J. N. CORBIN.

AIR RELIEF VALVE FOR WATER MAINS AND THE LIKE.

APPLICATION FILED APR. 8, 1915.

1,166,439.

Patented Jan. 4, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

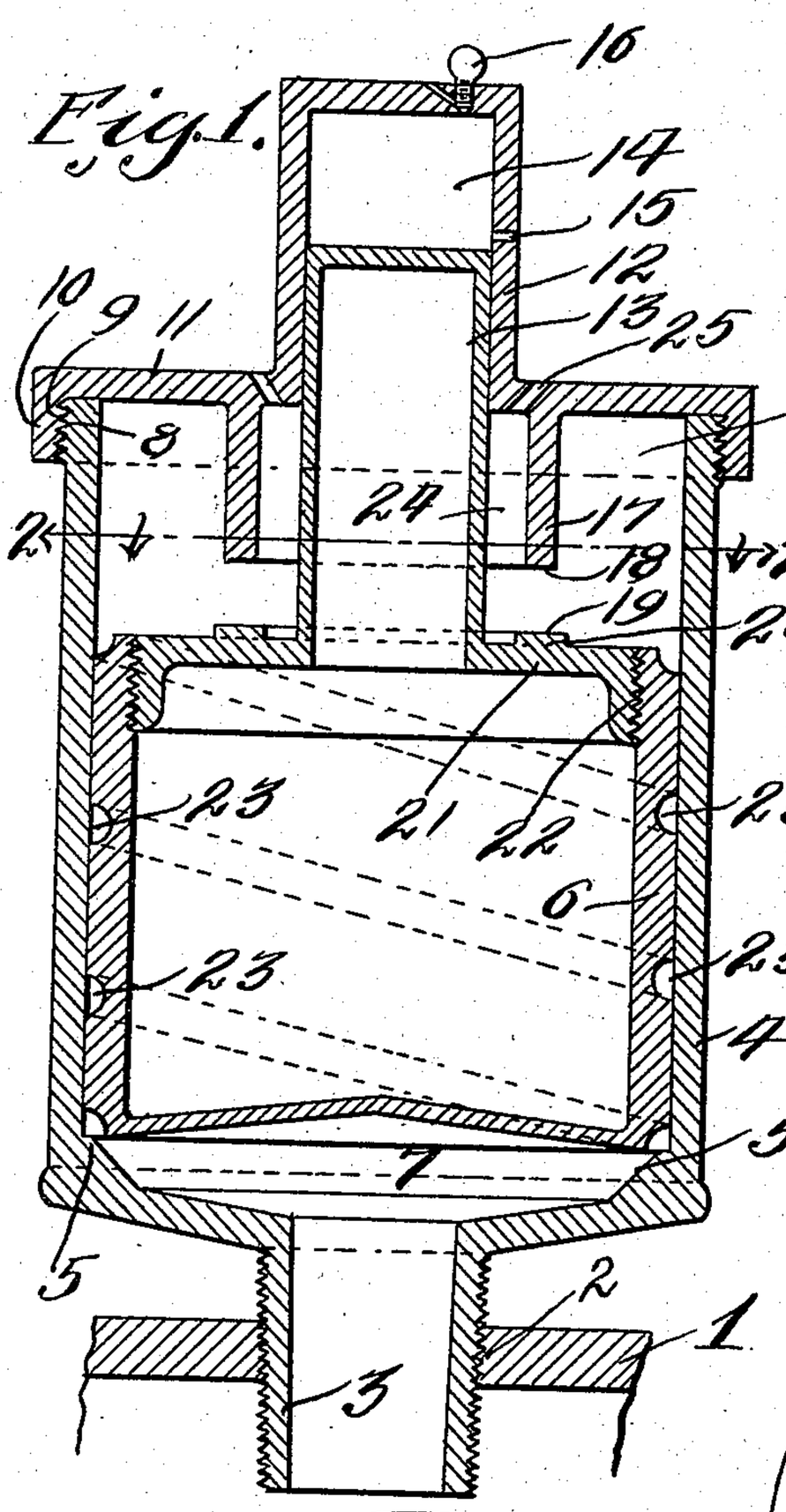



Fig. 2.

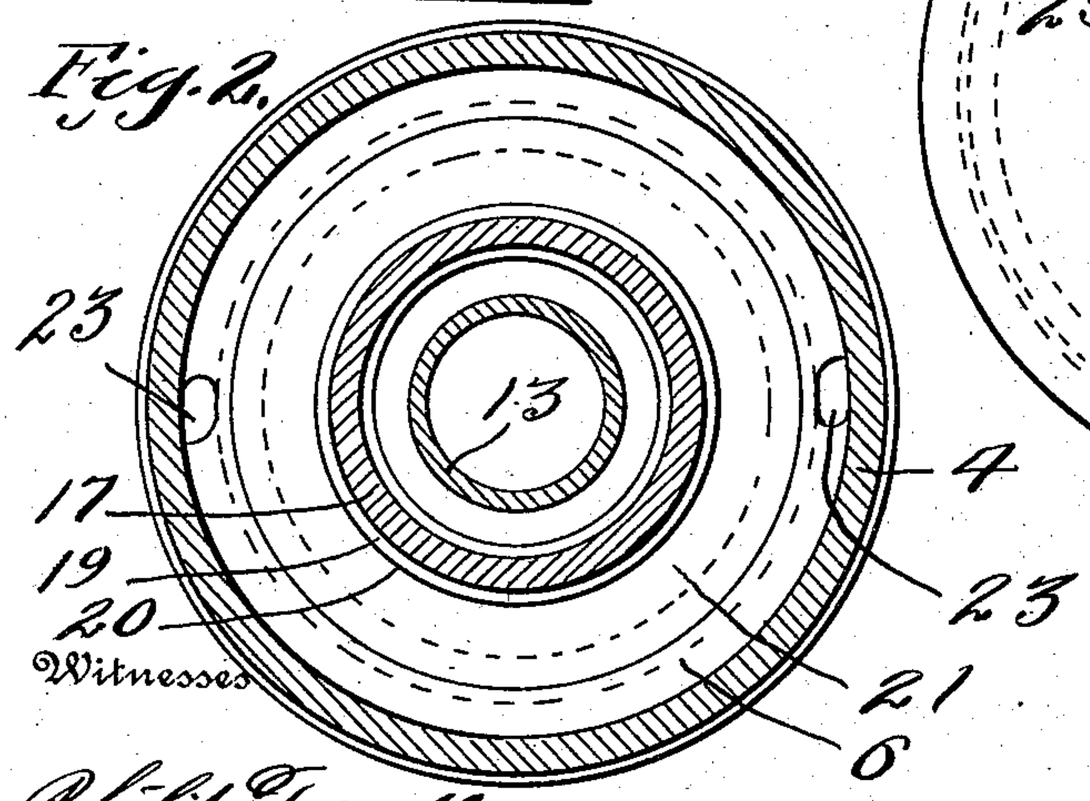
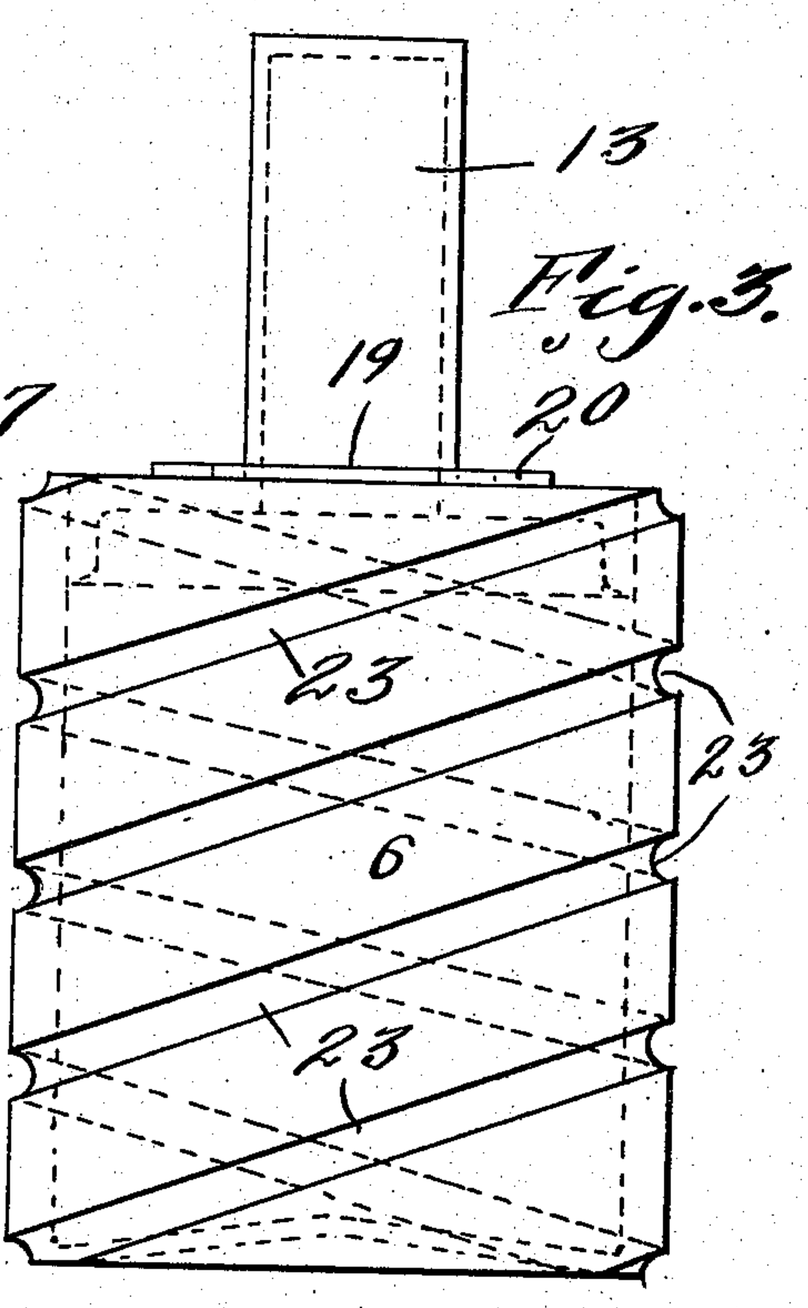



Fig. 3.



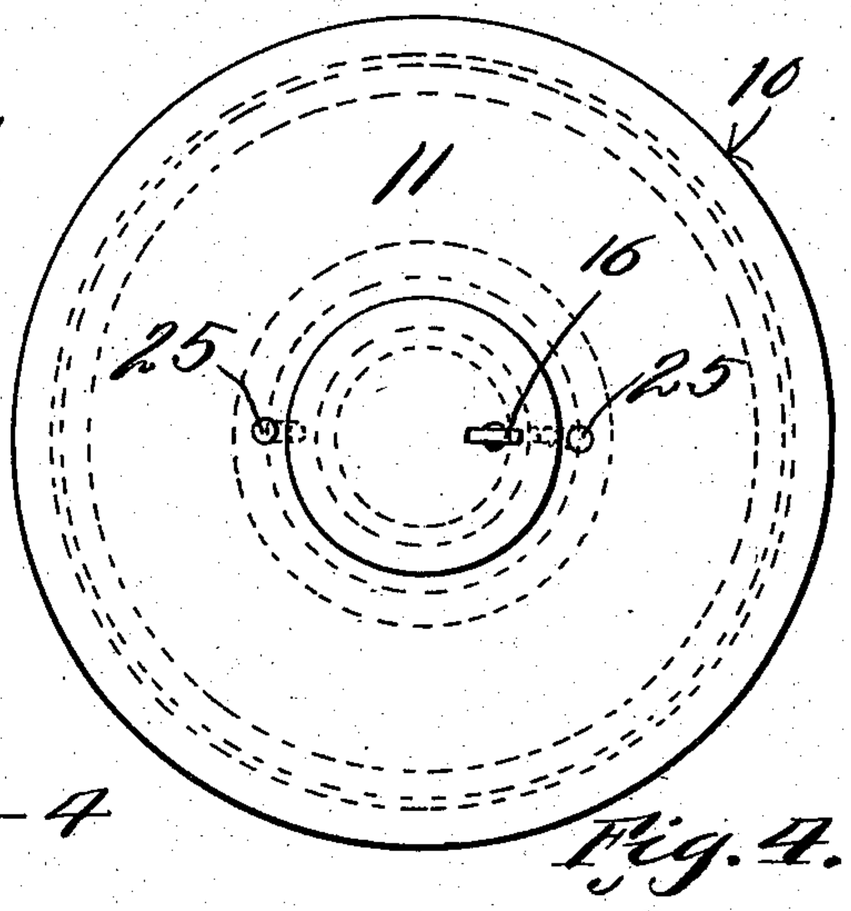




Fig. 4.

Witnesses

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2 SHEETS—SHEET 2.

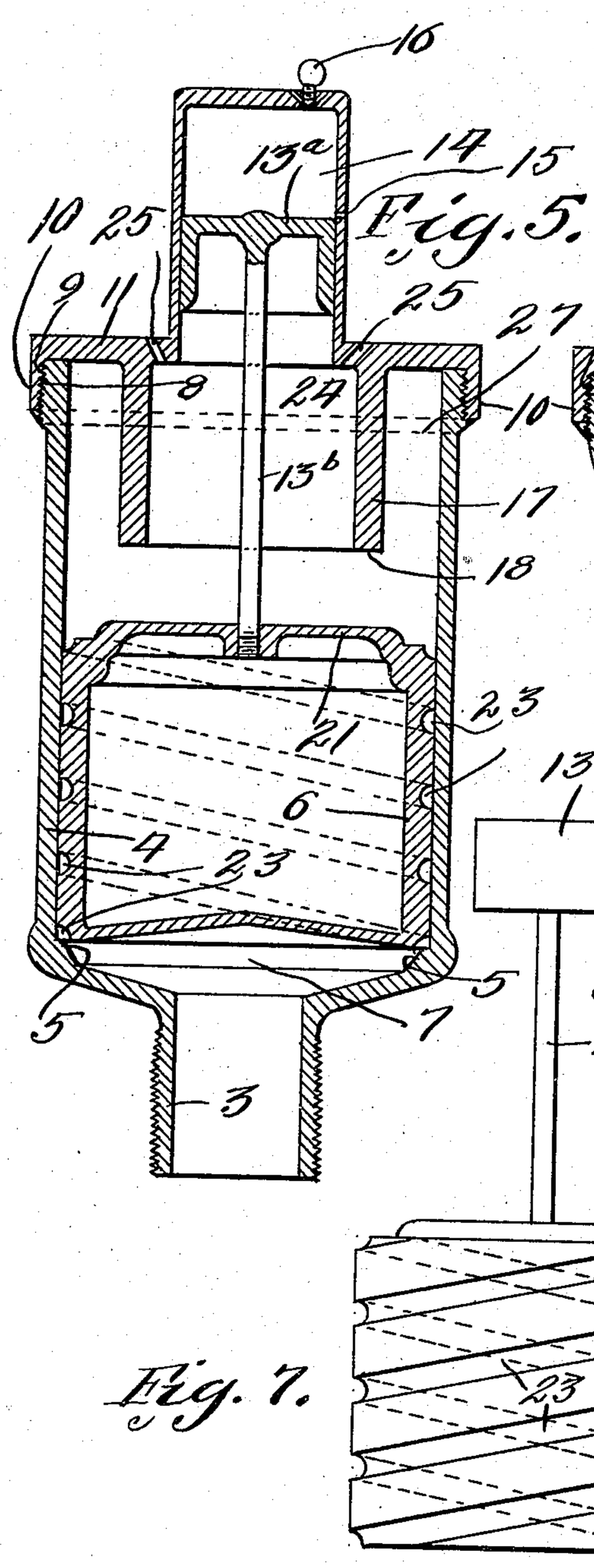


Fig. 5.

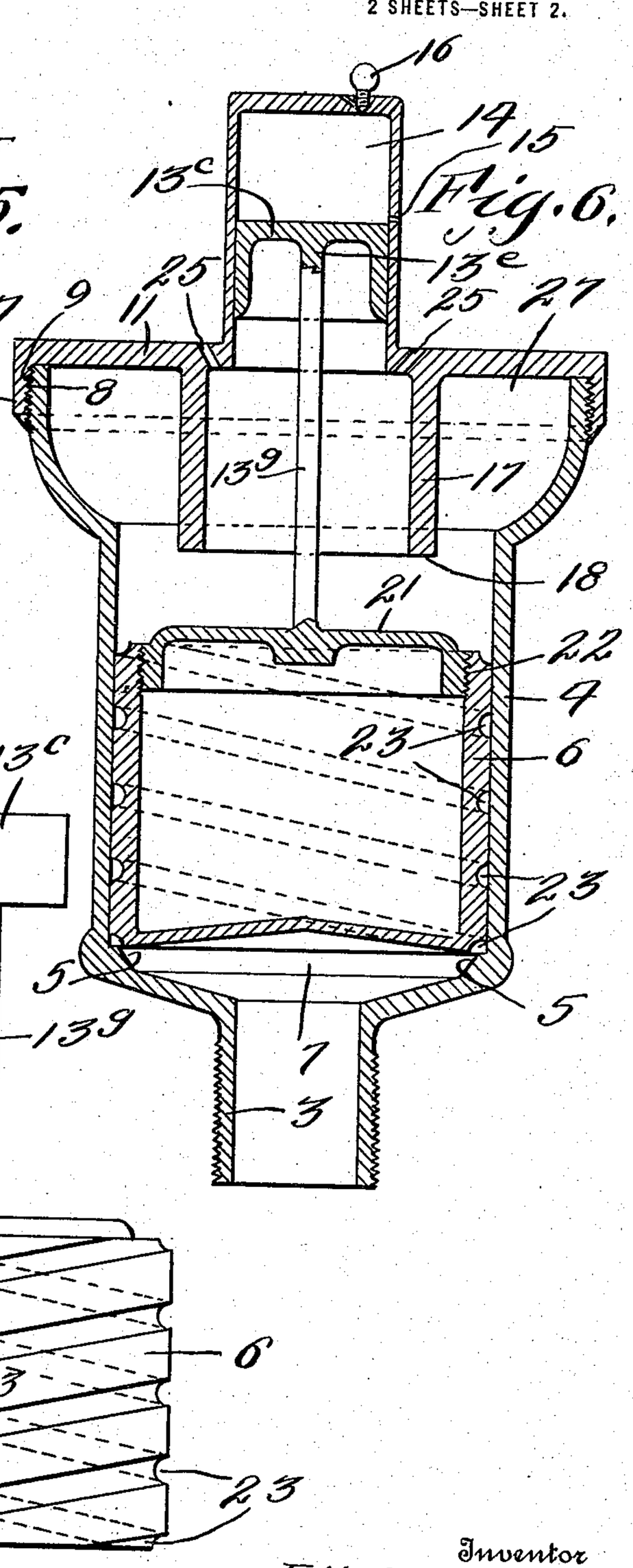


Fig. 6.

Fig. 7.

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# UNITED STATES PATENT OFFICE.

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## AIR-RELIEF VALVE FOR WATER-MAINS AND THE LIKE.

1,166,439. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed April 8, 1915. Serial No. 20,002.

*To all whom it may concern:*

Be it known that I, JUSTUS N. CORBIN, a citizen of the United States, residing at Fruita, in the county of Mesa and State of Colorado, have invented a new and useful Air-Relief Valve for Water-Mains and the like; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a new and useful automatic air relief valve adapted for use in connection with water mains and the like.

It has been found that by gravity systems for conveying water from a source of supply, such as a spring at an elevation of 9,500 feet for a great distance to another elevation of substantially 4,500 feet, passing numerous depressions, a great deal of trouble has been experienced, in the top of the highest elevated bend of the pipe line or main, which is now in use, and which trouble is due to the manner in which the air in the tops of the highest elevated bends acts. It has also been found that valves with the ordinary float lifts will pound and often seat with air pressure, and moreover, the pressure at many points along the main varies every few minutes, and a great many times the clatter of the air valve can be heard for a great distance, and the pounding of the valve causes heavy strain on the water main line.

Therefore, this invention aims to overcome or obviate the above disadvantages, by providing an improved air relief, which will not only control the air in the system, but will permit the valve to properly seat, and at the same time relieve the clatter and pounding.

In practical fields the details of construction may necessitate alterations, falling within the scope of what is claimed.

The invention comprises further features and combination of parts, as hereinafter set forth, shown in the drawings and claimed.

In the drawings: Figure 1 is a vertical sectional view through the improved air relief valve constructed in accordance with the invention. Fig. 2 is a cross sectional view on line 2—2 of Fig. 1. Fig. 3 is an enlarged detail view of the inner vertically movable cylinder showing spiral grooves thereon. Fig. 4 is a plan view. Fig. 5 is a vertical sectional view showing a modified form. Fig. 6 is a vertical sectional view showing another modified form. Fig. 7 is a detail view of one of the inner vertically movable cylinders with a spiral groove on its exterior as shown in Figs. 5 and 6.

Referring more especially to the drawings, 1 designates a portion of a water main having a threaded opening 2 in its wall, in which is threaded the threaded extension 3 of the cylinder 4 of the air relief valve. Such air relief valves may be located at different points where necessary throughout the main. On the interior of the casing or cylinder 4 adjacent its bottom is a shoulder 5, on which the inner vertically movable cylinder 6 normally rests, that is, before the water or other fluid rises in the chamber 7, below the cylinder 6, and which chamber 7 is formed owing to the provision of a shoulder 5, and also owing to the bottom of the cylinder 6 being conical. The cylinder 4 has its upper outer circumference threaded as shown at 8, with which the threads 9 of the flange 10 of the closure or top 11 engage. The top or closure 11 is provided with an extension cylinder 12, into which the cylinder piston 13 shown in Figs. 1, 2 and 3 telescopes and is movable, owing to the rise and fall of the inner cylinder 6. It is to be noted that the extension cylinder 12 has an air chamber 14 above the cylinder piston 13, and formed in the wall of the extension cylinder 12 immediately adjacent the upper end of the cylinder piston 13, that is, when the cylinder 6 is resting on the shoulder 5, is an aperture 15, which constitutes means to drain off any accumulation of fluid that might accidentally get over the cylinder piston into the air chamber 14. However, this aperture 15 is closed immediately after the piston 13 moves upwardly, and aids materially in permitting the piston to attain a good start, because it drains off the fluid that might get

above the piston and allows an escape of air for an instant or so. But just so soon as the piston closes the aperture 15 the quick starting of the piston 13 in its upward movement is retarded to a gradual movement, owing to compressing the air in the chamber 14. Connected to the upper end of the extension cylinder 12 is an adjustable air escape valve 16, which may be adjusted so as to permit a gradual escape of the compressed air in the chamber 14. This gradual escaping of air through the valve 16 relieves pressure in the chamber 14, so as to prevent or obviate too rapid rising of the cylinder piston 13. Extending downwardly from the under face of the top or closure 11 is an annular flange 17, the lower edge of which constitutes a valve seat 18, which is contacted with by the valve surface 19 of the rib 20 (which is annular in plan view) carried by the upper wall 21 of the inner cylinder 6. This upper wall or top 21 is threaded at 22 into the cylinder 6, which cylinder 6 upon its exterior is provided with spiral grooves 23, which permit the air from the chamber 7 to pass above the cylinder 6, and through the chamber 24, and subsequently through the apertures 25 to the atmosphere. By the provision of the annular flange 17, the chamber 24 is not only formed, but also a chamber 27.

In Figs. 5 and 6 the actions of the moving parts are practically the same as those in the other figures, but the construction of the air relief valve shown in Figs. 5 and 6 is slightly modified. For instance in Fig. 5 the valve seat 18 contacts directly with the upper surface of the top or wall 21 of the inner cylinder 6, and the piston $13^a$ is not integral with the top or upper wall 21 of the cylinder 6, but is carried by a rod $13^b$, which in turn is connected to the top 21. In Fig. 6 the structure only differs from that shown in Fig. 5, in that the upper portion of the cylindrical wall of the cylinder 4 is bulged outwardly, to form a larger chamber 27, and furthermore the piston $13^c$ is integral at $13^e$ with a connecting rod or bar or the like $13^g$, which in turn is connected to the top or head 21 of the cylinder 6.

When air enters the chamber 7 from the main pipe line, it passes upwardly through the grooves 23 into the chamber 24, and to the atmosphere through the apertures 25. The pitch and sides of the grooves depend largely on the density of the fluid passing through the pipe line, for this improved air relief valve may be used in connection with means, which conduct petroleum and its products, as well as water and the like. Subsequently to the air having passed through the grooves and through the chamber 24 to the atmosphere, water or other fluid enters the chamber 7, and floats the inner cylinder 6 sufficiently to cause the valve seat surface 19 to close or contact with the valve seat 18, thereby compressing air in the chamber 27.

By adjusting the air escape valve 16 to suit the conditions, the cylinder piston and cylinder 6 may be regulated in their vertical movements, and moreover, the valve 16 is employed to permit a gradual escape of compressed air from the chamber 14. It is to be noted that this gradual escaping of air through the valve 16 relieves pressure in the chamber 14, in order to obviate too rapid rising of the cylinder piston 13. When air again accumulates in the chamber 7 the cylinder and its cylinder piston 13 drop partially by their own weight and the loss of the floating effect of the fluid and the compressed air in the chamber 27. Very often a vacuum is formed in the chamber 7 by the rapid movement of the fluid in the pipe line, thus causing atmospheric pressure to act through the chamber 24, thereby causing the cylinder 6 and its cylinder piston 13 to drop.

By the use of this improved air escape valve, the accumulation of air in the pipe line is materially relieved, owing to the use of a combined floating cylinder and pressure piston, having a circular valve seat on one end to contact with a seat on the inner portion of the outer casing to form a chamber leading to the atmosphere, and having another closed air chamber at the other end of the cylinder, which receives the floating and pressure effect of the fluid passing through the pipe line, and the fluid packing effect on the piston by entering the spiral grooves, thereby governing the action or the activity of the inner cylinder, with the varied pressure regulated to prevent pounding or hammering of the fluid through the pipe line, owing to the cylinder piston 13 connected to the inner cylinder 6, and acting on air. As the inner cylinder 6 rises the air in the dash pot or chamber 14 is compressed by the cylinder piston 13, and owing to the apertures or openings 25, in practice, being of extreme small diameters, the air will very slowly pass from the chambers 24 and 27, which together with the compression of air in the dash pot or chamber 14, will prevent hammering or pounding of the valve surface 19 against the valve seat 18 as the cylinder 6 rises, incident to the pressure of the fluid in the pipe line. The showing of the sides of the openings 25 is somewhat exaggerated, for the mere purpose of illustration. By the provision of this improved device an air chamber is provided to receive air compressed therein by the action of the piston acted valve to aid release of valve when pressure on the same falls sufficient, or when air is accumulated under the cylinder 6 instead of fluid, and also to force out the fluid into the pipe line, when there

is air below the chamber under the piston valve or cylinder 6, thus balancing the air pressure around the piston and allowing the cylinder 6 to fall by its own weight, utilizing the principle that water will not compress while air will compress. The grooves in the cylinder 6 filled or partly filled with fluid, act in a degree as packing to the cylinder 6 thus utilizing the pressure effect of the fluid to close the valve seats by the action of the fluid on the cylinder 6. The chamber 27 acts to prevent the valve being closed by air pressure alone accumulating under the cylinder 6; in other words, the air pressure in the chamber 27 has a balancing effect on the cylinder moved valve, against the air accumulated below the cylinder 6.

The invention having been set forth, what is claimed as new and useful is:—

1. An air relief valve for fluid mains comprising an outer casing connected to the main and having an extension cylinder, an inner cylinder casing movable vertically in the first casing and provided with a cylinder piston operable in the extension cylinder, said first casing having air compression and air relief chambers above the inner cylinder and provided with a downwardly extending valve seat flange, the seat of which is designed to be closed by the inner cylinder, a chamber below the inner cylinder, an air compression chamber in the extension cylinder above the piston, and means of communication between the space below the inner cylinder and the air relief and air compression chambers above the inner cylinder, said extension cylinder having means to permit of a partial sudden rise of the inner cylinder and piston, but to drain off fluid that may arise above the piston in the extension cylinder.

2. An air relief valve for fluid mains comprising an outer casing connected to the main and having an extension cylinder, an inner cylinder casing movable vertically in the first casing and provided with a cylinder piston operable in the extension cylinder, said first casing having air compression and air relief chambers above the inner cylinder and provided with a downwardly extending valve seat flange, the seat of which is designed to be closed by the inner cylinder, a chamber below the inner cylinder, an air compression chamber in the extension cylinder above the piston, and means of communication between the space below the inner cylinder and the air relief and air compression chambers above the inner cylinder, said extension cylinder having means to permit of a partial sudden rise of the inner cylinder and piston, but to drain off fluid that may arise above the piston in the extension cylinder, and an adjustable device carried by the extension cylinder to permit of a gradual rise of the piston and the inner cylinder subsequently to the partial sudden rise thereof.

3. An air relief valve for fluid mains comprising an outer casing connected to the main and having an extension cylinder, an inner cylinder casing movable vertically in the first casing and provided with a cylinder piston operable in the extension cylinder, said first casing having air compression and air relief chambers above the inner cylinder and provided with a downwardly extending valve seat flange, the seat of which is designed to be closed by the inner cylinder, a chamber below the inner cylinder, an air compression chamber in the extension cylinder above the piston, and means of communication between the space below the inner cylinder and the air relief and air compression chambers above the inner cylinder, said extension cylinder having means to permit of a partial sudden rise of the inner cylinder and piston, but to drain off fluid that may arise above the piston in the extension cylinder, and an adjustable device carried by the extension cylinder to permit of a gradual rise of the piston and the inner cylinder subsequently to the partial sudden rise thereof.

4. An air relief means for fluid mains comprising an outer cylinder connected to the main and having an extension cylinder provided with an air compression chamber, the outer cylinder having an inner annular extension wall provided with a valve seat and dividing the upper portion of the outer cylinder into air relief and air compression chambers, the air relief chamber having communication with the atmosphere, an inner valve cylinder having a valve seat to coöperate with the first valve seat to cut off communication with the air relief cylinder and a chamber below the valve cylinder, and to close communication between the compression chamber of the outer cylinder and the air relief chamber, said valve cylinder having a piston operable in the chamber of the extension cylinder, the outer cylinder having an air chamber below the valve cylinder in communication with the fluid main, said valve cylinder having exterior grooves forming communications with the air chamber below the valve cylinder and the air relief chamber when the valve cylinder is in its downward position, said grooves forming continuous communication between the air chamber below the valve cylinder and the air compression chamber of the outer cylinder regardless whether the valve cylinder is up or down, the rising of the fluid in said grooves causing a fluid packing.

5. An air relief means for fluid mains comprising an outer cylinder connected to the main and having an extension cylinder provided with an air compression chamber, the outer cylinder having an inner annular extension wall provided with a valve seat and dividing the upper portion of the outer cylinder into air relief and air compression chambers, the air relief chamber having communication with the atmosphere, an in-

ner valve cylinder having a valve seat to coöperate with the first valve seat to cut off communication with the air relief cylinder and a chamber below the valve cylinder, and to close communication between the compression chamber of the outer cylinder and the air relief chamber, said valve cylinder having a piston operable in the chamber of the extension cylinder, the outer cylinder having an air chamber below the valve cylinder in communication with the fluid main, said valve cylinder having exterior grooves forming communications with the air chamber below the valve cylinder and the air relief chamber when the valve cylinder is in its downward position, said grooves forming continuous communication between the air chamber below the valve cylinder and the air compression chamber of the outer cylinder regardless whether the valve cylinder is up or down, the rising of the fluid in said grooves causing a fluid packing, said extension cylinder having means to permit of a partial sudden rise of the valve cylinder and piston, and to drain off fluid that may arise above the piston in the extension cylinder.

6. An air relief means for fluid mains comprising an outer cylinder connected to the main and having an extension cylinder provided with an air compression chamber, the outer cylinder having an inner annular extension wall provided with a valve seat and dividing the upper portion of the outer cylinder into air relief and air compression chambers, the air relief chamber having communication with the atmosphere, an inner valve cylinder having a valve seat to cooperate with the first valve seat to cut off communication with the air relief cylinder and a chamber below the valve cylinder, and to close communication between the compression chamber of the outer cylinder and the air relief chamber, said valve cylinder having a piston operable in the chamber of the extension cylinder, the outer cylinder having an air chamber below the valve cylinder in communication with the fluid main, said valve cylinder having exterior grooves forming communications with the air chamber below the valve cylinder and the air relief chamber when the valve cylinder is in its downward position, said grooves forming continuous communication between the air chamber below the valve cylinder and the air compression chamber of the outer cylinder regardless whether the valve cylinder is up or down, the rising of the fluid in said grooves causing a fluid packing, said extension cylinder having means to permit of a partial sudden rise of the valve cylinder and piston, and to drain off fluid that may arise above the piston in the extension cylinder, and an adjustable device carried by the extension cylinder to permit of a gradual rise of the piston and valve cylinder subsequently to the partial sudden rise thereof.

7. An air relief valve for fluid mains, comprising an outer cylinder having an extension cylinder provided with an air chamber, the outer cylinder having an air chamber adjacent its lower portion and provided with air relief and air compression chambers intermediate the chamber of the extension cylinder and the lower air chamber, and means operable in the outer cylinder and the extension cylinder and provided with valve parts with the outer cylinder and cooperating with the plurality of chambers for controlling the air and preventing pounding or hammering of the fluid in the main, said means having means of communication between the chambers above and the chamber below said first means, said air relief chamber having communication with the atmosphere.

8. An air relief valve for fluid mains, comprising an outer cylinder having an extension cylinder provided with an air chamber, the outer cylinder having an air chamber adjacent its lower portion and provided with air relief and air compression chambers intermediate the chamber of the extension cylinder and the lower air chamber, and means operable in the outer cylinder and the extension cylinder and provided with valve parts with the outer cylinder and coöperating with the plurality of chambers for controlling the air and preventing pounding or hammering of the fluid in the main, said means having means of communication between the chambers above and the chamber below said first means, said air relief chamber having communication with the atmosphere, said extension cylinder having means not only to permit of a partial sudden rise of the first means, but to drain off fluid that may arise in the extension cylinder.

9. An air relief valve for fluid mains, comprising an outer cylinder having an extension cylinder provided with an air chamber, the outer cylinder having an air chamber adjacent its lower portion and provided with air relief and air compression chambers intermediate the chamber of the extension cylinder and the lower air chamber, and means operable in the outer cylinder and the extension cylinder and provided with valve parts with the outer cylinder and cooperating with the plurality of chambers for controlling the air and preventing pounding or hammering of the fluid in the main, said means having means of communication between the chambers above and the chamber below said first means, said air relief chamber having communication with the atmosphere, said extension cylinder hav-

ing means not only to permit of a partial sudden rise of the first means, but to drain off fluid that may arise in the extension cylinder, and an adjustable device carried by the extension cylinder to permit of a gradual rise of said first means subsequently to the partial sudden rise thereof.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JUSTUS N. CORBIN.

Witnesses:
W. A. MERRIELL,
CHARLES H. BARNES.