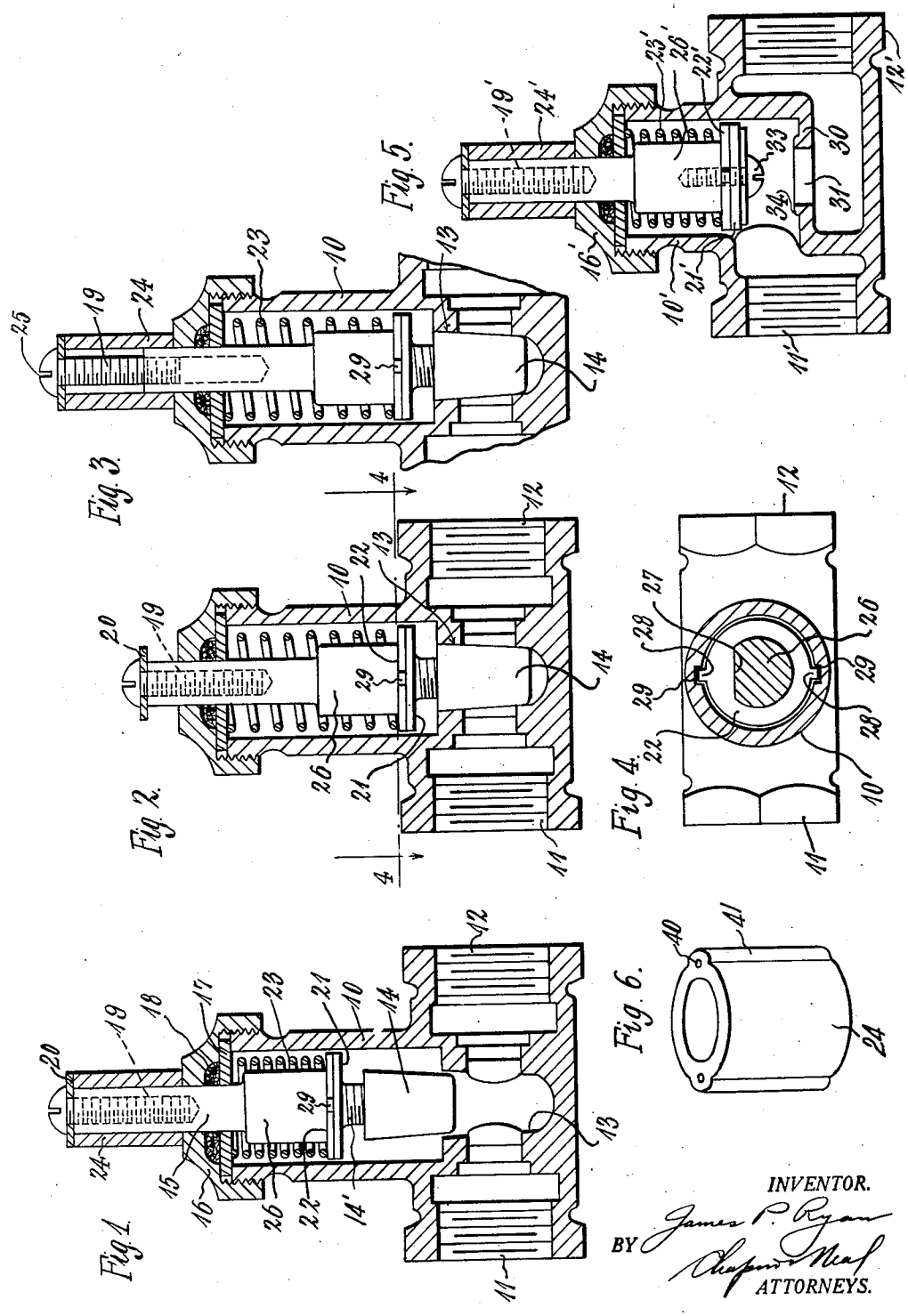
Dec. 1, 1931. J. P. RYAN 1,834,645

HEAT RESPONSIVE SHUT-OFF VALVE

Filed July 24, 1930 2 Sheets-Sheet 1



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Fig. 7.

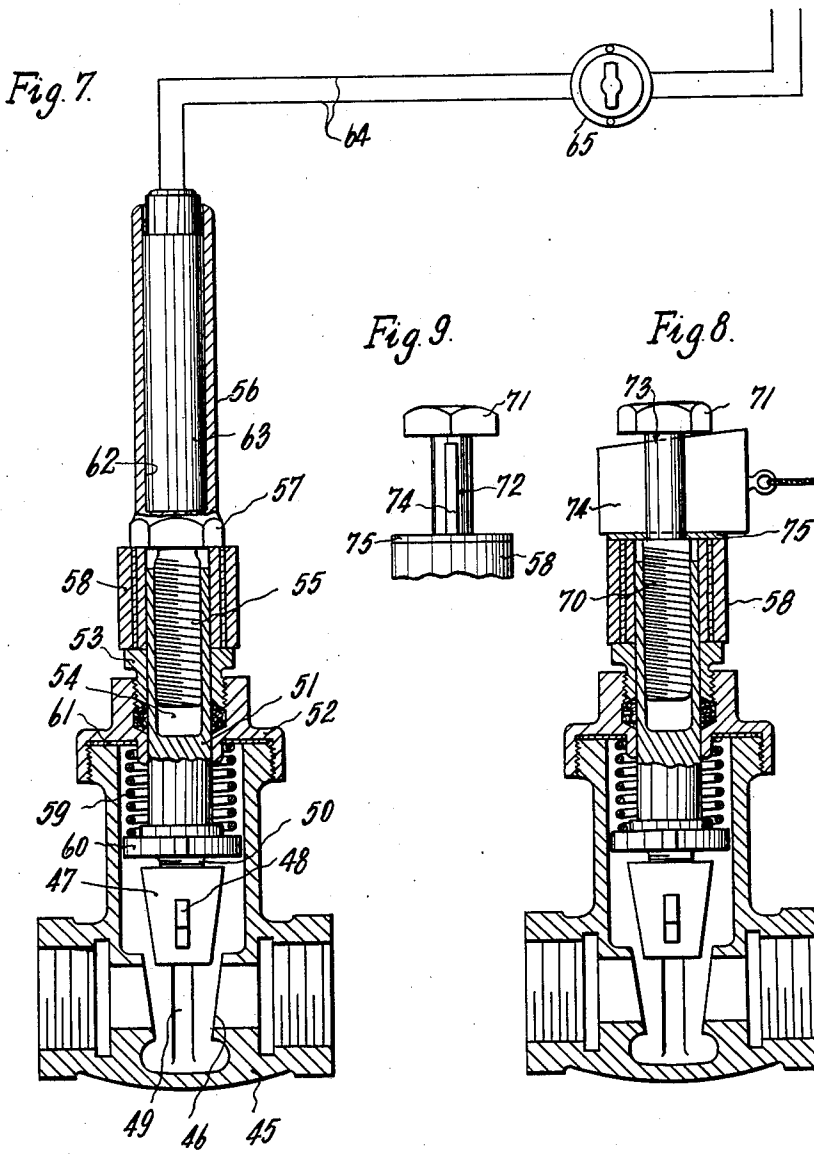


Fig. 9.

Fig. 8.

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UNITED STATES PATENT OFFICE

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HEAT RESPONSIVE SHUT-OFF VALVE

Application filed July 24, 1930. Serial No. 470,375.

This invention relates to valves particularly adapted for interposition in a main gas supply to a building, and has for its purpose the provision of a valve of this character which will automatically shut off the gas supply to the building in the case of fire. One object of the invention is to provide a valve of this general character which will be simple in construction and economical to manufacture. A further object is to provide a valve of this general character which can be operated manually when desired without removing or destroying the heat responsive portion of the device. A further object is to provide operating mechanism for valves of this general type which will be applicable to valve mechanisms of differing types. A further object is to provide a valve of this type in which tampering can affect the valve only in a way to shut it off, rather than in a way to interfere with its ability to close as intended. A further object is to provide a valve controlled by a fusible unit in which this unit is protected against the gradual distortion which tends to occur over relatively long periods of time, particularly when the valve is situated in a warm place. Other objects will appear from the following description and claims, and other uses of the described valve will suggest themselves to those skilled in the art.

This application for patent is a continuation in part of my prior application Serial No. 280,630, filed May 25, 1928.

The invention will now be described in connection with the accompanying drawings, in which:

Fig. 1 is a central section through a valve embodying my invention, the valve being shown in open position;

Fig. 2 is a similar section showing the valve after it has been closed by the operation of the heat-responsive device;

Fig. 3 is a similar section showing the valve as closed by manual means;

Fig. 4 is a section on line 4—4 of Fig. 3;

Fig. 5 is a section similar to that of Fig. 1 showing the invention applied to a different type of valve;

Fig. 6 is a perspective detail of a preferred form of fusible cylinder;

Fig. 7 is a section of a valve showing a modification permitting the use of a remotely controlled heating element for closing the valve;

Fig. 8 is a section of a valve showing a further modification in which remote control of the valve is attained by mechanical means; and

Fig. 9 is a detail looking from the left in Fig. 8.

The valve shown in Figs. 1 to 4 comprises a main casing 10 provided with the usual pipe connections 11 and 12 and having a conically tapered valve seat 13. Adapted to mate with the seat 13 is a conical valve plug 14 connected, preferably by a loose thread 14′, to an upwardly projecting shank 15. The looseness of the threaded connection 14′ assists in permitting self-adjustment of the valve plug with respect to the seat when the valve is closed, and insures a tight seal. This shank passes slidably through a cap or cover 16 having screw-threaded engagement with the casing 10.

A washer 17, having a packing 18 between it and the cover, is interposed between the cover and the casing, forming a tight seal. A screw 19, preferably made relatively long and with a left-hand thread for a purpose which will appear below, is threaded into the upper end of the shank 15 and bears against a washer 20 which rests on the end of the shank. The lower end of the shank is formed with a circular flange 21 upon the top of which is a washer 22 constructed and operating as will be described below. A spring 23, preferably of a vanadium steel or other alloy which will preserve its strength and elasticity at high temperatures, is compressed between the washers 17 and 22 and acts to urge the plug 14 downwardly towards the seat 13. Normally this action of the spring is resisted by a hollow cylinder 24 of a fusible alloy, such as one of the low fusing bismuth and tin compounds, which positively holds the valve open. The use of the washer 20 is preferred, but if desired the screw can be made to bear directly on the fusible cylinder. If the valve

is subjected to heat the fusible cylinder melts, permitting the valve to be closed by the action of the spring as shown in Fig. 2. The spring being within the casing, it is protected from heat to a greater degree than the exposed fusible cylinder.

It is preferable to permit the valve to be closed manually when desired without disassembling it. For this purpose the screw 19 is provided with a screw driver slot 25 by means of which it may be rotated or may be formed with a hexagonal or square head for the same purpose. By rotating the screw in a direction to withdraw it from the threaded hole in the shank 15, spring 23 is allowed to depress the plug 14 into contact with the valve seat as shown in Fig. 3. In order to prevent rotation of the shank during this motion, I preferably use the construction shown best in Fig. 4. The lower end of the shank 15 is enlarged as at 26 to assist in centralizing the spring 23, and this enlargement is flattened at 27 on one side. The washer 22 is correspondingly flattened on one side of its bore, so that it is positively restrained from rotation with respect to the shank. Lugs 28 project from the washer 22 into grooves 29 in the inner side wall of the casing 10. The flange 21 may be provided with a projection similar to projections 28, and the washer 22 may be omitted, if desired. Either construction permits vertical movement of the valve plug and its shank in the casing 10, but prevents the plug and shank from rotating. The turning of screw 19 will, therefore, be directly translated into a reciprocating movement of the valve plug under the force of the spring. The left-hand direction of the threads allows a right-hand rotation of the screw to close the valve, as is the case with valves of the usual manual closing type. When it is desired to reset the valve in its open position the screw is rotated in the reverse direction and the valve plug again drawn to the position of Fig. 1.

In Fig. 5 I have illustrated the valve as constructed according to the so-called globe type. The essential features of my invention may be applied to this type of valve in the same manner, and the parts reappearing in this modification in substantially unchanged form are shown by primed numerals. Instead of the casing being formed with a conical valve seat, however, it is provided with a web 30 in which is formed a hole 31. A packing washer 32, secured to the bottom of the flange 21′ by a screw 33, is adapted to bridge across the hole, the edges of which are preferably provided with a raised machined surface 34 to contact with the packing washer. The operation of this type of valve is the same as that previously described, and need not be gone over again. Other adaptations of the principles of the invention, as to valves of the gate type, will readily suggest themselves. If desired, the screws 19 or 19′ can be provided with a manually operable handle, but the construction described is preferred as it tends to prevent unauthorized tampering with the valve.

In Fig. 6 I have shown a preferred form of fusible cylinder, particularly adapted for use in warm locations. It has been found that when a plain fusible cylinder is subjected to the pressure of the valve spring for a long period of time, particularly in warm locations, the soft metal cylinder will undergo gradual deformation permitting a progressive closing of the valve. In order to avoid this effect the cylinder may be provided with one or more inserts 40, preferably of wood and about the size of a toothpick. These inserts are preferably located about half way between the inner bore and the outer surface of the cylinder and may for convenience be surrounded by integral elongated bosses 41 formed in the cylinder body. Without the support of the surrounding unmelted metal of the fusible cylinder the frail wooden inserts are insufficient to bear the pressure of the spring 23. Added to this support, however, the wood adds sufficient rigidity to prevent undesired deformation of the cylinder. When the valve is subjected to excessive heat the metal melts, and the wood snaps out, permitting the valve to close.

In Fig. 7, I have shown my invention adapted to the gate type of valve and provided with electrical means remotely controlled to permit the valve to be closed from a predetermined remote location. In this case the valve casing 45 is provided with the usual V-shaped seat 46 in which the gate 47 is adapted to fit to close off the gas passage. Lugs 48 on opposite sides of the gate run in slots 49 formed interiorly of the casing to preserve the gate in correct angular position. The gate 47 is threaded upon an extension 50 of a valve stem 51 passing through a cap 52 and a stuffing box 53. At its upper end the stem 51 is formed with an axially extending, interiorly threaded chamber 54 into which screws an extension 55 of a compression piece 56 having an intermediate nut 57. By turning this nut the screw 55 may be run into the chamber 54 until the nut strikes against a hollow fusible cylinder 58, preferably constructed like that shown in Fig. 6. If the rotation of the compression piece is continued, the stem 51 will be raised against the compression of a spring 59 located between the cap 52 and a flange 60 of the stem. A washer 61 may be provided between the cap 52 and the valve body and the flange 60 may have lugs like those on the gate if desired.

As thus far described, the type of the valve shown in Fig. 7 will operate in the same manner as the types previously described, the

spring 59 causing the valve to close whenever the cylinder 58 is fused by the heat of a fire. It is frequently desirable, however, that the valve be closed where the fire has not approached the valve sufficiently to cause fusion and yet has cut off access to the valve. For this purpose the compression member 56 is hollowed out as at 62 to receive an electric heating element 63 whose circuit 64 comprises a switch 65 located at any convenient point which is not likely to be cut off by fire. If the heating circuit is closed the heat of the element 63 will be carried by conduction to the fusible element 58 which will thus be caused to collapse.

A similar result is attained by mechanical means in the structure shown in Figs. 8 and 9. The valve there illustrated is for the most part identical in structure with that of Fig. 7, and will not be again described. The compression member 70, which replaces the member 56 of the previous type is formed with a nut 71 at its end and with a through slot 72 having a tapered upper wall 73. A plug 74, having a flat lower surface and a slanting upper surface, normally extends through the slot, bearing at its top against the end wall of the slot and at its bottom against a washer 75 interposed between it and the fusible cylinder 58. By means of a cord 76 extending from the plug to a convenient remote point, the plug can be removed at will, permitting the valve to be closed by its spring.

Instead of using washers for making a tight seal between the cap and the valve body, or between the flange 21′ of Fig. 5 and the valve seat 34, the contacting metal surfaces may be fitted by grinding. The use of ground joints is particularly desirable in case the valve is to be used on oil pipes, as oil has a tendency to destroy ordinary packings.

What I claim is:

1. A heat-responsive shut-off valve comprising a valve casing, a valve seat within the casing, a valve closing member movable within the casing and having an extension projecting outside the casing, a spring within the casing acting to urge the valve closing member towards closed position, a fusible cylinder surrounding the projecting extension of the valve closing member, and means including a screw, threaded into the extension of the valve closing member, for bearing on the fusible cylinder to resist the pressure of the spring so as to hold the valve normally open, whereby the valve will shut automatically by the fusion of the cylinder and can be closed manually by rotating the screw.

2. A heat-responsive shut-off valve comprising a valve casing, a valve seat within the casing, a valve closing member reciprocable within the casing and having an extension projecting outside the casing, a spring within the casing acting to urge the valve closing member towards closed position, a fusible cylinder surrounding the projecting extension of the valve closing member, means including a screw, threaded into the extension of the valve closing member, for bearing on the fusible cylinder to resist the pressure of the spring so as to hold the valve normally open, and a connection between the valve closing member and the casing to permit reciprocation of the valve closing member while preventing its rotation, whereby the valve will shut automatically by the fusion of the cylinder and can be closed manually by rotating the screw.

3. A heat-responsive shut-off valve comprising cooperating valve members, a spring urging the members into contact to close the valve, a fusible member normally resisting the closing action of the spring, and a reinforcement for said fusible member insufficient of itself to resist the spring but sufficient to prevent progressive deformation of the fusible member.

4. A heat-responsive shut-off valve comprising a valve casing, a valve seat within the casing, a valve closing member movable within the casing and having an extension projecting outside the casing, a spring within the casing acting to urge the valve closing member towards closed position, a fusible metal cylinder surrounding the projecting extension of the valve closing member and having wooden inserts embedded therein for assisting in bearing the pressure of the spring, and means connected to said extension and bearing on the fusible cylinder to resist the pressure of the spring so as to hold the valve open.

5. A heat-responsive shut-off valve comprising cooperating valve members, a spring urging the members into contact to close the valve, and a fusible metal cylinder having wooden inserts normally resisting the closing action of the valve.

6. A heat-responsive shut-off valve comprising a valve casing provided with a valve seat, a reciprocable valve closing member within the casing movable into or out of contact with the valve seat, a stem connected to the valve closing member and extending exteriorly of the casing, a compression member threaded into the stem and having an extending flange, a fusible cylinder located between the flange and the casing, a spring urging the valve closing member towards its seat but restrained normally by the fusible cylinder, an electric heating element mounted within the compression member, and an electric circuit for the heating element including a switch located at a remote point.

7. A heat-responsive shut-off valve comprising a valve casing provided with a valve seat, a reciprocable valve closing member within the casing movable into or out of

contact with the valve seat, a stem connected to the valve closing member and extending exteriorly of the casing, a compression member threaded into the stem and formed with a slot, a fusible cylinder surrounding the compression member and bearing on the casing, a plug fitting in said slot and normally bearing on the fusible cylinder, a spring urging the valve closing member towards the seat but restrained normally by the fusible cylinder and the plug, and a cord actuatable from a remote point for withdrawing the plug from the slot.

8. A heat-responsive shut-off valve comprising cooperating valve members, a spring urging the members into contact to close the valve, a fusible member normally resisting the closing action of the spring, and a reinforcement for said member to normally prevent its progressive deformation by the pressure of the spring.

In testimony whereof I have affixed my signature.

JAMES P. RYAN.