May 12, 1936. D. B. WILLIAMSON 2,040,229

PILOT CONTROLLED VALVE

Filed March 29, 1934 2 Sheets-Sheet 1

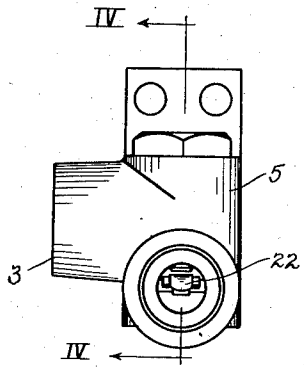

Fig. II

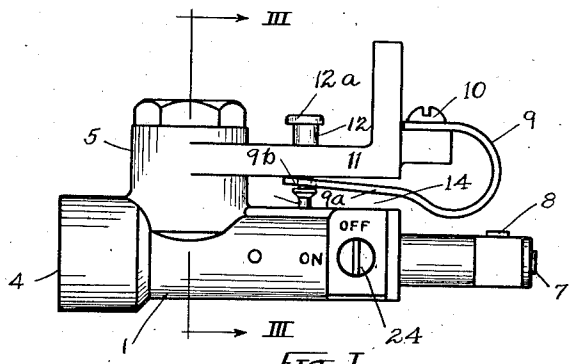

Fig. I

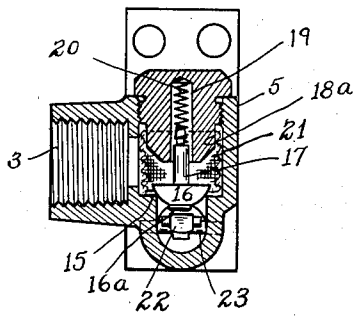

Fig. III

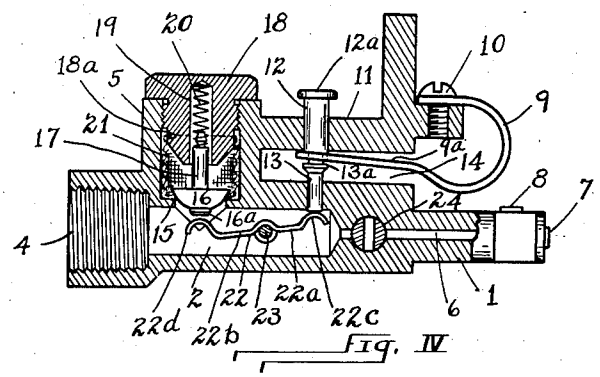

Fig. IV

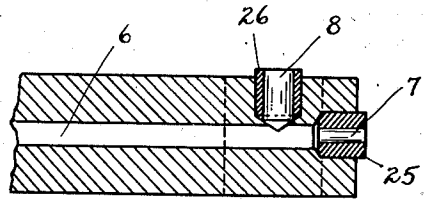

Fig. V

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PILOT CONTROLLED VALVE

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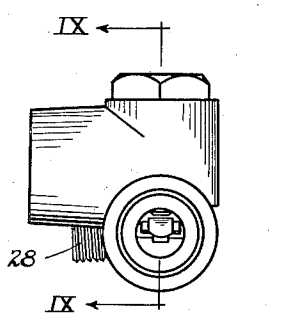


Fig. VII

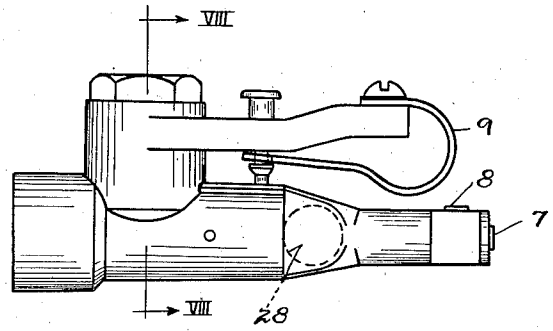


Fig. VI

Fig. VIII

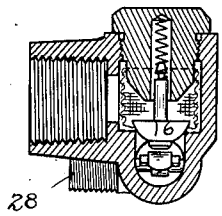
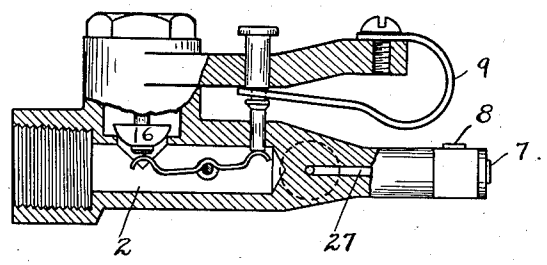


Fig. IX



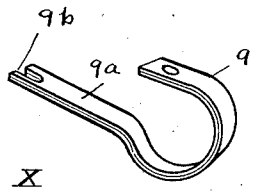


Fig. X

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UNITED STATES PATENT OFFICE

2,040,229

PILOT CONTROLLED VALVE

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Application March 29, 1934, Serial No. 717,930

1 Claim. (Cl. 158—117.1)

This invention relates to a pilot controlled valve for fluid burners.

In various fluid burners, such as those used in conjunction with heating furnaces, water heaters, and the like, it is of great importance that a pilot flame be maintained at all times when there is a possibility that fluid fuel may be passed to the burner. If the burner be connected for the use of a liquid fuel, the opening of the main fuel supply to the burner at a time when the pilot flame is not in existance, results in waste of the fuel, and in the formation of a pool of the liquid fuel which may be difficult to remove, in fouling the burner, and may even result in the formation of an explosive mixture. If a combustible gas is the fluid fuel supply, there is a waste of fuel under such circumstances, and an explosive mixture is almost inevitably formed. The extinguishment of the pilot flame without synchronous checking of the flow of gas to the burner creates a highly dangerous condition.

For the foregoing reasons various pilot controlled valves have been devised to automatically cut off the main flow of fluid fuel to a burner upon extinguishment of the pilot flame.

One object of this invention is to provide a pilot controlled valve which is of improved simplicity in structure and positiveness in operation, and which is of great compactness to adapt it to use in connection with burners so installed that a loosely constructed or bulky pilot controlled valve could not, with satisfaction, be used.

Another object of this invention is to provide a pilot controlled valve which is of unitary construction, and such that no adjustments are made or required either in its assemby or normal use.

Still another object of the invention is to provide a pilot controlled valve in which the pilot fuel is cut off by the valve which cuts off the main gas supply, so that upon extinguishment of the pilot flame, the pilot supply, as well as the main fuel supply, is cut off.

In the accompanying drawings Fig. I is a side elevation of the most highly specialized form of the pilot controlled valve; Fig. II is a rear elevation of the pilot controlled valve shown in Fig. I; Fig. III is a vertical cross section taken on the line III—III of Fig. I; Fig. IV is a vertical longitudinal section taken on the line IV—IV of Fig. II; Fig. V is a detail view taken in vertical longitudinal section through the pilot burner, and illustrating a preferred form and arrangement of pilot tips; Fig. VI is a side elevation of the less specialized form of the pilot controlled valve; Fig. VII is a rear elevation of the pilot controlled valve shown in Fig. VI; Fig. VIII is a vertical cross section taken on the line VIII—VIII of Fig. VI; Fig. IX is a vertical longitudinal section taken on the line IX—IX of Fig. VII; and Fig. X is an isometric detailed view of the bimetallic element which acts under differences of temperature, attendant upon the presence or absence of the pilot flame to control the valving element in the main fuel passage of the apparatus.

Referring to the particular form of the pilot controlled valve shown specifically in Figs. I to IV inclusive of the drawings, reference numeral 1 designates the body of the apparatus, which may be, as shown, a single integral casting. Within the body 1 is a chamber 2. The body has a fuel inlet 3 and a fuel outlet 4, both in the form of internally threaded barrels. Fuel inlet 3 communicates with a third barrel 5, which is in immediate communication with chamber 2, and in which there is mounted the main valve assembly of the apparatus, as will be hereinafter in detail described. A pasasge 6 leads forwardly from chamber 2 to the pilot outlets 7 and 8.

The valve controlling means comprise a crook-shaped bimetallic element 9, which has the loop terminal thereof attached by means of a set-screw 10 to a bracket 11 which extends forwardly in parallel relation to the forward portion of the body 1. It will be observed that the loop or hook of the bimetallic element 9 is so disposed that flame from the pilot tip 8 serves directly to heat this portion of the element. Means are provided for transmitting to the main valve of the apparatus movement of the bimetallic element resulting from temperature changes in the element.

The operating connections from the bimetallic element to the valve comprise a pin slidably mounted in the body portion of the apparatus and in the bracket 11. The outer portion 12 of this pin, slidably mounted in bracket 11, has thereon a thumb buttom 12*a*; and the inner portion 13 of the pin, slidable in body 1, projects into the chamber 2 in the body.

The leg 9*a* of bimetallic element 9 extends rearwardly into the interval between body 1 and bracket 11 of the apparatus and inclines toward the bracket. This leg 9*a* is forked terminally at 9*b* to embrace the inner portion 13 of the pin. It will be noted that the inner portion 13 of the pin is of lesser diameter than the upper pin por-

tion 12, and that it is provided with a collar 13a in the interval 14 lying between the body 1 and bracket 11. Collar 13a is so positioned that a seat for the forked terminal 9b of the bimetallic element is provided between collar 13a and the inner shoulder on outer pin portion 12. The seat so provided is of substantially greater width than the thickness of the bimetallic element 9, so that there is no binding effect between the bimetallic element and the stem, and adequate play of the bi-metallic element to act upon the pin is permitted.

It is to be understood that the effect of heat on bimetallic element 9 is to produce a straightening tendency, which causes leg 9a of the element to bear upon collar 13a and force inner pin portion 13 radially inward of the chamber 2. Conversely, cooling of bimetallic element 9 produces a shortening or curling tendency, which causes the leg 9a to bear against the under face of the pin portion 12 and thereby move inner pin portion 13 radially outward in chamber 2.

The main valve of the apparatus comprises an annular valve seat 15 at the point of communication between secondary inlet barrel 5 and internal chamber 2. The seating element 16 of the valve is of inverted bell shape, and has on its convex surface a contact boss 16a. Valve stem 17 extends from the opposite, or concave face, of the seating element. As shown, a plug 18 is screw-threaded into the barrel 5 and has therein a bore of substantially greater diameter than the diameter of the valve stem 17. This bore 19 serves to house a light coil spring 20 which engages the valve stem.

This structure and mounting permits the convex face of bell-shaped seating element 16 to find its seat on the valve seat 15, and thus allows a wiping action which tends to keep both the valve seat 15 and the convex face of the seating element clean and polished.

It will be noticed that inlet 3 and secondary inlet barrel 5 are arranged at an angle to each other. This arrangement permits the use of a screen of very simple form at the communication between these two elements. As shown, the screen 21 is of wire cloth in the form of a cylinder to lie against the inner wall of barrel 5, and is held in place by the lower inset portion 18a of plug 18. Since it is so mounted, screen 21 may consist merely of a strip of wire cloth of suitable width, and of such length that its edges lap slightly when it is curled into a cylinder and inserted in the barrel.

The arrangement of the plug 18 in barrel 5, with bore 19, which houses the spring 20 and limits its angular movement of the valve stem and seating element, and with lower inset portion 18a which holds screen in place, gives a desirable compactness and coherence to the assembly.

Opened and closed positions of the valve are produced respectively by lifting seating element 16 from its seat, and by permitting it to find its seat under the influence of coil spring 20. The valve lifting means is housed in the chamber 2, and is operable both manually, and automatically under the influence of bimetallic element 9. The valve lifting means comprise a lever 22 pivoted on a cross pin 23. This lever 22 may be, as shown, a relatively small strip of light gauge metal, having its legs 22a and 22b, which extend oppositely from the pivot, deformed into hooks 22c and 22d. These hooks are shaped to provide convex faces presented one to the inner extremity of pin portion 13 and the other to the contact boss 16a on the convex face of seating element 16.

It is to be noted that the lever arm 22b is of greater length than the arm 22a. This diversity in length gives increased travel at the extremity of arm 22b with respect to travel at the extremity of arm 22a. Hook 22c contacts the inner face of inner pin portion 13, and hook 22d acts upon contact boss 16a of valve seating element 16, but a slight gap exists between hook 22d and boss 16a in the inactive position of the lever, to prevent any unseating pressure of the lever against the seating element of the valve. Hence the upward extent of hook 22d is made such that the hook is out of contact with boss 16a in inactive condition; that is, when bimetallic element 9 is unheated. Also in this position hook 22c bears lightly, if at all, against the inner extremity of inner pin portion 13.

The above-noted mounting and proportioning avoids accidental unseating of the valve seating element, since a substantial travel of the actuating pin, under the influence of bimetallic element 9 is necessary in order to unseat valve element 16. This results in a definite and positive seating and unseating action under the influence of coil spring 20 on the one hand and the influence of bimetallic element 9 on the other hand. The formation of lever 22 is such that it provides, within small compass, an effectively great length of valve-lifting movement, which contributes permissively to the positive seating and unseating of the valve, and the prevention of accidental valve unseating.

It may here be noted that the structure and mounting of the lever actuating pin is such as to prevent leakage around inner pin portion 13 in the bore in which it is mounted. To this end, the pin is desirably polished, and has as close a fit in its bore as is compatible with sliding movement therein. The bore is sealed by collar 13a, which in open valve position bears firmly against the outer surface of the body structure. If desired, the body in the region surrounding the bore of pin portion 13 may have inset therein a pad of suitable compressible heat-resisting material.

As to the detail structure of the pilot burner it will be noted that a plug valve 24 is provided to control the passage of liquid fuel to the pilot outlets. This control permits the pilot flames to be adequate under various pressures of the fluid fuel, without wasting fuel by supplying it in unnecessarily great volume to the pilot burner.

Referring to Fig. V it will also be noted that the effective cross-sectional area of outlet 7, which is directly in line with pilot fuel passage 6, is less than the effective cross section of outlet 8. This diversity is to compensate for the directness in the flow of fuel through outlet 7, the outlet for ignition of a main burner, and to direct an adequate volume of fuel through pilot outlet 8, which serves directly to heat the bimetallic element 9. The diversity in the effective cross-sectional area of the outlet bores is obtained by a relatively greater wall thickness of burner tip 25, in outlet 7, with respect to the wall thickness of burner tip 26, in outlet 8. These burner tips have a driving fit in the outlet openings, and in order that they may be driven, I make them of some suitable non-corrosive metal, such as Monel metal.

To describe the operation of the apparatus it will be assumed that the valve is closed, with no fuel passing through the apparatus to a main burner, and consequently with no fuel passing to the pilot burner. It may be assumed, however,

that plug valve **24** is in position to permit flow of fuel to the pilot burner through passage **6**. In order that fuel may be supplied through the valve to use, pressure is brought to bear manually on thumb button **12***a* on outer pin portion **12**. This forces the pin inwardly, and causes the inner pin portion **13**, bearing against arm **22***a* of lever **22**, to force arm **22***b* of the lever outwardly. Hook **22***d* on the lever, thus contacts boss **16***a* on seating element **16**, and forces the seating element from seat **15** against the resistance of coil spring **20**. Fuel can thus pass both through the valve outlet **4**, and through passage **6** to the pilot burner, and may be ignited at the pilot burner.

Under the heating effect of a flame jet from outlet **8** of the pilot burner, bimetallic element **9** heats rapidly. It is necessary to apply manual pressure to lever operating pin for only a few seconds, before bimetallic element **9** becomes so heated that it acts to maintain the valve in open position.

Let it be assumed that the pilot flames are both blown out, due, for example, to slamming a door in the locality of the pilot valve. Under such circumstances bimetallic element **9**, in contracting, moves the control pin outwardly, so that it does not exert inwardly directed force on lever **22**, and outwardly directed force on seating element **16**. Coil spring **20**, therefore, causes seating element **16** to find its seat, cutting off flow of fuel through the valve. It is to be noted that with the seating of the main valve element of the apparatus, fuel no longer passes to the pilot burner irrespective of the position of plug valve **24**. Passage of fuel through the valve is thus totally cut off.

In the modified form of pilot controlled valve shown in Figs. VII to IX inclusive of the drawings, the mechanism is identical with that shown in Figs. I to IV inclusive of the drawings save in the supply of fluid fuel to the pilot burner. In this modified form, passage **27**, conducting fuel to the pilot burner does not extend through to chamber **2** within the body **1** of the valve. Passage **27** does communicate with an independent pilot inlet **28**, which is not provided in the more specialized form of the valve. Since, moreover, the passage of fuel to the pilot burner may be readily controlled by an externally arranged valve, no control valve, such as the plug valve **24** shown in the preceding figures of the drawings, is provided.

The main supply valve is opened merely by relasing and igniting fuel at the pilot burner. The jet of flame from outlet **8** then acts upon bimetallic element **9** to unseat valve seating element **16**. It will be noted that this unseating is effected wholly by the transmitted forces originating in bimetallic element **9** through the valve actuating pin, and that no force is applied manually to the valve actuating pin.

Should flame from the pilot burner be blown out, or otherwise lost, contracting action of bimetallic element **9** acts to release the main valve, and to permit return of seating element **16** to its seated position.

In this modification of the pilot controlled valve, the seating of the main valve to cut off the flow of main supply fuel through the valve apparatus does not cut off the supply of fuel to the pilot burner, and if the loss of flame at the pilot burner is caused by the blowing-out of the flame, rather than by an obstruction to the passage of fuel to the burner there is waste of fuel in the pilot until it has been re-ignited.

Under many conditions when gaseous fuel is used, the relatively small volume of fuel escaping at the pilot burner is wholly inadequate to create an explosive mixture, and is not sufficient to cause material waste or create other conditions which are substantially disadvantageous. Under certain conditions, and particularly when liquid fuel is used, the more specialized form of the pilot controlled valve shown in Figs. I to IV inclusive, of the drawings, should be used. In either form of the pilot controlled valve, extinction of the pilot flame automatically cuts off the main fuel supply.

The use of this pilot controlled valve is not limited to the control of a flow of combustible gas, although that is the use to which it is most naturally put. The pilot controlled valve may also be used with advantage in controlling the flow of various liquid fuels, such as distillates of petroleum and coal, alcohol, and the like.

To one skilled in the art and the advantages derived from the structural simplicity and compactness of this pilot controlled valve, as well as from the positiveness and rapidity of its operation, are at once apparent.

I claim as my invention:

In a device of the character described, a body member having a passage therethrough, a valve member within said body member dividing said passage into inlet and outlet passages, a spring normally urging said valve member to closed position, a tubular extension integral with said body having a pilot jet on its end remote from the body and communicating with said outlet passage, a lever pivotally mounted intermediate its ends in said outlet passage, one end of said lever being positioned to engage said valve member, a plunger mounted in a wall of said outlet passage in position to engage the end of said lever remote from said valve member, an arm on said valve body extending in spaced parallel relation to said outlet passage, said plunger extending through said arm whereby it may be manually actuated to open said valve member, a bowed bimetallic thermostat rigidly mounted on said arm with the bowed portion in position to be heated by said pilot jet, said thermostat having a portion extending between said arm and said body and engaging said plunger whereby said thermostat holds said valve member in open position when heated by said pilot.

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