Dec. 30, 1930. R. C. HOYT 1,786,948

AUTOMATIC WATER HEATER CONTROL VALVE

Filed April 22, 1927 2 Sheets-Sheet 1

FIG. 3.

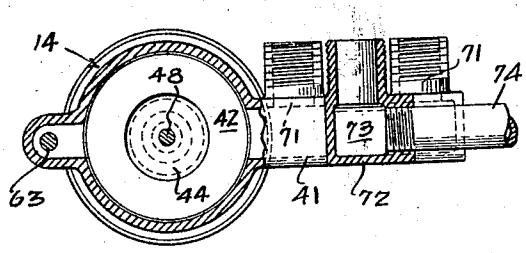

FIG. 1.

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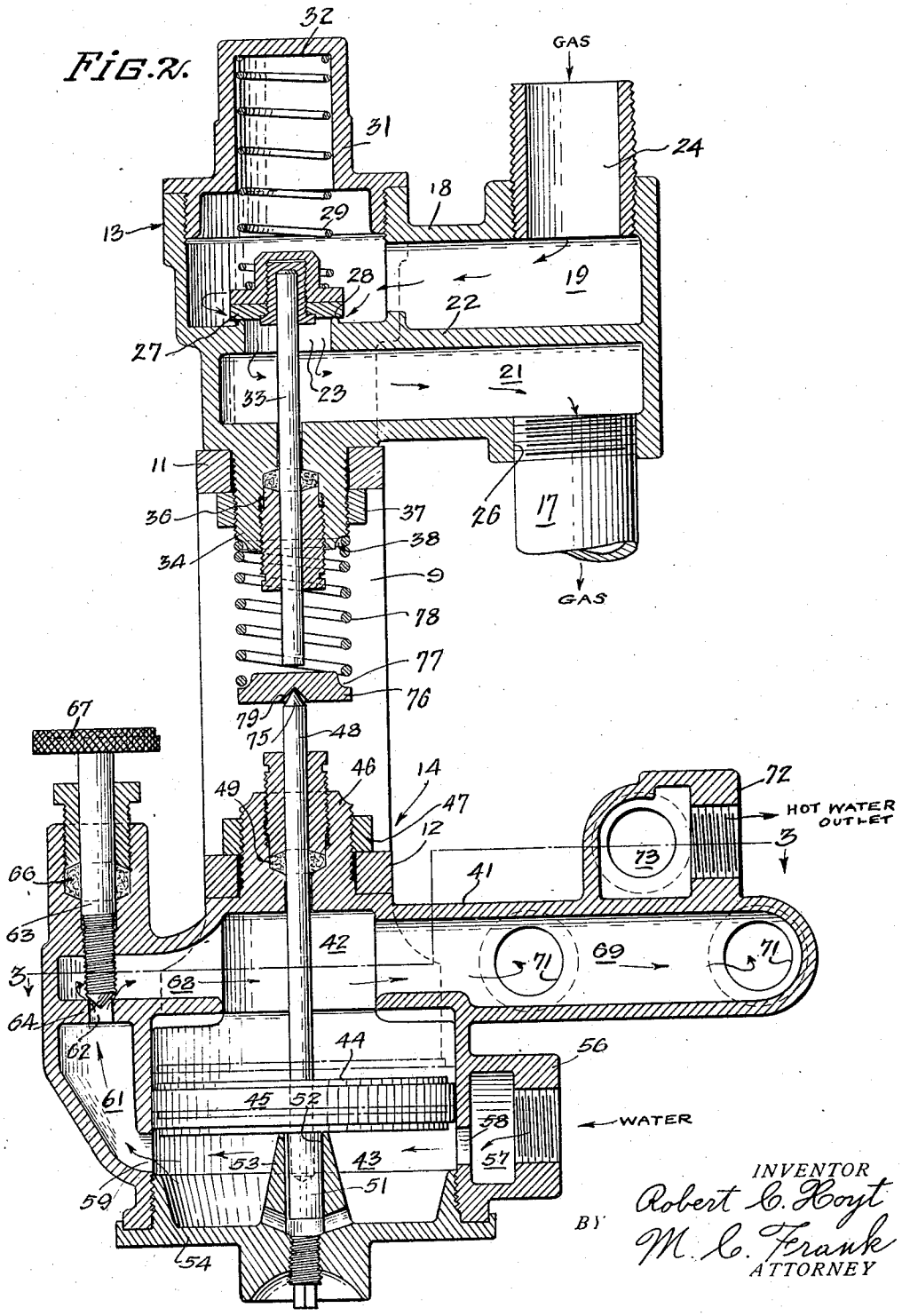
FIG. 2.



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UNITED STATES PATENT OFFICE

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AUTOMATIC WATER-HEATER CONTROL VALVE

Application filed April 22, 1927. Serial No. 185,864.

My invention relates to improvements in mechanism operative to control the supply of fluid fuel to the burner of an automatic water heater and particularly to mechanism such as that disclosed in the patent to Robert C. Hoyt, No. 1,595,400, dated August 10, 1926, in which a fuel supply valve is arranged to be directly operated by a differential piston which is automatically actuated in accordance with the turning on and off of service faucets.

A general object of the present invention is to so improve and simplify the structure and operation of said mechanisms as that particularly disclosed in the before-mentioned patent as to overcome certain disadvantages which have been found to reside in such mechanisms.

A more specific object of my invention is to provide mechanism of the class described in which the settlement of water-borne sediment within the mechanism will be automatically minimized, and such sediment as does settle will be prevented from accumulating in a place where it may interfere with the operation of the device and from which it may be readily removed.

Another object of the invention is to provide an improved control mechanism of the class described which will operate at all times with particular positiveness.

A further object is to provide mechanism of the class described in which the operating force of the water-controlled piston is at all times exerted axially of the piston and a fuel valve operating rod on which it acts, whereby the exertion of side thrusts by such piston and rod will be prevented and the deleterious effects of such side thrusts will therefore be eliminated.

Additional objects and advantages will appear as the invention is unfolded in the following detailed description having reference to a preferred embodiment of my invention as illustrated in the accompanying drawings, in which:

Figure 1 is a front view showing a portion of a heater unit having the mechanism of my invention incorporated therewith.

Figure 2 is an enlarged side sectional view of the control mechanism.

Figure 3 is a reduced sectional view taken on the broken line 3—3 in Figure 2.

As herewith particularly disclosed, the mechanism of my invention is incorporated with a heater 4 having a base 6 on which is mounted a casing 7, said base and casing being arranged to enclose a suitable water heating coil (not shown) having disposed beneath it a gas burner 8 for heating said coil. Fixed to the base 6 is a bracket 9 providing a pair of vertically spaced upper and lower arms 11 and 12, such arms being arranged to respectively support a gas feed valve 13 and a water control-valve 14. As here shown, the feed valve 13 is connected between a shut-off valve 16 and a supply pipe 17 for the burner 8, it being noted that the pipe 17 is disposed vertically and is positioned generally rearwardly of the valves.

In the present embodiment of the invention, the valve 13 comprises a body 18 providing a gas passage therethrough, said passage comprising portions 19 and 21 separated by a horizontally disposed common wall or partition 22. A port 23 to connect the passage portions is provided through one end of the partition 22, while the body portions opposite the other end of the partition are provided with aligned threaded inlet and outlet openings 24 and 26 respectively communicating with the passages 19 and 21. Means are provided for controlling the flow of gas through the port 23, such means comprising a valve disk 27 arranged to be normally held against a seat 28 provided on the upper side of the partition 22, by means of a compression spring 29 operatively interposed between the disk and an opposed seat provided in the body. As here shown, the body wall is perforated opposite the disk to permit access thereto, and the perforation provided is arranged to be closed by a screw-cap 31 providing a seat 32 for the spring 29. Fixed to and extending axially downwardly from the disk 27 through the port 23 and the underlying wall portion of the valve body is a valve rod 33 which is arranged to

be longitudinally displaced for unseating the disk 27.

Preferably, and as here shown, the valve body is formed with a depending cylindrical boss 34 at the point of egress of the rod 33, such boss being provided with a stuffing box 36 for the rod and being externally threaded. The bracket arm 11, it will now be noted, is perforated to receive the boss 34 therethrough, and the valve body 18 is arranged to be fixedly secured to the arm 11 by means of a nut 37 mounted on the boss outwardly of the bracket arm. The boss is also provided at its outer end with an annular spring seat 38, which seat is provided for a purpose to be hereinafter set forth.

The water control-valve 14, it will now be noted, comprises a body 41 providing an upper pressure chamber 42 and a lower pressure chamber 43, the upper chamber being merely a reduced continuation of the lower chamber. The lower chamber 43 holds for vertical reciprocation therein a piston 44 provided with a packing 45 whereby it may maintain a water-tight engagement with the chamber walls. Extending upwardly from the body 41 in axial alignment with the piston 44 is an externally threaded boss 46, such boss being arranged to be inserted through a perforation provided in the lower bracket arm 12 whereby, by means of a nut 47, the body may be fixedly secured to the arm in predetermined position thereon. Fixed to the piston 44 to extend axially upwardly therefrom and through the boss 46, is a piston rod 48, a suitable stuffing box 49 for the rod being provided in the boss. Depending axially from the piston is a projection 51, which projection is arranged to slidably engage in a guideway bore 52 provided in a frustro-conical boss 53 extending upwardly from the bottom of the chamber 43, the top of such boss being arranged to support the piston in its lowermost position. Preferably, and as here shown, the boss is provided on the inside of a cap 54 which is in threaded engagement with the lower end of the body 41 whereby ready access to the chamber for cleaning it out is permitted.

Formed on the body 41 to extend generally radially from the chamber 43, is an extension 56 provided with a passage 57 opening outwardly of the body and threaded at its outer end to receive a water supply pipe (not shown). Leading from the passage 57 to the chamber 43 is an open inlet port 58, which port is disposed in the chamber wall at a point between the inner edge of the cap 54 and the plane of the top of the piston supporting boss 53. Preferably provided at a point in the chamber wall diametrically opposite the inlet port 58 is an open outlet port 59, which latter port communicates with an upwardly directed passage 61 formed in the valve body and having provided at the upper end thereof a port 62 arranged to have the effective opening thereof varied. As here shown, control of the opening at the port 62 is provided by means of an adjustably positionable valve needle 63 having the conical tip 64 thereof arranged to be variously disposed in and with respect to the port and having its stem extending from the body through a suitable stuffing box 66 and terminating in a knurled head 67, the structure thus provided constituting in effect, an adjustable throttle valve. Extending from the outlet side of the port 62 to the chamber 42 is a passage 68, while extending from the opposite side of chamber 42 is a second passage 69, which latter passage is provided with a plurality of openings 71, said openings being here shown threaded for connection to the inlet ends of a heating coil (not shown). As here shown, an integral body portion 72 is mounted above the passage 69, which body portion is provided with a passage 73 therethrough and is formed to constitute, in effect, a pipe elbow for connecting the outlet end of the heating coil with the hot water service pipe 74.

It will now be noted that the portion of chamber 43 below the piston is the lowest point reached by the water in passing through the control and heating mechanism, and that any sediment in the water will therefore tend to settle in said chamber. When, as particularly disclosed in the patent hereinbefore referred to, the chamber beneath the control piston merely constiutes a dead-end branch with respect to the water supply to the heating coil, the accumulation of sediment therein is quite rapid and is unhindered, so that such sediment soon accumulates in such amounts as to seriously interfere with the operation of the piston, and particularly its lowering movement. In the present embodiment, however, water flowing to the heater coils is directed across the upper portion of chamber 43 around and against the boss 53 whereby the seat for the piston provided on the boss is kept clean and settlement of any sediment above the bottom of the stream of flow is positively prevented, while at the same time the chamber space below such flowing stream provides an efficient trap for larger sediment particles.

When the water control device now described is in use, the port 62 will always be open to such an extent that water will be allowed to flow through the coils at such a rate that it will be delivered from the heater at the desired temperature. Under these conditions, when service faucets are in closed position, the pressures at opposite sides of the piston 44 will be equal and the piston will normally rest on the boss 53, while the opening of one or more service faucets will sufficiently reduce the pressure at the upper side of the piston to permit it being raised

and held in raised position by reason of the excess pressure beneath it, such raising of the piston being utilized to effect the turning on of the fuel valve in a manner to be hereinafter described. At the instant of closing of the faucets, the resulting surge of water in the service pipes creates a momentary back pressure in excess of the supply pressure, which pressure, in combination with the gravitational pull on the piston 44, has heretofore been usually relied on to reseat the piston on the boss 53. In practice, it has been found, however, that, the piston does not always return to its normal position unless the service faucets are closed, since frictional resistance sufficient to overcome the surge pressure and gravity may exist and means are accordingly provided for positively insuring the lowering of the piston 44 when no water is flowing through the water-control valve.

It will now be noted that in order to most simply effect a lifting of the valve disk 27 from its seat to thereby supply fuel to the gas burner during the passage of water through the heating coil, the piston rod 48 is arranged to exert an upward thrust on the valve rod 33 when the piston 44 is raised. Accordingly, and as here shown, the rods 33 and 48 are arranged for reciprocation in a common axial line whereby an upward movement of the rod 48 may effect an axial movement of the rod 33 to lift the valve disk 27 from its seat. Pivotally mounted on the free end 75 of the rod 48 and disposed generally thereacross is a disc member 76, such member being provided with an annular seat 77 at the upper side thereof, while operatively interposed between the seat 77 and the seat 38 provided on valve 13, is a helical compression spring 78 whereby the piston will be at all times resiliently urged to maintain its depressed position. Preferably, and as here shown, the spring seat member 76 is provided with a socket 79 in which the piston rod end 75 is arranged to so engage as to permit a rocking engagement of the member 76 with the rod end. In the present embodiment the socket 79 and rod end 75 are both conical with the apex angle of the former the greatest. In this manner, the thrust of the spring in the rod is arranged to be at all times axially directed with respect thereto whereby its rod is prevented from effecting a side thrust against the packing of the stuffing box 49 through which it extends, which thrust would provide added frictional resistance to the reciprocative movement of the rod and result in a leakage through such packing. It will, of course, now be obvious that the present structure is particularly positive in its acting both as to the return of the piston 44 and the centering of the pressure transmitted by the piston rod.

The lower end of rod 33, it will now be noted, is preferably normally disposed in slightly spaced relation from the member 76 whereby it will be engaged thereby only after the latter has been raised appreciably. In this manner, a slight flow of water through the service pipes, as an account of leakage in a faucet thereof, will not cause an opening of the gas valve 13, nor will the unseating movement of the valve disk 27 be as great as the operative movement of the piston 44, and furthermore, the structural independence of the valves 13 and 14 herein provided permits the independent installation of such valves and therefore is an important factor in the installation and servicing of the mechanism.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent of the United States, the following:

1. In combination with a self-closing fuel valve of an automatic water heater, a rod member longitudinally reciprocable to open said valve, water pressure controlled means for actuating said rod, a helical spring axially operative against said rod to resiliently urge it to maintain an inoperative relation with respect to said valve, and a member providing a seat for said spring operatively interposed between said spring and rod and arranged for a freely pivotal and rocking engagement with said rod whereby the pressure of said spring will be exerted entirely axially of said rod.

2. In combination with a self-closing fuel valve of an automatic water heater, a longitudinally reciprocable valve rod for said valve for effecting the opening thereof, a second rod disposed for longitudinal reciprocation in the axial line of said first rod, water pressure controlled means for projecting said second rod toward said first rod, and a member carried by said second rod in pivotal and rocking engagement therewith and in normally spaced relation from said first rod and arranged to engage and displace said first rod when said second rod is operatively projected.

3. In mechanism for controlling the fuel valve of an automatic water heater, a valve casing providing a water passage having spaced and enlarged cylinder portions separated by an imperforate partitioning piston having the opposite ends thereof exposed in the different said cylinder portions, said pas-

sage being constantly open to a fixed degree and entering and leaving each of the respective cylinder portions at opposite sides thereof, and means controlling said fuel valve in accordance with the position of said piston.

4. In combination with a self-closing fuel valve of an automatic water heater, a longitudinally reciprocable valve rod for said valve for effecting the opening thereof, a second rod disposed for longitudinal reciprocation axially with respect to said first rod and axially spaced therefrom, water pressure controlled means constantly engaging the second rod for projecting it against the first rod, a helical spring constantly operative against said second rod to urge it to maintain an inoperative relation with respect to said first rod, and a member providing a seat for said spring and operatively interposed between said spring and second rod in pivotal engagement with said last rod, said member being normally spaced from the opposed end of the first rod and arranged for projection thereagainst.

5. In combination with a valve mechanism for controlling the fuel flow to the burner of an automatic water heater, a valve casing providing a passage for the flow of a stream of water therethrough and providing a pair of pressure chambers comprising spaced portions of said passage, the outlets of each of said chambers being opposite the respective inlets therefor whereby said stream will flow diametrically across and entirely through both of said chambers for continuously flushing the same.

6. In combination with a valve mechanism for controlling gas flow proportional to water flow in an automatic water heater, a valve casing providing a single passage for the flow of a stream of water therethrough and having its inlet and outlet on the same side of the casing and providing pressure chambers interposed directly in said passage at spaced points therealong and separated by a vertically movable valve operating piston member separating the chambers, the portion of said passage connecting the chambers being on the opposite side of the piston from the inlet and outlet of the casing, and an adjustable throttle valve interposed in the passage portion between said chambers, whereby said stream is arranged to flow solely diametrically through both of said chambers for flushing the same.

7. In a device for controlling the fuel valve of an automatic water heater, a valve casing providing an unbranched and constantly open water passage having spaced and coaxial cylinder portions separated by an imperforate piston having the opposite ends thereof exposed in the said spaced cylinder portions and connected by an intermediate passage portion, said last passage portion leaving one cylinder portion at a point diametrically opposite its inlet and entering the other cylinder portion at a point diametrically opposite its outlet, and means connecting said piston with said fuel valve for controlling the same in accordance with the disposal of the piston.

In testimony whereof, I affix my signature.

ROBERT C. HOYT.