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SAFETY VALVE

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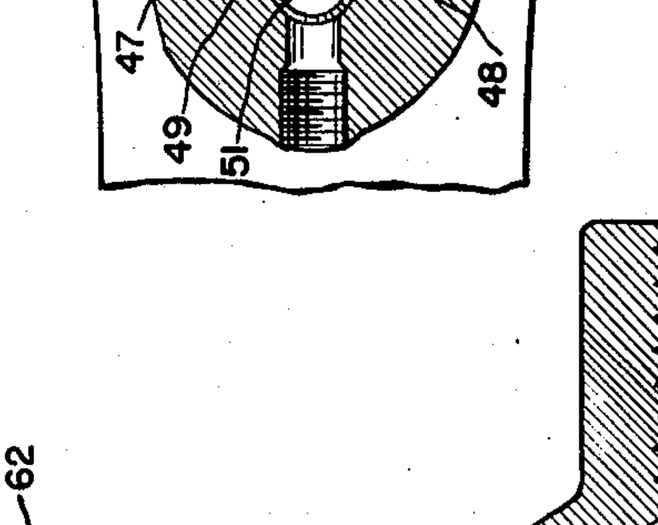

FIG. 2

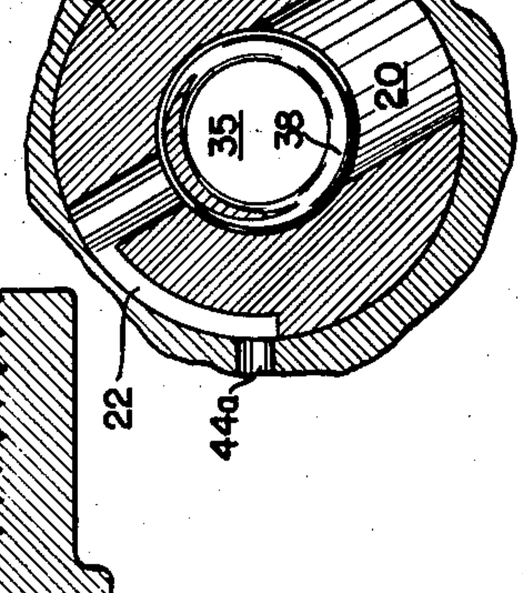

FIG. 3

FIG. 4

FIG. 1

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SAFETY VALVE

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This invention relates to safety valves in general and, more specifically, to the combination of a plug valve, a thermoelectric safety valve and a pilot valve, for use in gas heating systems, to provide 100% safety control of the flow of gas to both a main burner and a pilot burner.

Valves of the above mentioned type are generally well known in the heating controls art. While there are a large number of these so called "safety pilot" valves being produced by various valve manufacturers, the heating controls industry is constantly striving to design improved safety pilots which are less costly to manufacture, more reliable in operation and of smaller size.

It is one of the objects of this invention to provide a safety pilot that is an improvement over the prior art valves of this type.

Another object of the invention is to produce a very compact valve of the above mentioned type that is of simple construction, easy to manufacture, and which operates very simply and reliably.

Another object of the invention is to provide a combination plug valve, safety valve and pilot valve wherein the plug valve may be rotated between "off," "pilot" and "on" positions and wherein a means common to the plug valve and the pilot valve may actuate the pilot valve to first supply gas to the pilot burner from up-stream of the safety valve and then from down-stream of the safety valve.

Still other objects of the invention will become apparent upon reading the following detailed description of the invention in conjunction with the accompanying drawings wherein:

Figure 1 is a vertical sectional view of the combination valve with a thermoelectric unit portion thereof shown partially in cross-section;

Figure 2 is a cross-sectional view of the valve taken along line 2—2 of Figure 1, with the plug valve in its "on" position;

Figure 3 is a cross-sectional view along the same line 2—2 of Figure 1 but showing only a portion of the valve body around the plug valve, and with the plug valve shown in its "off" position that cuts off the flow of gas to both the main burner and the pilot burner; and

Figure 4 is a view similar to Figure 3 but with the plug valve in its "pilot" position, which permits gas to flow to the pilot burner but not to the main burner.

The valve body, designated by the reference numeral 11, has a threaded inlet 12 and a threaded outlet 13 with a partition wall 14 therebetween. A tapered bore 15 extends from the top surface of the body 11 across an outlet chamber 16 to an inlet chamber 17.

A hollow plug valve 18 has a lower open end portion thereof shaped to form a valve seat 19, for a purpose to be presently described. A large radial bore 20 extends outwardly from an upper closed end portion of the

hollow plug valve, for registering with the outlet chamber 16 when the plug valve is in its "on" position. In this "on" position of the plug valve, a second smaller radial passage 21 extends from the closed end portion of the hollow plug valve, substantially diametrically opposite from the passage 20, to an arcuate groove 22 formed in the outer surface of the plug valve and extending substantially one-fifth of the distance around the plug valve, for a purpose to be hereinafter described. A plate 23 has an aperture therein through which the stem 18a of the plug valve extends. It is secured by any suitable means (not shown) to the valve body with a coiled compression spring 24 positioned between the inner surface of the plate 23 and the outer end of the plug valve 18. This spring 24 resiliently holds the plug valve seated against the tapered bore 15 in the valve body.

A large threaded opening 25 in the bottom of the valve body 11 has a conventional condition responsive means or thermoelectric unit 26 therein, substantially coaxial with the plug valve 18. The unit is of the type that includes a generally U-shaped core member 27 on which is wound a copper wire coil (not shown) that is adapted to be energized by a thermocouple heated by a pilot burner. An armature 28, which forms a part of the thermoelectrc unit, is movable from its retracted or "safety" position, shown in full lines in Figure 1, to an attracted or "on" position (shown in dotted lines in Figure 1). The armature has a stem 29 loosely secured at one end thereto that extends through an opening 30 in the inner wall of the housing of the thermoelectric unit 26 and terminates in an enlarged head portion 31 at the other end thereof. A coiled compression spring 32 extends between the head 31 and a shoulder 33 formed by an enlarged diameter portion 34 of the opening 30. This spring normally holds the armature in its retracted position but is not of such strength as to be able to move the armature 28 from the ends of the core member 27 when the coil of the magnetic unit 26 is being energized in response to the presence of a pilot flame.

A disc type of valve 35 is positioned to move into and out of engagement with the valve seat 19 in the plug valve 18. The valve 35 has a stem 36 that is axially slideable in a guide bore 37 extending inwardly from the headed end of the armature stem 29. The disc valve 35 is spring loaded in a direction to normally hold the valve out of engagement with the valve seat 19 by means of a coiled compression spring 38 positioned within the hollow plug valve 18 and extending from the closed end thereof to the disc valve 35, surrounding a centering boss on the disc valve.

The valve 35 is actuated to its closed or safety position by means of a lever 39 pivoted at one end in a recess 40 formed in the wall 14. The lever 39 has an upwardly rounded and apertured portion 41 bearing at spaced points against the adjacent surface of the disc valve 35, on opposite sides of the valve stem 36. The lever 39 is prevented from moving out of the recess 40 by engagement of the portion 41 with the stem 36. Secured at one of its ends, by means of a hinge 42, is another lever 43 that is apertured substantially in alignment with the aperture in the lever 39 and the bore 37 in stem 29. The lever 43 is normally held intermediate its ends against the free end of the lever 39 by means of the adjacent rounded surface of the head 31 of the armature stem being biased thereagainst by means of the spring 32. However, by applying force to the left hand or free end of the lever 43, the hinged end of the lever 43 reacts against the lever 39 to hold the valve

35 closed while the intermediate portion of the lever 43 rotates counterclockwise to force the armature stem 29 axially of the valve stem 36, to position the armature 28 into engagement with the electromagnet, which is the "on" position thereof. Should the electromagnet be energized at the time the lever 43 is released, the armature 28 will be held against the electromagnet and the spring 38 will force the disc valve 35 off of its seat 19 and rotate the lever 39 counterclockwise about the edge of the recess 40 as a pivot. As lever 39 rotates counterclockwise, the lever 43 will rotate clockwise about the hinge 42 to cause both adjoining surfaces of the levers 39 and 43 to come together in a plane which substantially bisects the angle formed between the full or solid line position and the dotted line position of the lever 43, as shown in Figure 1 of the drawing. The actuating mechanism for the lever 43 and the remaining portion of the invention will now be described.

Extending through a wall of the valve body 11, generally above and substantially parallel with the axis of the inlet 12, is a stepped bore 44—44*a* which is threaded at its outer end and which has a reduced diameter portion terminating at the tapered opening 15, substantially in axial alignment with the bore 21 in the plug valve when said plug valve is in its "open" position. Another stepped bore 45 and 46 extends from the top of the valve body 11 to the inlet chamber 17. This bore is substantially parallel with the axis of the plug valve 18 and intersects the bore 44 intermediate the ends thereof.

Positioned in the bottom of the bore 44 and projecting a short distance into the bore 46, against a sealing washer 47, is a ball valve unit consisting of a ball valve 48 in a "squirrel cage" retainer 49. Extending through the stepped bore 45—46 is a plunger 50 having a reduced diameter portion 51 intermediate its ends, with a cone-shaped portion at the upper end of the reduced diameter portion 51 forming a cam surface for actuating the ball valve 48, upon rectilinear movement of the plunger 50. At the lower end of the reduced diameter portion 51 and spaced inwardly from the lower end of the plunger 50, is an enlarged diameter portion 53, forming a piston-like valve, that fits loosely in the lower end of the bore 46 so as to permit gas to pass around and past the portion 53. Surrounding the lower end of the portion 53 is a sealer O-ring 54, made of rubber or any other suitable material, that is resiliently biased against the wall of inlet chamber 17 around the lower end of the bore 46, by means of a compression spring 55 extending between a fixed abutment washer 56, on the lower end of the plunger 50, and a sliding washer 57, bearing against the under side of the O-ring valve sealer 54. The spring 55 thus serves the function of providing a strain release and means for exerting a uniform pressure on the sealing ring 54. The lower end of the plunger 50 is positioned over the free end of the lever 43 so that inward movement of the plunger 50 will cause engagement thereof with the lever 43 and move it from its solid line position to its dotted line position, shown in Figure 1 of the drawing. The plunger 50 is guided in its axial movement by means of a bearing sleeve 58, slideable in the bore 45 and on the plunger 50, and resiliently held against a flanged packing sleeve 59 surrounding the plunger 50 and bearing against the lower end of the bore 45. The upper end of the plunger 50 is guided by a cup-shaped member secured at the upper end of the plunger 50 with the lower open end thereof extending into the bore 45. The spring 61 extends between the inverted cup-shaped member 60 and the sleeve 58 to compress the packing 59 against the bore 45 and plunger 50 and to normally hold the plunger 50 in its outermost or retracted position.

A disc like handle 62 has a non-round socket 63 through which the complementary shaped stem 18*a* of the plug valve 18 extends to permit relative axial movement between the disc 62 and the plug valve but non-

rotatable movement of the disc 62 with respect to the stem 18*a*. A coiled compression spring 64 normally biases the handle 62 to its outermost position against a retainer nut 65 threaded on the upper end of the stem 18*a*. The disc handle 62 is of sufficient diameter to extend over the plunger 50 so that inward movement of the handle 62 with respect to the plug valve will cause inward movement of the plunger 50.

Operation

With the safety valve installed in a heating system, with the inlet 12 connected to a suitable source of gas supply, the outlet 13 connected to a main burner, the bore 44 connected to a pilot burner and the thermoelectric unit 26 connected to a thermocouple positioned to be heated by the pilot burner, the heating unit will be in its shut down position with the elements of the valve in the position shown in Figures 1 and 2 of the drawing. The heating system may be placed in operation, with the plug valve in the position shown in Figure 1 of the drawing, or by rotating the handle 62 and the plug valve to the "pilot" position shown in Figure 4, by sliding the handle 62 axially of the stem 18*a* to move the plunger 50 to its innermost position. The inward movement of the plunger 50 will cause the cam 52 to move the ball valve 48 against the sealing washer 47 to seal the passage 44*a*, to move the valve 54 out of sealing engagement with the bore 46, position the valve head 53 below the bore 46, and move the free end of the lever 43 to the dotted line position of Figure 1. It will be observed at this point that the valve 35 is retained in its seating or safety relationship with respect to the valve seat 19, due to the fact that the hinged end of the lever 43 reacts against the intermediate portion of the lever 39 to hold the valve seated while the intermediate portion of the lever 43 moves the armature 28 into engagement with the electromagnet 27. In this condition of the elements of the valve, gas will flow from the inlet 12, past the O-ring 54, and head 53, through the passage 46, bore 44, to the pilot burner. By lighting the pilot burner and holding the handle 62 in its depressed position for a sufficient time to allow the thermocouple to sufficiently heat and energize the electromagnet, return movement, by releasing the handle 62, will enable the spring 64 to return the handle 62 to its retracted position against the nut 65 and enable the spring 61 to return the plunger to its retracted position, freeing the ball valve to open under gas pressure or by a spring (not shown), and the reseating of the valve 53—54. As the plunger returns to its retracted position, the spring 38 will cause the valve 35 to open to its "on" position by pivoting the lever 39 about the pivot 40. This permits gas to flow from the inlet 12, through inlet chamber 17 to the interior of the plug valve, through bore 21, slot 22, bore 44*a*, across bore 46, and through bore 44 to the pilot burner. If the plug valve is in its open position, gas will also flow from the interior of the plug valve through bore 20, outlet chamber 16 and outlet 13 to the main burner. However, if the plug valve is in its "pilot" position, it will be necessary to rotate the plug valve to the "on" position before gas can flow to the main burner.

Should it be desirable to turn off the main burner and still leave the pilot burner operating, it is only necessary to rotate the handle 62 to the "pilot" position, shown in Figure 4, which will cut off the flow of gas to the main burner by taking the bore 20 out of registration with the outlet chamber 16 but continuing to permit gas flow from the interior of the plug valve through bore 21 and through the arcuate groove 22 to the bore 44*a* and the bore 44 connected to the pilot burner. Should it be desired to completely shut down the heating system, the handle 62 would have to be rotated, to position the plug valve in the "off" position, shown in Figure 3, that is, with the bore 20 out of registration with the outlet chamber 16, on the opposite side of said chamber from

the pilot position, and with the arcuate groove **22** out of register with the bore **44***a*. This will cut off the flow of gas to the pilot burner as well as the main burner and will cause the thermocouple to become deenergized and, consequently, the electromagnet to become deenergized, permitting the spring **32** to expand and move the valve **35** into seating engagement with the seat **19**.

Should the pilot burner become extinguished while the valve is in its "open" or "pilot" position, the electromagnet will also become deenergized, due to the cooling of the thermocouple, and permit the spring **32** to close the safety valve **35**. This will prevent any discharge of gas into the furnace where there is no means for re-igniting it and thus will prevent any dangerous accumulation of gas in and about the furnace.

While I have described the preferred embodiment of my invention above, it is to be understood that various changes may be made therein without departing from the spirit of the invention. Therefore, the scope of the invention should be determined solely from the appended claims.

I claim as my invention:

1. In a safety valve, the combination comprising a valve body having an inlet and a first outlet and a second outlet, a wall between said inlet and said outlets and having first and second openings therethrough, a first valve controlling fluid through said first opening, means tending to bias said first valve to open position, a second valve controlling fluid flow through said second opening, means tending to bias said second valve to closed position, a first lever pivoted at one end on said wall and at its other end on said first valve, a second lever pivoted at one of its ends on said first lever intermediate its ends, the other end of said second lever being positioned for engagement with said second valve when said second valve is moved to open position, means for opening said second valve, and condition responsive means having biasing means engaging said second lever intermediate its ends for normally holding said first valve closed against its biasing means and operable to an "on" position to permit said first valve to open when a predetermined condition exists and operable to an "off" position to close said first valve by overpowering its biasing means.

2. In a safety valve, the combination comprising a valve body having an inlet and first and second outlets, a wall between said inlet and said outlets and having first and second openings therethrough, a first valve controlling fluid flow through said first opening, means tending to bias said first valve to open position, a second valve controlling fluid flow through said second opening, means tending to bias said second valve to closed position, a first lever pivoted at one end and at its other end pivotally engaging said first valve, a second lever pivoted at one of its ends on said first lever intermediate its ends, the other end of said second lever being poistioned for engagement with said second valve when said second valve is moved to open position, means for opening said second valve, and condition responsive means having biasing means engaging said second lever intermediate its ends for normally holding said first valve closed against its biasing means and operable to an "on" position to permit said first valve to open when a predetermined condition exists and operable to an "off" position to close said first valve by overpowering its biasing means.

3. A safety valve comprising a valve body having an inlet and main and secondary outlets, a wall therebetween, an opening through said wall, a rotatable valve in said opening, a first passage in said rotatable valve extending from the inlet side of said wall to the main outlet side thereof, a first valve positioned to control fluid flow through said first passage, means for biasing said first valve to open position, a second passage in said rotatable valve extending from said first passage to an

arcuate groove in the circumferential surface thereof, condition responsive valve closing means capable of holding open but not capable of opening said first valve and having means for closing said valve by overcoming its biasing means, a third passage in said wall extending from said inlet to said secondary outlet, a fourth passage extending from said opening to said secondary outlet, a normally closed second valve positioned to control fluid flow through said third passage, a normally open third valve positioned to control fluid flow through said fourth passage, and actuating means operably connected to said second valve and engageable with said third valve for closing said third valve and opening said second valve and moving said condition responsive means to another position while holding said first valve closed to free said first valve to open upon return movement of said actuating means provided the condition exists that causes said condition responsive means to be held in said another position.

4. A safety valve comprising a valve body having an inlet and main and secondary outlets, a wall therebetween, a first passage through said wall, a first valve positioned to control fluid flow through said first passage, means for biasing said first valve to open position, condition responsive valve closing means capable of maintaining said first valve in open position but not capable of opening said first valve and being able to overcome said biasing means to close said valve, a second passage in said wall extending from said inlet to said secondary outlet, a third passage extending from said first passage to said secondary outlet, a normally closed second valve positioned to control fluid flow through said second passage, a normally open third valve positioned to control fluid flow through said third passage, and manually operable means positioned in said valve body adjacent said third valve and operably connected to said second valve for closing said third valve and opening said second valve and moving said condition responsive means to another position while holding said first valve closed to free said first valve to open upon return movement of said actuating means provided the condition exists that causes said condition responsive means to be held in said another position.

5. In a safety valve, the combination comprising a valve body having an inlet and two outlets, a wall between said inlet and said outlets, a first passage through said wall and terminating in one of said outlets, a first valve controlling flow through said passage, means for biasing said first valve towards open position, condition responsive means movable between "on" and "safety" positions and capable of holding said valve open but incapable of opening said valve, a second passage in said wall extending from said inlet to the other outlet, a second valve biased to normally close said second passage, a third passage extending between said first and second passages, a third normally open valve controlling flow through said third passage, reset means movable in one direction for mechanically closing said third valve and opening said second valve and moving said condition responsive means to a position it maintains when said first valve is in "on" position while holding said first valve closed, and means for biasing said first valve open upon movement of said reset means in the opposite direction.

6. In a safety valve, the combination comprising a valve body having an inlet and two outlets, a wall between said inlet and said outlets, a first passage through said wall and terminating in one of said outlets, a socket formed in said wall, a first valve controlling flow through said passage, means biasing said first valve towards open position, a lever pivoted at one end in said socket and pivotally engaging said valve, condition responsive means movable between "on" and "safety" positions and capable of holding said valve open but incapable of opening said valve, a second passage in said wall extending from said

inlet to the other outlet, a second valve biased to normally close said second passage, reset means movable in one direction to bear against said lever while opening said second valve and moving said condition responsive means to a position it maintains when said first valve is in "on" position, said lever holding said first valve closed during the time said reset means engages said lever, and means for biasing said first valve open upon movement of said reset means in the opposite direction.

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