

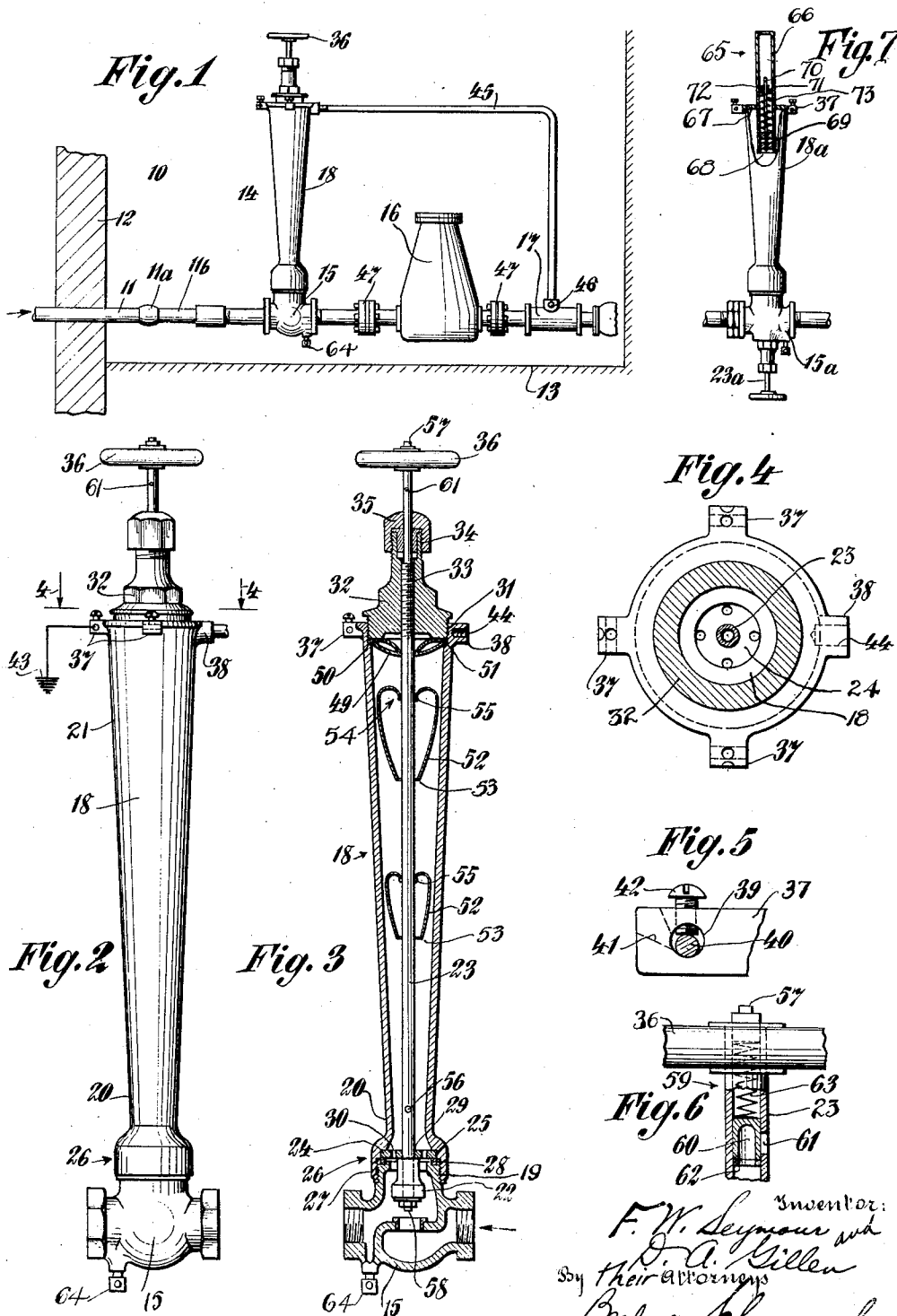
July 5, 1932.

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1,865,486

COMBINED VALVE AND AIR CUSHION

Filed Jan. 24, 1929



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COMBINED VALVE AND AIR CUSHION

Application filed January 24, 1929. Serial No. 334,638.

This invention relates to plumbing systems for buildings, and more particularly to valves, air cushions, and electrical ground connections employed therein.

One object of the invention is to provide a device of the character described having improved means to eliminate noises in piping systems due to the flow of water therein.

Another object of the invention is the provision of a device of the nature set forth including an improved combined valve and air cushion.

Another object of the invention is to furnish a device of the type mentioned having means in improved association therewith for electrically grounding to a plumbing or other system.

A further object of the invention is to construct a device of the species alluded to, which is arranged in an improved compact manner for protecting a water meter against damage from mechanical or electrical causes.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated on the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawing:

Figure 1 is a view in elevation showing an embodiment of the invention.

Fig. 2 is an enlarged view in side elevation showing the combined valve, air cushion, and electrical ground detached from the plumbing system.

Fig. 3 is a view in vertical section of the same.

Fig. 4 is a horizontal sectional view taken on the line 4—4 of Fig. 2.

Fig. 5 is an enlarged fragmentary view of an electrical ground connection.

Fig. 6 is an enlarged view in vertical cross section showing a detail of the invention.

Fig. 7 is a view in side elevation of a modification of the invention.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which this invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

Generally described, the invention provides a combined valve and air cushion that can be used in any piping system where the flow of a liquid occurs, whether in a heating system, or water supply or plumbing system of the type used in buildings. The valve controls the flow of the liquid, while the air cushion eliminates noises, such, for instance, as water hammer. A unitary construction includes the valve and air cushion, which is thus of a high degree of compactness, of less cost to manufacture than if made separately, and is adapted for more rapid and cheaper installation. The air cushion, while directly connected to the valve body, may be disposed in any desired relation therewith. Preferably the parts mentioned are symmetrically and coaxially arranged. The stem of the valve may extend through the compartment or dome of the air cushion, or in an opposite direction therefrom, depending upon the nature of the installation. While the dome may be of any desired shape, it is preferably elongated as shown with a view to providing for an increased length of the valve stem, so that the handwheel for the latter may be positioned for convenient access. This is particularly desirable where the valve is positioned in a conventional manner in a pit as shown, the handwheel being then easily reached in an upper part of the pit, while at the same time the stem is protected in the dome. A mechanical resilient device may be used for cushioning to relieve water hammer.

An improved venting means is provided to relieve the pressure of the crest of a wave

in water hammer. The dome may be so constructed as to various details hereinafter more particularly described, as to afford the maximum cushioning action for removal of noises from the piping system. Due to the elongated form of the dome, the electrical ground connections with the same can be easily made and inspected. Furthermore, a combined mechanical guard and electrical connection may be easily secured to the dome in a simple and compact manner.

This invention is an improvement over the construction shown in our Patent No. 1,590,590.

Referring in detail to the drawing, 10 denotes a device embodying the invention. The same includes an inlet pipe 11 extending from a suitable water main through a building wall 12, into a pit 13 within the building. Connected with the inlet pipe 11 by a solder connection 11a is a pipe 11b which communicates by means of suitable connections with a device 14, including a valve body 15. Connected to the latter is a meter 16, through which the water is discharged into the building by any desired fittings including a coupling 17.

The device 14 comprises a dome 18, which constitutes an air cushion. The said dome is in the nature of an elongated coupling having threaded connection at 19 with the valve body. A comparatively narrow throat 20 is formed in the bottom portion of the dome, while the upper end portion 21 thereof enlarges in cross section according to the well known Venturi principle.

Co-operating in the valve body 15 is a valve 22 carried by a stem 23 in the usual manner. To guide the stem, a plate 24 is provided which seats in an annular recess 25 interiorly formed in enlarged end bell portion 26 of the dome 18. This plate is fixedly secured in accurate aligned position by the coacting flange 27 of the valve body, the end of which may bear on the underside of the said plate. To assure a fluid tight connection, a packing gasket 28 may be positioned along the periphery of the flange 27, which gasket is pressed against the plate 24 and thus deformed laterally to snugly contact the portion 26 of the dome. The said plate has a central opening 29 to receive the stem 23, and a plurality of holes 30 to permit communication between the valve body 15 and the dome 18.

Threaded at 31 into the upper end of the dome is a bonnet 32 of any conventional type. The same has threaded connection at 33 with the stem 23 that extends centrally through the dome. A standard gland 34 and packing nut 35 make a fluid tight connection with the stem. A handwheel 36 at the end of the stem permits the same to be rotated for opening or closing the valve 22.

Formed integrally with the dome at the

upper end thereof are a plurality of lugs 37 and a single lug 38. The former are each provided with a hole 39 to receive an electrical ground wire connection 40. In order to form absolutely reliable electrical contact between the wire and the lug, the latter has an opening 41 communicating with the hole 39, to permit solder to be poured into the said hole. Finally, a set screw 42 is brought to bear upon the wire to hold the same against any possible movement so as to avoid disturbing the soldered connection.

A plurality of lugs 37 are provided, since it is necessary to ground as at 43 electrical supply wires, conduits, and apparatus for light, power, telephone, and radio equipment.

The lug 38 has a threaded hole 44 therein for connection to a combined electrical conductor and mechanical guard 45. The latter extends over the top of the meter 16 and is connected to the fitting 17 in any suitable manner as, for example, by a pin 46. Since gaskets of an insulating material are commonly employed at the flanged connections 47 of the meter 16, it is necessary to have the connection 45 for forming an electrical shunt. At the same time the meter is guarded from damage due to electrical and mechanical disturbances.

The action of the air cushion in the dome 18 may be modified in various ways to assure the most positive and reliable working of the same, under the most adverse conditions, and to eliminate effectively noises and water hammer from the piping system. To this end, a resilient tubular, air filled member 49 may be extended across the dome at the end of the bonnet 32, but in spaced relation thereto. The member 49 may be of annular form to centrally receive the stem 23, with substantial fluid tightness. When pressure acts on the air cushion, the member 49 will add its cushioning effect by yielding upward, or toward the said bonnet. The said member 49 may be made of various materials, as, for instance, rubber to retain the air without possibility of leakage and loss thereof, and may be held in position at 50 between the bonnet 32 and the dome 18. If desired, the member 49 may have a bead 51 along the edge thereof, that may simultaneously act as a packing gasket between the dome and bonnet. At the stem 23, the member 49 may be suitably re-enforced to tightly contact the stem. Owing to the normally slow movement of the latter, the operation thereof will not be affected.

Mounted within the dome 18 on the stem 23 are one or more inverted chambers 52. These constitute individual air cushion chambers, that act conjointly with the main air cushion in the dome 18, and may be made of metal, or rubber for additional cushioning action. The chambers 52 are spaced along the stem 23 and clearance is provided between

them and the side wall of the dome 18. The said chambers 52 receive the stem 23 centrally and are open at their bottoms 53 to communicate with the air cushion in the dome 18.

Forming fluid tight engagement between each of the chambers and the stem 23 is an anchorage 54. This includes an elastic bead 55 which may be integral with the chamber and is adapted to snugly hug the stem 23 when the chamber is slipped over the stem.

The stem 23 may itself consist of a tubular member having a plurality of openings 56 in proximity to the lower end thereof, while the upper and lower ends thereof are closed by threaded plugs 57 and 58 respectively. Thus a maximum air cushion volume is obtained.

Since the pressures generated by water hammer are very high, it is desirable to afford relief for the same by withdrawing or removing part of the pressure. Preferably a valve controlled vent device 59 is provided on the stem 23 and communicating with the hollow therein. The said device 59 includes a plunger type valve 60 slidable within the stem and controlling an opening 61 therein. The said valve rests on an annular seat 62 with which it makes fluid tight engagement, as well as with the wall of the stem. An expansion coil spring 63 seats against the plug 57 and bears down on the valve to close the same. The tension on the spring is predetermined so that the valve 60 will not open under normal conditions. However, when water hammer occurs, the excessive pressure will overcome the force of the spring, causing the valve 60 to open and partially relieve the pressure. As the pressure wave recedes, atmospheric air may flow into the stem in the instant before the valve 60 closes, re-establishing the cushion. The valve 60 itself may be of inverted chamber form to provide an air cushion that is always available. Since the holes 56 in the stem are normally submerged in the water in the dome 18, there is no possibility of destroying the air cushion in the dome by the device 59.

The operation of the device will now be clearly apparent. The electrical grounding of the electrical service supply wires, conduits, and other electrical devices, occurs through the combined valve and air cushion 14 on the street side. When the valve 22 is closed, the pressure will not act in the dome 18, since the direction of flow of the water is as shown by arrow in Fig. 3. This permits the packing for the stem 23 to be changed if necessary. On opening the valve, the water enters rapidly and through the holes 30 acts on the air in the dome 18 rendering the cushion effective. Simultaneously the diaphragm 49, the chambers 52 and the tubular space of the stem 23 are effective. Then the vent valve 60 will pulsate, relieving the pressure. A drain valve 64 may also serve to replenish the air cushion.

In Fig. 7 is shown a modification of the invention applied to an overhead piping stem, in which case the dome 18a extends upward from the valve body 15a, while the valve stem 23a extends downward, rendering the same easily accessible. The upper portion of the dome may have the electrical grounding lugs, or these may be omitted. The plate 24 is unnecessary in this modification. The upper end of the dome may be closed by any suitable cap or plug. This arrangement is highly simplified and inexpensive to manufacture.

If desired a mechanical resilient cushioning device 65 may co-operate with either of the domes 18 or 18a or directly with the plumbing system. The said means is shown as including a cylinder or tubular member 66 which is mounted on the upper end wall 67 of the dome 18a in central relation therewith. The lower end 68 of the cylinder is open and in communication with the said dome. Mounted for reciprocation in the cylinder is a piston head 69 connected to a rod 70 whose upper end is slidably received in a guide 71 having a suitable stop member 72. Taking around the rod 70 is an expansion coil spring 73 that acts against the piston head and the guide 71 to move the piston downward until the stop 72 is in engagement with the guide 71. When pressure builds up in the dome due to hammering vibrations, the force of the spring 73 will be overcome and the piston moved inwardly into the cylinder, thus affording additional volume to relieve the pressure caused by the vibrations mentioned. By this arrangement of the means 65 there is no possibility of losing air through leakage and consequent elimination of the cushion. The means 65 will always function, and as stated, may be connected to any part of a plumbing or water supply system by being threaded thereinto or in any other suitable manner.

We claim:

1. A device of the character described, including a valve body, a valve therein, a stem for the valve, a separable air cushion compartment coaxial with the stem and communicating with the valve body, a bonnet for said compartment at the free end thereof, and means to form a fluid tight connection between the stem and the bonnet, said stem consisting of a tubular member communicating with said compartment to form an auxiliary air cushion chamber.

2. A device of the character described, including a piping system for liquids, a valve therefor, and an air cushion dome interposed between the valve body and the bonnet thereof, and means to relieve pressure from the dome only at the pressure of the crest of a wave in "water hammer", a tubular member extending through the dome to communicate at its lower end with the liquid, the said

tubular member having a vent for relieving pressure of the wave, the said vent being positioned at the upper end of said member.

3. A device including an air cushion chamber having inlet means for connection with a piping system, said chamber having an air cushion pocket therein opening toward said inlet, said pocket having a wall in such uniformly close proximity to the wall of the chamber as to afford a restriction against the advance of water hammer.

4. A device including an air cushion chamber having an end wall and a side wall, an open air cushion pocket member therein spaced from said end wall, and having a resilient wall disposed in such uniformly close proximity to the side wall of the chamber as to create a cushioning restriction against the advance of a water hammer wave.

5. A device including an air cushion chamber of elongated tubular construction and having a closed end, the chamber increasing in area toward said closed end, and a plurality of baffles of correspondingly increasing size within said chamber at longitudinally spaced points therealong.

6. A device including a valve, a casing therefor, and a stem for the valve, said stem being hollow and having an opening communicating with the casing to constitute the stem an air cushion chamber.

7. A device including a valve, a casing therefor, and a stem for the valve, said stem being hollow and having an opening communicating with the casing to constitute the stem an air cushion chamber, said stem having an end extending outside the casing, a vent at said stem end communicating with the chamber, and a movable closure for the vent.

In testimony whereof we affix our signatures.

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