 42, 42'. Thermocouple 40 is indicated as of the tubular construction shown more in detail in Figures 1 to 4 inclusive, and projects through the casing of burner 43 and is held by any suitable means, as, for example, by a compression fitting 49 which also prevents the leakage of gas around the thermocouple.

In Figure 6 the thermocouple and its mounting are similar to that in Figure 5, and since these parts have already been described, no further description will be given here. Primed reference characters, corresponding with the reference characters in Figure 5, have been used to designate like parts. In Figure 6 one of the ports 43*a* of burner 43' is arranged to provide a flame 57 for the "hot" junction 41' of the thermocouple 40'. The burner 43' is intended to be operated between high and low positions, and therefore no separate pilot burner is required. If desired, burner 43 in Figure 5 may be provided with an auxiliary port to supplement heating the thermocouple by pilot flame 47 during operation of the main burner. Forced cooling of the thermocouple upon flame extinction takes place at the "hot" and "cold" junctions.

In Figure 7, forced cooling of the thermocouple 60 is accomplished by the gas flowing to and issuing from the pilot burner 68 when the pilot flame is extinguished. Thermocouple 60 has a "hot" junction at 61 and "cold" junctions at 62, 62'. Leads 65—66 are connected to the operating winding of a suitable safety device and to the respective thermo-elements of the thermocouple. "Cold" junctions 62, 62' are located inside the pilot burner housing and are cooled by gas moving toward the pilot burner 68. A suitable compression fitting, as a compression fitting 72, permits bringing the thermocouple leads, the outer one of which may be tubular as shown more in detail in the preceding embodiment of the invention, through the housing of the pilot burner without the leakage of gas. A similar compression fitting 72' permits the hot junction end of the thermocouple to pass through the pilot burner casing without the leakage of gas.

Upon failure of the pilot flame 67 of the embodiment of the invention shown in Figure 7, the "hot" junction is cooled by the relatively cool gas issuing from the pilot burner 68. If desired, an auxiliary port may be provided on the main burner 43'' to direct a flame to the "hot" junction of the thermocouple 60, thereby augmenting the heating of the thermocouple during the operation of the main burner. Here again, the extinction of the burner flames results in relatively cool gas forcibly cooling the "hot" and "cold" junctions of the thermocouple.

The embodiments of the invention shown in the drawings are for illustrative purposes only, and it is to be expressly understood that said drawings and the accompanying specification are not to be construed as a definition of the limits or scope of the invention, reference being had to the appended claims for that purpose.

I claim:

1. A burner control apparatus comprising, in combination, a fuel supply pipe, a high and low flame burner comprising a casing on the outer end of said pipe and forming with said pipe a fluid supply conduit and a burner face plate carried by said casing and having ports opening therethrough for maintaining a flame outside said plate, a heat conducting member extending on the outer side of said face plate and having an aperture in communication with the interior of said burner casing, said member being subject to the heat of the flame maintained by said ports, a thermocouple extending through said face plate and into said heat conducting member comprising a pair of thermocouple elements joined to form a "hot" junction within said heat conducting member and subject to the heating

of said member by the flame, and lead conductors extending through said fuel supply pipe and joined to said thermocouple elements to form "cold" junctions at least one of which is disposed within the fuel supply conduit to be cooled by the relatively cool fuel flowing through said conduit.

2. A burner control apparatus comprising, in combination, a fuel supply pipe, a high and low flame burner comprising a casing on the outer end of said pipe and forming with said pipe a fluid supply conduit and a burner face plate carried by said casing and having ports opening therethrough for maintaining a flame outside said plate, a heat conducting member extending on the outer side of said face plate and having an aperture in communication with the interior of said burner casing, said member being subject to the heat of the flame maintained by said ports, and a thermocouple extending through said face plate and into said heat conducting member comprising a pair of thermocouple elements joined to form a "hot" junction within said heat conducting member and subject to the heating of said member by the flame.

3. A burner control apparatus comprising, in combination, a fuel supply pipe, a high and low flame burner comprising a casing on the outer end of said pipe and forming with said pipe a fluid supply conduit and a burner face plate carried by said casing and having ports opening therethrough for maintaining a flame outside said plate, a heat conducting member carried on the outer side of said face plate and subject to the heat of the flame maintained by said ports, a thermocouple comprising an outer tubular thermocouple element extending through said plate and into said heat conducting member and secured therein, and an inner thermocouple element disposed within said outer tubular thermocouple element and joined at its outer end to the outer end of said outer tubular thermocouple element to form a "hot" junction subject to the heating of said heat conducting member by the flame.

4. A burner control apparatus comprising, in combination, a fuel supply pipe, a high and low flame burner comprising a casing on the outer end of said pipe and forming with said pipe a fluid supply conduit and a burner face plate carried by said casing and having ports opening therethrough for maintaining a flame outside said plate, a heat conducting member carried on the outer side of said face plate and subject to the heat of the flame maintained by said ports, a thermocouple comprising an outer tubular thermcouple element extending through said plate and into said heat conducting member, an inner thermocouple element disposed within said outer tubular thermocouple element and joined at its outer end to the outer end of said outer tubular thermocouple element to form a "hot" junction subject to the heating of said heat conducting member by the flame, an outer tubular lead conductor joined to the inner end of said outer tubular thermocouple element to form a first "cold" junction, and an inner lead conductor disposed within said outer tubular lead conductor and joined to the inner end of said inner thermocouple element to form a second "cold" junction, said thermocouple being disposed with the "cold" junction between the tubular thermocouple element and the tubular lead conductor within the fuel supply conduit to be cooled by the relatively cool fuel flowing through said conduit and with the "cold" junction between the inner thermocouple element and the inner lead conductor within the tubular enclosure formed by said tubular thermocouple element and said tubular lead conductor.

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