

May 21, 1940.

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2,201,398

SAFETY CONTROL FOR GAS BURNING APPLIANCES

Filed June 14, 1937

3 Sheets-Sheet 2

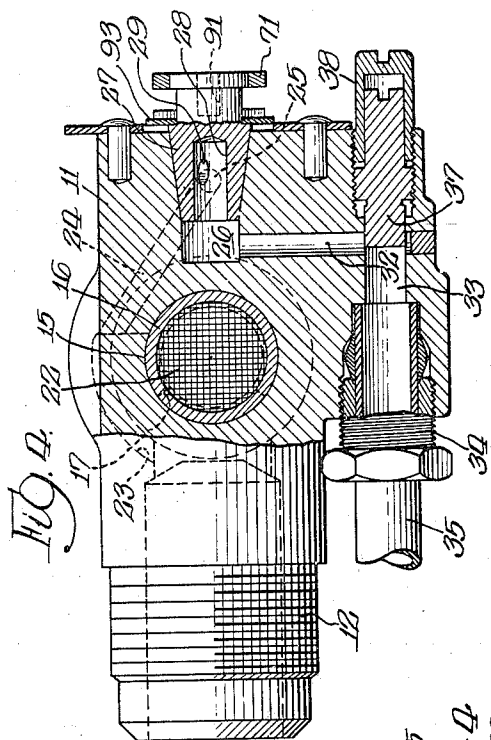


FIG. 6.

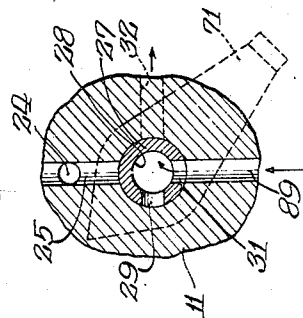


FIG. 5.

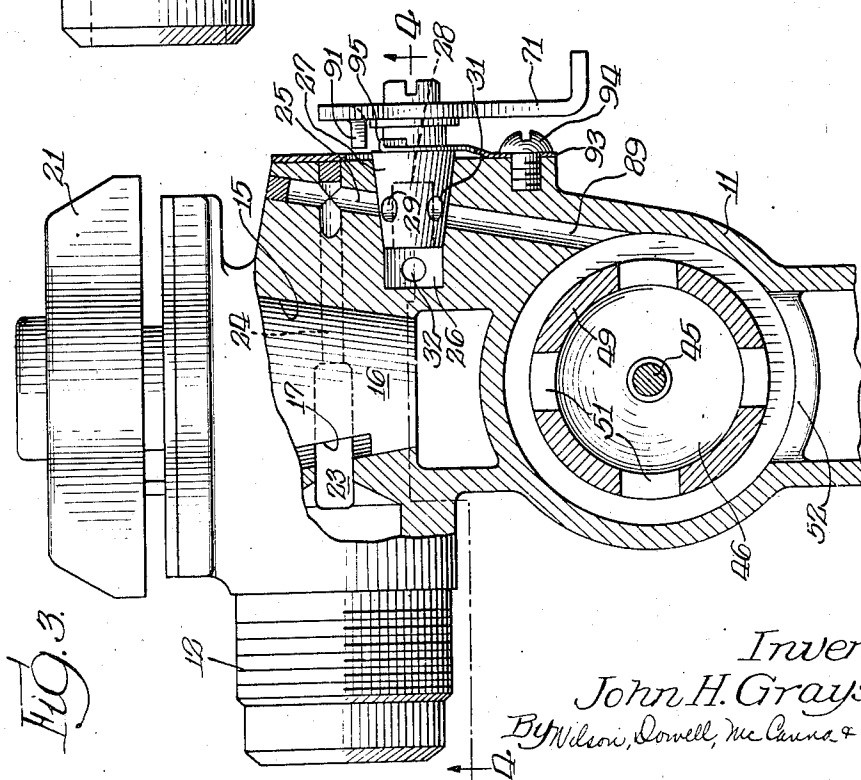
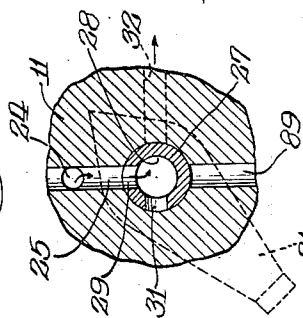


FIG. 3.

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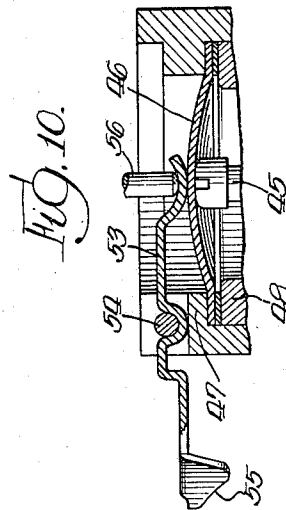
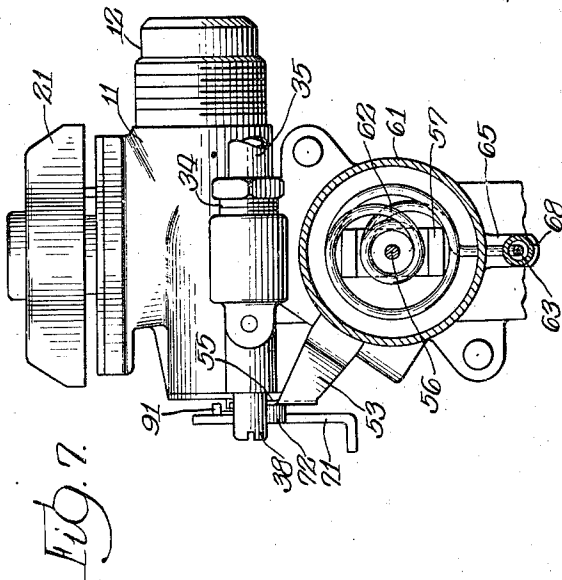
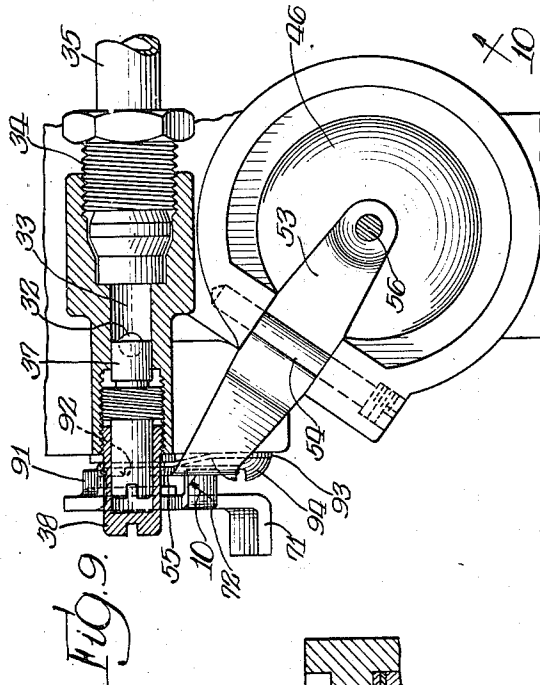
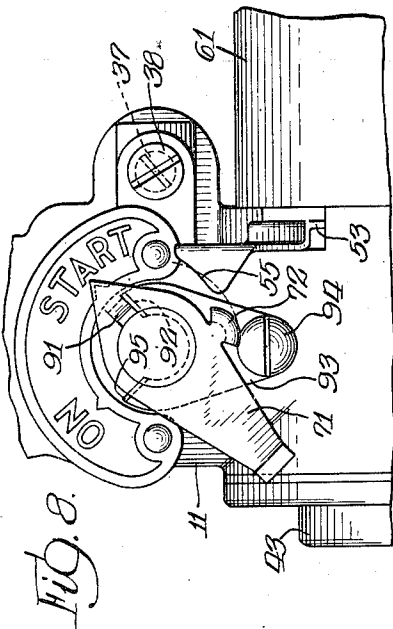
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SAFETY CONTROL FOR GAS BURNING APPLIANCES

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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SAFETY CONTROL FOR GAS BURNING
APPLIANCES

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Application June 14, 1937, Serial No. 148,036

6 Claims. (Cl. 158—117.1)

This invention pertains to gas burning appliances and while the principles thereof may be utilized in controlling the fuel supply in many different types of gas burning devices, the invention is here shown and described for illustrative purposes merely, as being embodied in an apparatus for controlling the fuel supply to a gas burning domestic water heater.

One of the primary purposes of my invention is to provide a fuel control which in normal operation will thermostatically regulate the fuel supply to the main or heating burner so as to maintain a quantity of water heated to a predetermined temperature and which, upon extinguishment of the pilot burner by which the main burner is lighted, will automatically and completely shut off the fuel supply not only to the main burner but also to the pilot burner so that no fuel can escape through either burner until the device has been manually reset and the pilot burner has been relighted.

Another object of the invention is to provide for a control device of this character a starting mechanism which, when set to starting position, will connect the pilot burner with the fuel supply ahead of the safety valve so that said burner may be relighted and when subsequently set to operative position will open the safety valve to permit a fuel flow to the main burner and will simultaneously switch the fuel supply to the pilot burner from a point in front of the safety valve to a point rearwardly of this valve so that when the safety valve subsequently closes it will shut off the fuel supply not only to the main burner but also to the pilot burner.

Another feature of my invention resides in the employment of a thermomagnetic device for normally maintaining the safety valve in open position, which device embodies a thermocouple positioned to be energized by the heat from the pilot burner so that when so energized it will maintain the safety valve in open position but when deenergized by extinguishment of the pilot burner will permit the safety valve to be promptly closed.

Another object of the invention is to provide a compact and reliable unit embodying a thermostatic control valve, a thermomagnetically controlled safety valve, and a manually adjustable shut-off valve by which the fuel supply to both the safety valve and the thermostatic valve may be shut off when desired.

Another feature of the invention resides in the manually operable starting device by which the fuel supply to the pilot burner is initially estab-

lished independently of the safety valve and is subsequently established at a point rearwardly of the safety valve so that closure of this valve will shut off the fuel supply to the pilot burner, and furthermore the same manipulation of the starting device which switches the source of fuel supply to the pilot burner, automatically opens the safety valve so that the fuel supply to the pilot burner is not interrupted.

Additional advantageous features of the invention will be found in the construction, arrangement and novel combination of the various elements, all of which will be apparent as the same become better understood by reference to the following description when considered in connection with the accompanying drawings.

Referring to the drawings:

Fig. 1 is a longitudinal sectional view through a control device embodying the principles of my invention;

Fig. 2 is a fragmentary elevation showing the upper portion of the device;

Fig. 3 is a partial elevation and partial section taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional view on the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary sectional view through the starting valve, the parts being shown in starting position;

Fig. 6 is a similar view showing the position of the parts during normal operation;

Fig. 7 is a fragmentary view, partially in elevation and partially in section, taken on the line 7—7 of Fig. 1;

Fig. 8 is a fragmentary view similar to Fig. 2 showing the parts on an enlarged scale;

Fig. 9 is a sectional view on the line 9—9 of Fig. 2; and

Fig. 10 is a sectional view on the line 10—10 of Fig. 9.

Referring now to the drawings more in detail, it will be observed that the device comprises essentially an elongated casing 11 provided near one end with a laterally extending intake nipple 12 adapted to be connected with a gas main or other source of fuel supply and an outlet nipple 13 designed to be connected by suitable piping with the main or heating burner of the appliance, a fragment of such burner being shown at the right in Fig. 1 and designated by reference character 14.

The upper portion of the casing is shaped to provide a tapered valve seat 15 adapted to accommodate the tapered shut-off cock 16 of hollow construction having one side cut away as

indicated at 17 (Fig. 3) to afford communication between the nipple 12 and the bore of the cock through which the fuel is delivered into the casing of the device when the cock is in the open position shown in Fig. 4. The size of the opening and consequently the fuel flow may be regulated by an adjustable plug 19 in the bore of the cock. The cock may be manipulated by the usual disk or handwheel 21. A screen 22 disposed across the bore of the cock protects the automatic control valves against entrance of rust flakes or other solid particles from the fuel supply line which might when lodged upon the seats interfere with the closing of these valves.

An arcuate passage 23 around the cock plug 16 communicates through a horizontal passage 24 and an inclined vertical passage 25 with a chamber 26 formed in the body of the casing and tapered throughout a portion of its length to receive a tapered valve plug 27 having a cored passage 28 extending from its inner end and a pair of ports 29 and 31 communicating with said passage. A passage 32 leads from chamber 26 to a passage 33 (Fig. 4) in a lateral extension of the casing body, which latter passage communicates through a suitable coupling connection 34 with a tube 35 connected as shown in Fig. 1 with a pilot burner 36. An adjustable valve 37 threaded into the outer end of passage 33 may be regulated to control the flow of fuel to the pilot burner from the passage 32, this valve being normally protected against tampering by a protective cap 38. When the parts are in the position shown in Fig. 5, a continuous conduit for the flow of fuel from the supply nipple 12 to the pilot burner 36 is established through conduit 24 and 25, port 29, bore 28, chamber 26, conduits 32 and 33, and tube 35.

The casing 11 beneath the cock 16 is provided with a valve seat 39 against which a valve 41 is urged by a spring 42 and access to which may be had by removal of the cap 43. The valve stem comprises two relatively adjustable parts 44 and 45, the latter of which engages a flexible sealing disk 46 clamped around its peripheral margin between a shoulder 47 formed in the casing and the annular end portion 48 of a cage 49 formed integrally with the valve seat 39 and provided with radial ports 51 through which gas passing the valve may flow to exit through the passage 52.

The opposite face of the disk 46 is engaged by the curved end of a lever 53, best illustrated in Fig. 10, fulcrumed upon a pin 54 and provided at its outer end with a laterally offset cam 55, the purpose of which will be later explained. A stem 56 abutting the outer face of lever 53 and extending through the base of a horseshoe magnet 57 carries at its outer end an armature bar 58 which is urged toward the poles of the magnet by a light spring 59 interposed between this bar and the surrounding shell 61. Spring 42 being much stronger than spring 59 tends to hold the parts in the position shown in Fig. 1.

The horseshoe magnet 57, which is not of the permanent magnetization type, is wrapped by the coils 62 of a wire 63, one end of which is anchored at 64 to a conducting member 65 upon which the base of the magnet is mounted and the other end is connected with one element 66 of a thermocouple, the other element 67 of which is connected through a tube 68 with the conducting member 65. The thermocouple is supported by a bracket 69 in position to be heated by the pilot burner 36 to thereby establish an

electric current through the coils 62 of sufficient strength to energize the magnet 57 and hold the armature 58 in contact therewith against the force of spring 42 when once the armature has been brought into contact with the magnet in a manner which will now be explained. Upon the outer end of the pilot burner light control valve plug 27 there is fixedly mounted a hand operable lever 71 provided, as shown in Figs. 2 and 8, with a laterally projecting cam member 72 positioned to cooperate with the cam 55 and rock the lever 53 on its pivot as the lever 71 is moved from the position shown in Fig. 2 to that shown in Fig. 8. This actuation of the lever will cause the inner end thereof to flex the diaphragm 46 and push the valve 41 away from its seat against the action of spring 42. Simultaneously armature bar 58 will be urged by spring 59 against the poles of the magnet 57, and if the magnet be energized the armature will be magnetically held in contact therewith to retain valve 41 in open position. Flow of fuel to the main burner will accordingly be permitted subject, however, to control by the thermostatic valve mounted in the casing 11 beneath the thermostatically controlled valve.

The thermostatic valve designated by reference character 73 is urged against its seat 74 by a spring 75. This valve is controlled by a thermostat comprising a tube 76 having a high coefficient of expansion mounted at its inner end in a nipple extension 77 of the main casing and a rod 78 having a low coefficient of expansion threadedly connected at 79 to a plug 81 anchored in the outer end of tube 76 and adapted upon contraction of tube 76 to exert a thrust through a cap 82 against a thrust member 83 within the casing. This thrust member is provided with an annular knife-edge shoulder 84 adapted to cooperate with a companion annular shoulder 85 to flex a thin metal clicker disk 86 from the position shown in Fig. 1 to a reverse convex position to thereby force the valve 73 off from its seat. Adjustment of the thermostat may be effected through a lever 87 secured by a set screw 88 or otherwise to the outer end of the rod 78 in the usual manner.

During normal operation of the control, the safety valve 41 is, of course, open as previously explained, and the flow of fuel to the main heating burner is controlled by the thermostatic valve 73 which is opened by the clicker disk 86 upon contraction of the thermostat tube 76 when the temperature of the surrounding medium falls below a predetermined point and is again closed by the spring 75 when, as the result of a higher temperature of the medium being controlled, the tube 76 expands sufficiently to permit the clicker disk 86 to reassume the position shown in Fig. 1.

During this operation the lever 71 is set to the position indicated "on" in Fig. 2 and illustrated in dotted lines in Fig. 6. In this position of the lever and the valve 27, the fuel to the pilot burner 36 is supplied not through the passages 24 and 25 as it was when lever 71 was moved to start position but is supplied through a passage 89 (Figs. 3 and 6) which communicates at its lower end with the chamber between the safety valve 41 and the diaphragm 46. In other words the fuel is supplied to the pilot burner rearwardly of the safety valve 41 so that when this valve is closed the supply of fuel to the pilot burner is shut off, thereby precluding fuel loss from the pilot burner.

Assuming that the pilot burner is extinguished, 75

the parts are in the position shown in Fig. 1 and that it is desired to start operation, the modus operandi is as follows: Lever 71 is swung to start position shown in Figs. 5 and 8, its movement being limited by engagement of a rearwardly projecting finger 91 with an abutment 92 (Fig. 8) carried by a spring plate 93 which overlaps the head of the plug valve 27 to hold the plug against its seat, this plate being secured in position by a screw 94. The other prong of the plate is provided with an abutment 95 in the path of the finger 91 to limit swinging movement of lever 71 in the opposite direction. Movement of lever 71 to start position brings port 29 and valve plug 27 into alignment with passage 25, thereby permitting a flow of fuel from the intake nipple 12 of the device to the pilot burner 36 through the route previously described. The fuel issuing from the pilot burner is now lighted by a match or otherwise and the heat therefrom directed against the thermocouple 66, 67 generates an electric current which passes through the energizing coils 62.

After the lapse of a time interval sufficient to energize the magnet 57, the lever 71 is swung in a counterclockwise direction, viewing Figs. 2 and 8, to the "on" position illustrated in Fig. 6. This movement shuts off the passage 25 and simultaneously establishes communication between the safety valve chamber at the delivery side of the valve and the pilot burner. This movement of the starting lever 71 wipes the cam member 72 across the lever cam 55, thereby swinging the lever 53 in a clockwise direction, viewing Fig. 10, and to the left, viewing Fig. 1, to open safety valve 41 and permit the armature bar 58 to engage or approach the poles of the electromagnet 57 under the influence of spring 59. While the electromagnet is not strong enough to pull the bar 58 against the force of spring 42, it is sufficiently strong to hold the bar against the end of its poles against the force of this spring when the magnetic circuit is closed through the bar. The electromagnet, therefore, will hold the safety valve in open position so long as the electromagnet remains energized by the thermocouple under the influence of the flame from the pilot burner. Fuel will, therefore, flow to the main burner under the control of the thermostatic valve 73 so long as the pilot burner remains lighted. Upon extinguishment of the pilot burner, however, the resultant decrease in energization of the electromagnet will promptly permit the safety valve 41 to be closed by the spring 42 even before the electromagnet is completely deenergized. This closing of the valve shuts off the fuel supply both to the main burner and to the pilot burner so that no fuel loss will occur while the apparatus remains inoperative. The fuel supply will thus remain shut off irrespective of the position of the thermostatic valve 73 until the starting lever 71 is again moved to start position and the pilot burner has been relighted, whereupon after a suitable interval the starting lever may be moved to "on" position and normal operation will ensue.

While I have shown and described a preferred embodiment of my invention, obviously the structural elements disclosed for illustrative purposes merely are capable of considerable modification and variation without departure from the essence of the invention as defined in the following claims.

I claim:

1. In a fuel control device, the combination of a casing, a safety fuel valve therein, a pilot burner,

a pilot burner control valve, conduits extending from said control valve into said casing both forwardly and rearwardly of said safety valve, manually operable means for positioning said control valve to supply fuel to the pilot burner from forwardly of the safety valve for starting purposes and for subsequently positioning said valve to supply fuel to the pilot burner from a point rearwardly of the safety valve, and means operable by said manual means for opening said safety valve when the control valve is moved from said first position to said second position.

2. In a fuel control device, the combination of a safety valve, a pilot burner, a pilot burner control valve connected to supply fuel to the pilot burner from a point forwardly of said safety valve or from a point rearwardly thereof, manually operable means for positioning said control valve, and means positioned to be operated by said manually operable means for opening said safety valve when said control valve is moved to a position to supply fuel to the pilot burner from a point rearwardly of the safety valve.

3. In a fuel control device, the combination of a casing, a safety valve, and a pilot control valve mounted in said casing, a pilot burner connected with said control valve, a conduit in a wall of the casing connecting said control valve with the interior of the casing forwardly of the safety valve for supplying fuel to the pilot burner for starting purposes, a conduit in the casing establishing communication between said pilot control valve and the interior of the casing rearwardly of the safety valve for supplying fuel to the pilot burner for normal running purposes, a common manually operable means for opening the safety valve and simultaneously moving the pilot valve from starting to running position, and means rendered operative by the flame of the pilot burner for holding said safety valve in open position.

4. In a fuel control device, the combination of a casing forming a conduit for supplying fuel to a heating burner, a safety valve mounted in said casing for controlling the flow of fuel there-through, a pilot burner, a pilot control valve mounted in the casing, branch conduits formed in the casing walls establishing communication between said pilot control valve and the conduit through the casing at points forwardly and rearwardly, respectively, of said safety valve, the pilot valve being adapted to be positioned to supply fuel to the pilot burner from a point forwardly of the safety valve for starting purposes and from a point rearwardly of the safety valve for running purposes, a control valve operating member, means including a cam and a lever operable by said member upon movement of the pilot valve from starting to running position for opening said safety valve, and means controlled by the flame of the pilot burner for holding said safety valve in open position.

5. In a fuel control device, the combination of a safety valve, a pilot burner, a control valve connected to supply fuel to the pilot burner from one source for starting purposes and from another source for running purposes, a manually operable device whereby said control valve may be positioned, means operable by said device to open said safety valve upon movement of said device from starting to running position, and means rendered operative by a flame from said pilot burner for preventing the closing of said safety valve so long as the pilot burner remains lighted.

6. In a fuel control device, the combination of a safety valve, a pilot burner, a control valve arranged to supply fuel to the pilot burner from a point forwardly of the safety valve for starting purposes and from a point rearwardly of the safety valve for running purposes, a manually operable device whereby said control valve may be positioned, means operable by said device to open said safety valve upon movement of said device from starting to running position, and means rendered operable by a flame from said pilot burner for preventing the closing of said safety valve so long as the pilot burner remains lighted. 5

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