No. 697,303. Patented Apr. 8, 1902.

C. C. WENTWORTH.

RAM.

(Application filed June 11, 1901.)

(No Model.) 3 Sheets—Sheet I.

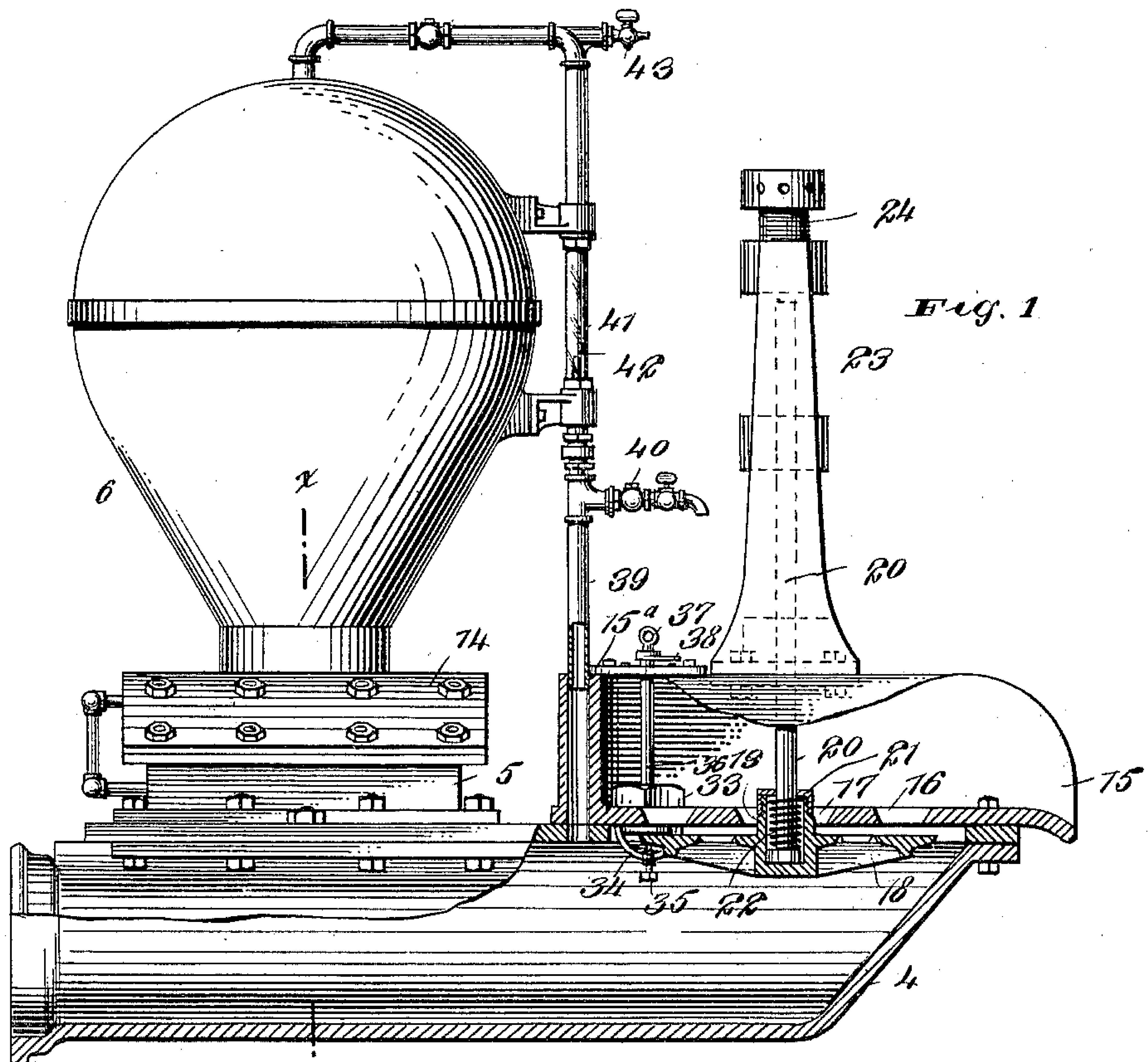

Fig. 1

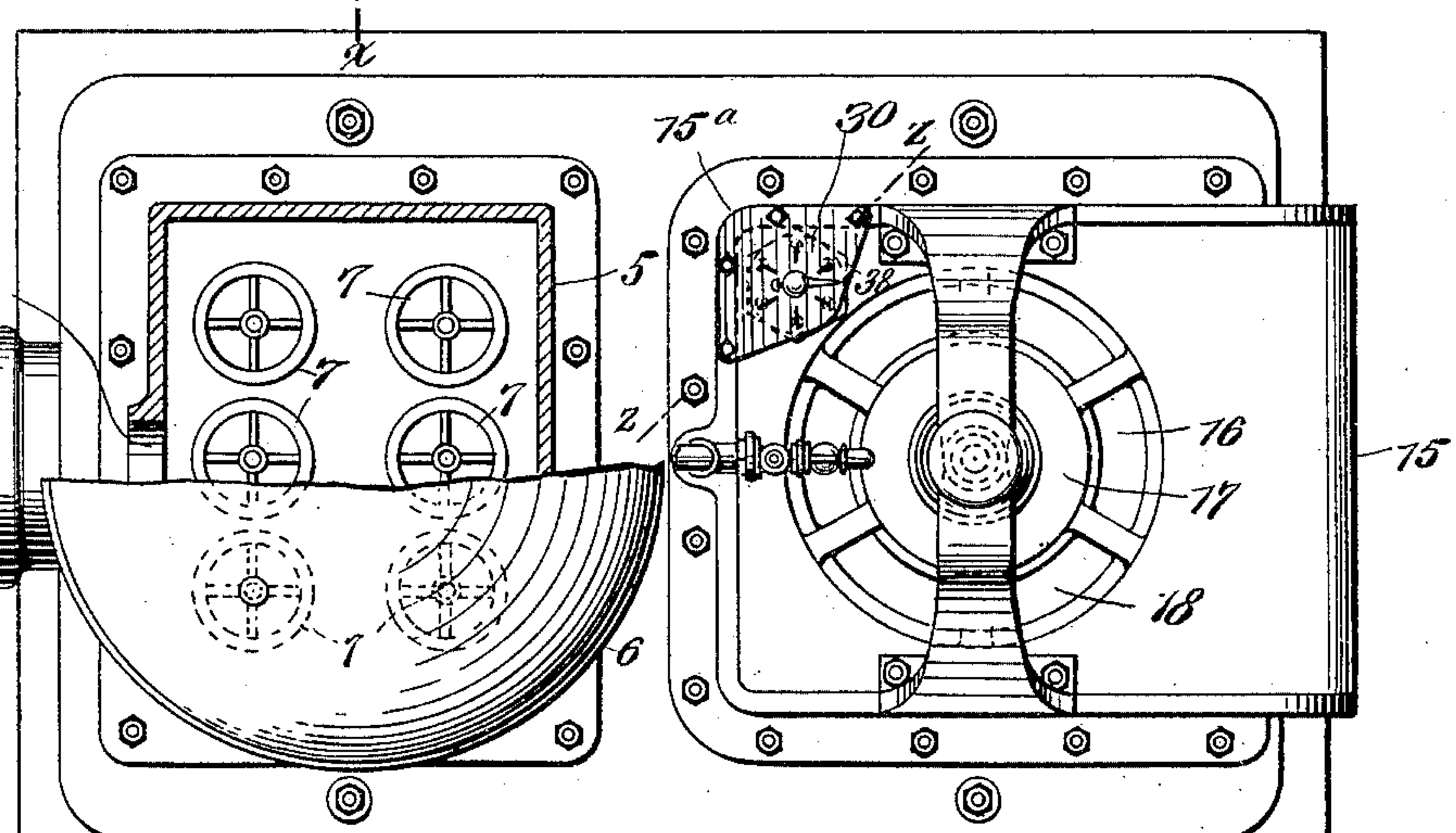

Fig. 2

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Fig. 3

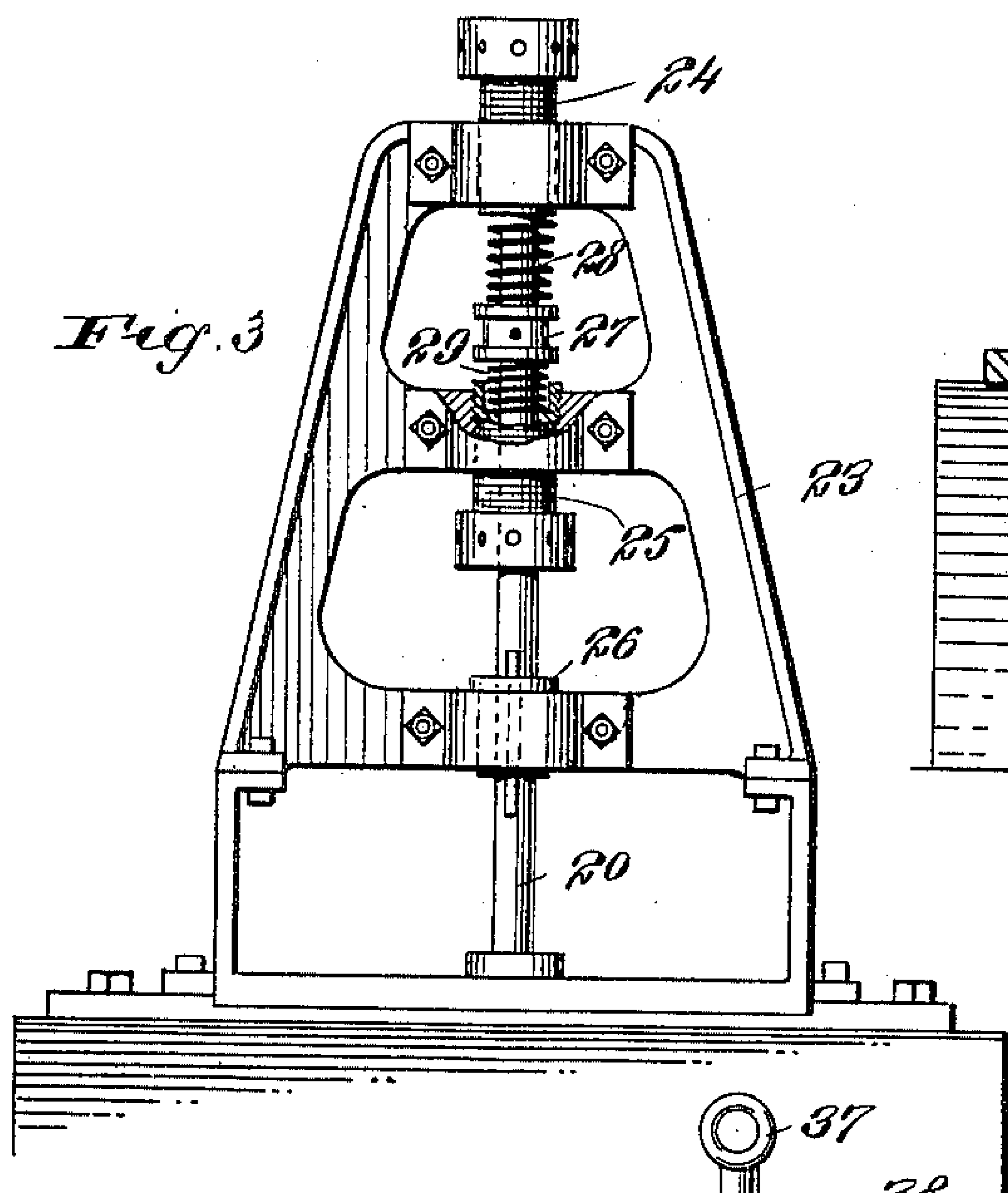


Fig. 4

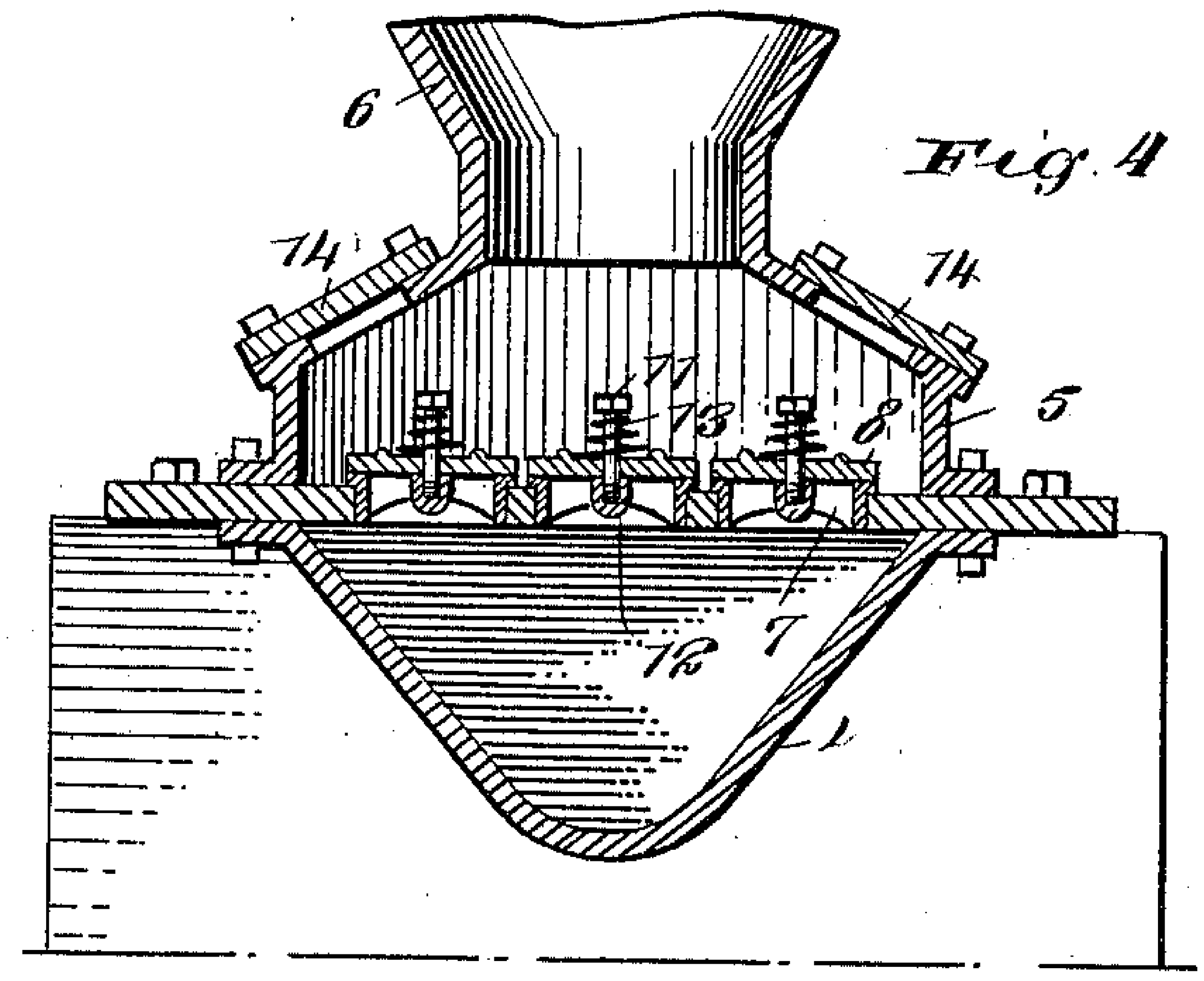


Fig. 6

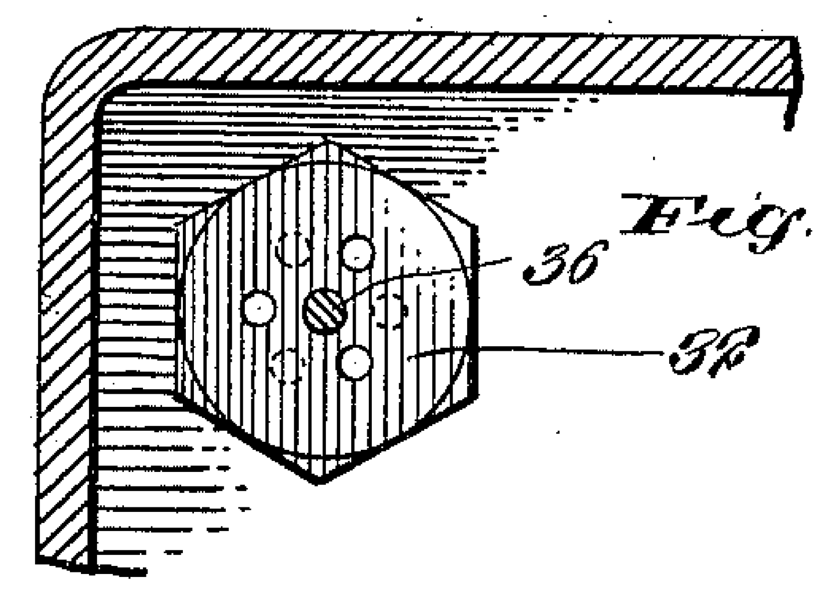
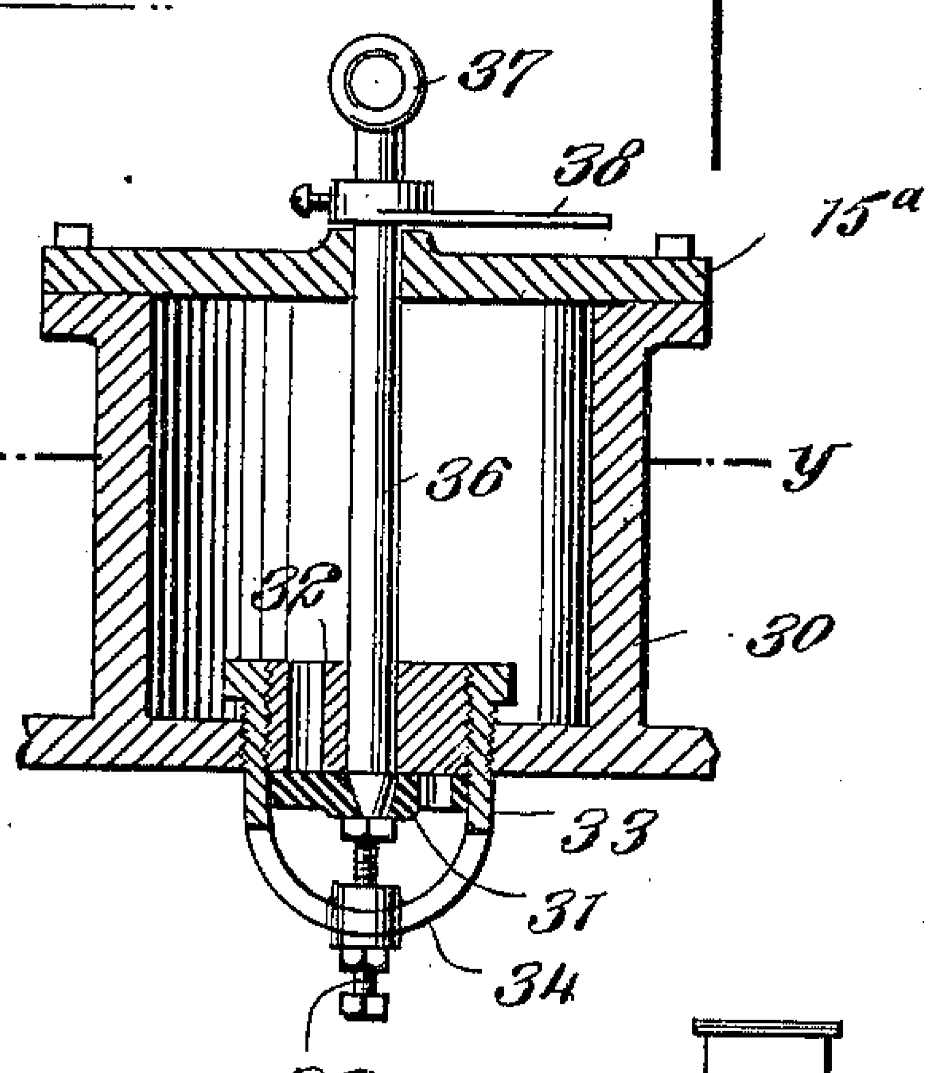


Fig. 5



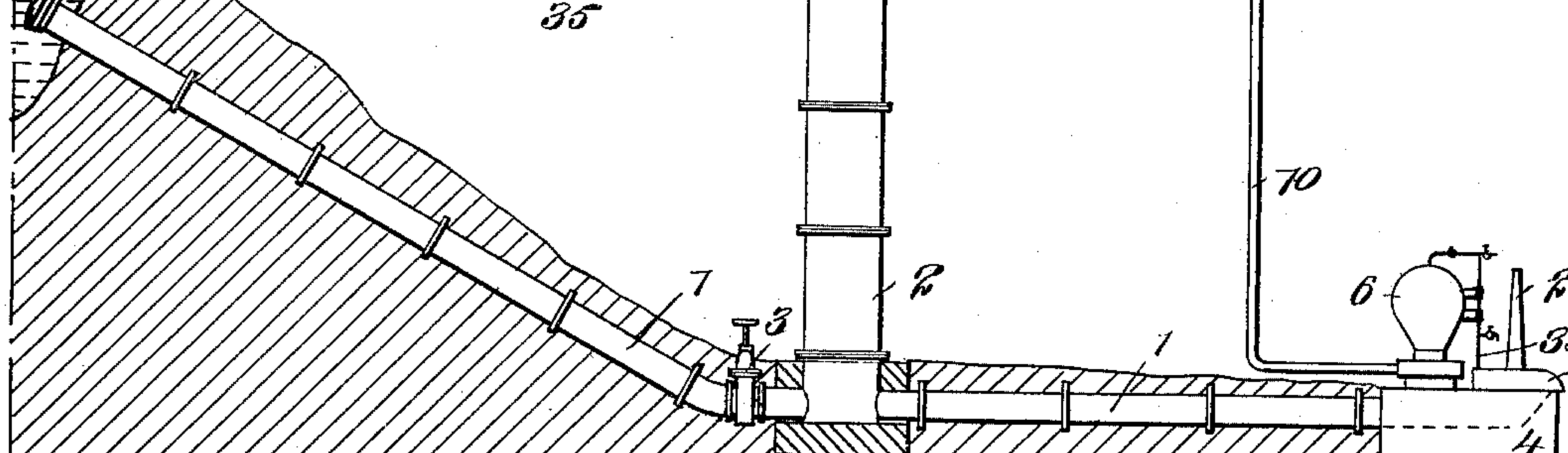


Fig. 7

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3 Sheets—Sheet 3.

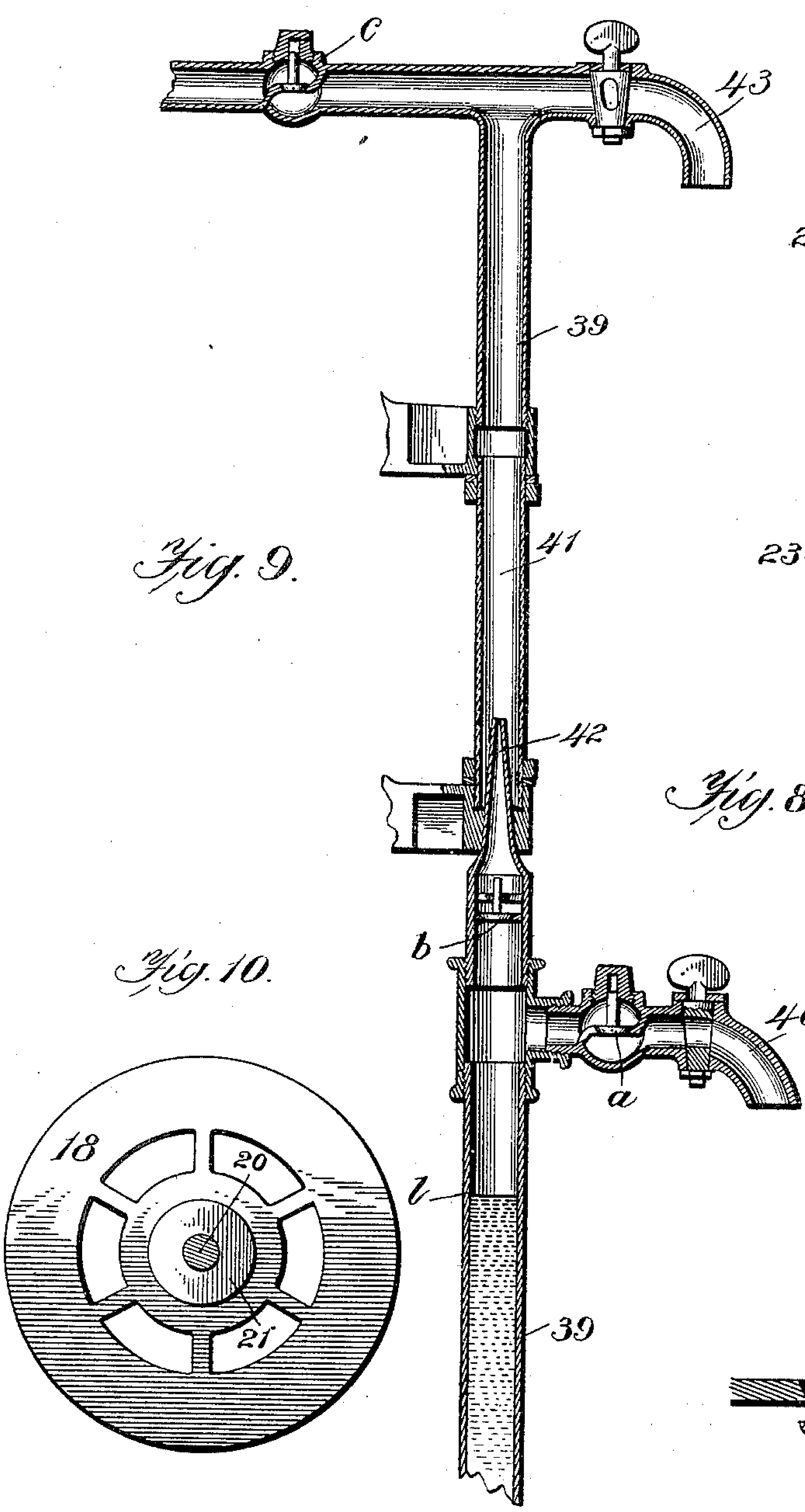

Fig. 9.

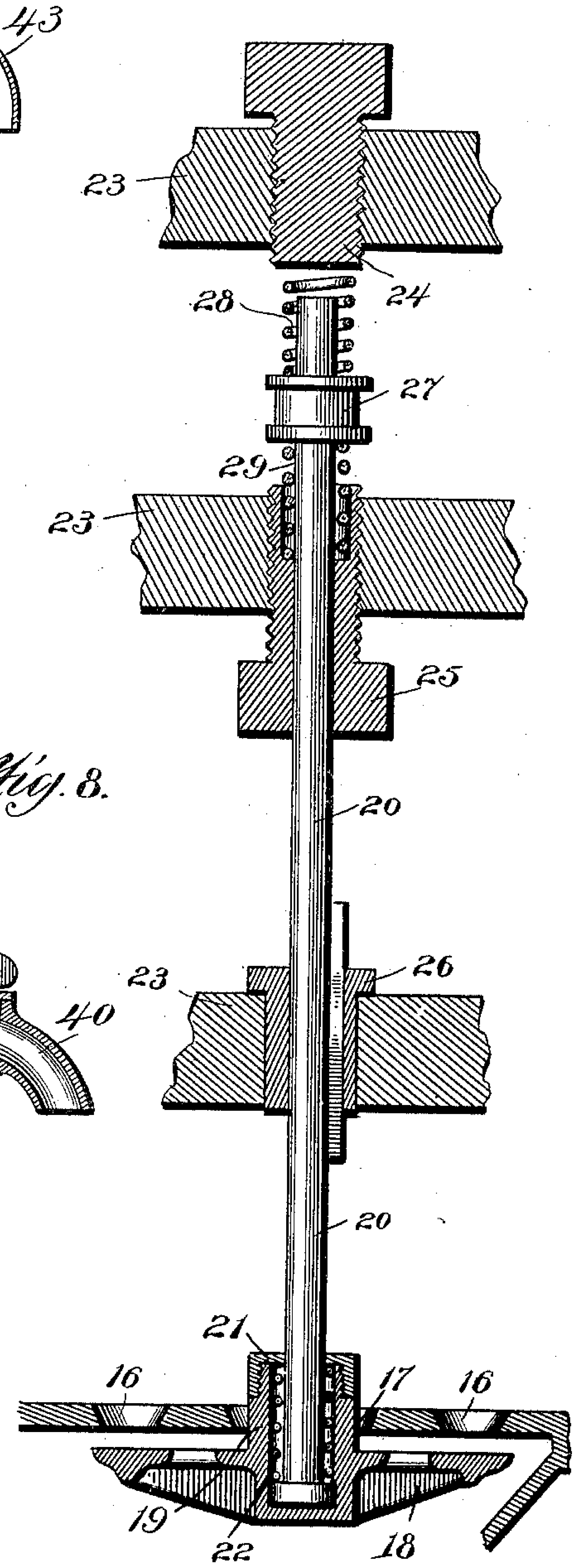

Fig. 8.

Fig. 10.

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UNITED STATES PATENT OFFICE.

CHARLES C. WENTWORTH, OF ROANOKE, VIRGINIA.

RAM.

SPECIFICATION forming part of Letters Patent No. 697,303, dated April 8, 1902.

Application filed June 11, 1901. Serial No. 64,069. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. WENTWORTH, a citizen of the United States, and a resident of Roanoke, in the county of Roanoke and State of Virginia, have invented a new and Improved Hydraulic Ram, of which the following is a full, clear, and exact description.

This invention relates to improvements in hydraulic rams; and the object is to provide a ram for high duty and for pumping in large quantities, as needed for supplying railroad water-tanks, small towns, and the like.

Figure 1 is a side elevation, partly in section, of a ram embodying my invention. Fig. 2 is a plan view thereof, partly in section. Fig. 3 is an elevation showing the waste-valve connections. Fig. 4 is a section on the line $x\,x$ of Fig. 1. Fig. 5 is a sectional elevation on the line $z\,z$ in Fig. 2 of a quick-acting relief-valve employed. Fig. 6 is a section on the line $y\,y$ of Fig. 5. Fig. 7 is a general view showing the ram connections. Fig. 8 is an enlarged vertical section taken through the waste-valve and its stem. Fig. 9 is an enlarged vertical section taken through the air-supply pipe for the air-dome, and Fig. 10 is a detail of the waste-valve.

Referring to the drawings, Fig. 7, 1 designates the drive-pipe, and at one end of this drive-pipe I have shown a stand-pipe 2, which furnishes the head or pressure for the operation of the ram. This stand-pipe is filled from an elevated source of supply through the inclined pipe and the valve 3. The drive-pipe leads into the base-casing 4 of the ram, upon which is a receiving-casing 5, surmounted by an air-dome 6. Arranged in the wall separating the casing 4 from the casing 5 are spider valve-seats 7, Fig. 4, with which upwardly-opening valves 8 engage, and leading from the casing 5 to the receiving-tank 9 is a pipe 10. (Shown in Fig. 2.) The valves 8 should be made as light as possible. For instance, they may be made of hard rubber, because the relatively small weight of this material enables it to respond more quickly to the actuating force, and thus less water escapes back into the casing 4. Furthermore, I employ a large number of small valves 8 in preference to a small number of large valves, because as the outlet is on the circumference only there is a greater circumferential measurement in the aggregate of the small valves, and the vertical motion of each valve is lessened, and the time taken to close and the water loss are therefore less.

Each valve 8 is mounted to move on a stud or bolt 11, which engages in an interiorly-threaded socket 12 in the valve-seat, and the valve is held yieldingly on its seat by means of a spring 13, engaging at its lower end with the valve and at its upper end with the head of the bolt.

The casing 5 is extended horizontally to a much larger area than usual, so as to accommodate the large number of valves, and its top wall is provided with openings, which are normally closed by one or more covers 14. By removing these covers access may be had to the interior of the casing, when desired, to regulate or clean the valves. In front of the casing 5 is a waste-spout 15, which communicates with the interior of the casing 4 through concentric rows of segmental openings or ports 16 and 17, Figs. 1 and 2. These openings or ports should have an area considerably in excess of the area of the drive-pipe, and they are controlled by a subjacent waste-valve 18. This valve 18 should be made as light as is practicable, and the vertical movement of the valve should be as short as possible; otherwise its velocity and consequent impact on closing will be such as to wear away the surfaces. To overcome this in ordinary rams, a thick rubber disk is put on the top of the valve, which continually wears out, with consequent expense and stoppage, besides the loss of effect due to the work done in compressing the rubber. These objections are overcome by my construction and arrangement of the valve, as it will be noted that instead of opening only on the outer periphery, as in ordinary ram-valves, my valve is (see Fig. 10) made of spider form or is perforated with concentric segmental openings about the hub and discharges on three concentric circular lines parallel to the lines of the openings above, so that the water issues around the outer edge of the valve to the openings 16, also through the openings in the valve to openings 16, and also through the openings in the valve to the central opening 17. This reduces the vertical motion fifty per cent., thus reducing by one-half the work needed to lift the weight of the valve, and the parallelism of the segmental openings in the valve and the plate above permits of accurate computation of the discharge.

The hub portion 19 of the valve 18 is made cup-shaped (see Figs. 1 and 8) to receive the end of an impact-rod 20, and arranged between a head on the lower end of this rod within the hub and a cover 21 for the hub is a spring 22, which is given a considerable initial compression by means of said cap or cover 21. This spring 22, in connection with the head of the rod 20, holds the valve 18 on a practically horizontal plane and at right angles to the rod, but at the same time admits of a small tilting deviation in case a solid particle is caught between the valve and its seat on one side of the center. Transverse strains on the shaft or stem 20 are by this means avoided. The space around the spring is designed to be filled with thick grease or tar to prevent the entrance of water.

A vertical frame 23 is mounted on the outlet-spout 15, and the rod 20 passes up through bearings in cross-bars of said frame. Arranged in the top cross-bar of the frame is an adjustable abutment 24, shown in the form of a screw, and said rod passes through an exteriorly-threaded sleeve 25, vertically adjustable in the center cross-bar. Below this sleeve the rod passes through a bearing 26, and to prevent a rotary movement of the rod, and consequently preventing a rotary movement or displacement of the valve 18, there is a feather-and-groove connection between the bearing 26 and the rod.

Arranged on the upper end of the rod 20 and resting on a collar 27 on said rod is a spring 28, forming a cushion for engaging with the abutment 24. This spring 28 needs no initial compression, as it is made quite strong. It does not constantly fill the space between the top of the rod 20 and the bottom of the abutment-screw, but is entirely out of contact with said abutment-screw when the valve 18 is down, as in Fig. 8, and only comes in contact with the abutment-screw during the last portion of the upward movement of the valve and rod, as in Fig. 3. It should on the compression from the free state by an amount, say, one-eighth of an inch, (being the last part of the upward movement of the rod 20,) exert a resistance sufficient to depress and open valve 18 in the normal action of the ram. There is therefore practically no work done by the water in compressing the spring 28, the upward momentum of the valve doing the work. This secures the economical use of the water-power and also results in the safe and easy seating of the valve. The screw or abutment 24 fixes the point at which the contact of the spring 28 with the abutment-screw begins. It will be seen, therefore, that in my ram the waste-valve has a free and unobstructed initial rise in closing, and the opening-spring is put under a resilient tension only by the last part of the movement of the valve in closing.

Arranged between the collar 27 and abutting against a shoulder in the sleeve 25 is a stout spring 29, which cushions the valve 18 against jar or strain when it reaches its lowermost point.

In the adjustment of the tension of the opening-spring 28 for the valve it is not made strong enough to open said valve at the start, but only strong enough to open it when aided by the temporary backlash of water in the drive-pipe in the normal action of the ram. To start the valve 18 to open when the ram is first put in action, I employ a starting-valve which temporarily relieves the pressure of water in the drive-pipe or subjacent chamber of the ram. It is in the nature of a quick-opening valve controlling communication between the casing 4 and spout 15. (See Figs. 1, 5, and 6.) A valve 31 is mounted to rotate below a seat 32, the valve being provided with a port or a series of ports, as is also the valve-seat, as clearly indicated in Fig. 6. The valve-seat 32 is screw-threaded into a sleeve 33, on the lower portion of which is a yoke 34, in which is a step-bearing, here shown as an adjustable screw 35 for the stem 36 of the valve, this stem being extended through an opening in the valve-seat. The stem extends upward through a plate 15^a on the top of the spout 15 and is provided with an eye 37, in which a bar or other device may be inserted for turning the valve, and a pointer 38 on the stem will indicate the position of the valve—that is, whether open or closed. When the valve is suddenly turned to open position, it releases the pressure in the casing 4 sufficiently to allow the spring 28 to open the valve 18. This release of pressure is momentary, but sufficient in connection with the spring 28 to effect its purpose. After the ram starts into action the starting-valve is closed, as the alternate backlash in the drive-pipe and subjacent chamber 4 at every movement of the air-dome valves is sufficient to aid spring 28 in continuing to perform the proper opening of the main waste-valve 18.

I will now describe means for automatically supplying air to maintain the air-cushion in the top of air-dome 6, reference being had to Figs. 1 and 9. For this purpose communication is provided between the interior of the casing 4 and the interior of the upper portion of the air-dome by means of a pipe 39, in which is arranged an air-inlet valve 40 and a glass sight-tube 41, into which a nipple 42 extends at the bottom, and in the upper portion of the pipe 39 is a relief-valve 43.

The air-valve 40 and relief-valve 43 are in the nature of simple stop-cocks, which may be opened or closed at will. In the stop-cock branch of air-valve 40 is an inwardly-opening check-valve *a*. Above it and below the nozzle is another one, *b*, and above this and between the relief-valve 43 and the air-dome is another inwardly-opening check-valve *c*. Now it will be remembered that there is in the normal action of the ram alternately a high pressure and then a reduced pressure and backlash in the drive-pipe and subjacent chamber of the ram, due to the action of the air-dome valves, and as the lower part of pipe 39 is in open communication with the subjacent chamber 4 the water-level *l*, Fig. 9, in stand-pipe 39 will alternately rise and fall to suit these fluctuations of pressure. When said level *l* falls, valve *b* closes and valve *a* opens and air is sucked in through air-inlet 40. When the level *l* rises, it forces the air up, closing valve *a* and opening valves *b* and *c*, and the air rising through nozzle 42 is visible through the glass sight-tube 41 and passes into the air-dome. The air-inlet 40 is above the line of backwater, and hence never becomes water-logged.

With regard to the function and value of nozzle 42 I would state that every one knows that it takes a considerable time for air to rise out of a bottle under water and also for the water to get into the bottle to replace the air. Consequently by making the aperture in the nozzle 42 small, like the neck of a bottle, I am assured of some air being in or under the aperture at the completion of each stroke, which will not have time to get away before another stroke. Therefore the action of the water in the vertical pipe and the action of the valve just below the nozzle will not be impeded by the inertia of the water above it, having only to further compress this small amount of air, which finally reaches a tension that insures its passage to the air-chamber. This space below nozzle 42 acts as an air-chamber to the vertical drive-pipe. The smallness of the aperture in nozzle 42 prevents the air that is drawn in by the weight of water in the vertical pipe from rising instantly to the top of the glass tube, but leaves the air in such position that it may be acted on as described. It also keeps the water in the glass tube from running out. If the water all ran out of the glass tube, its purpose would be destroyed—namely, that of allowing the operator to estimate how much air was entering. If too much air entered the dome, the efficiency of the machine as a water-pump would be impaired.

The use of relief-cock 43 is to allow all the piping below it to be forcibly cleared of any obstruction. Open this cock and all below it is at each stroke cleaned and the glass tube filled with water. This makes this mechanism perfectly under control of the operator.

To indicate the height of water in the chamber under the air-dome, a water-gage is tapped into the same, as seen on the left of Fig. 1.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a hydraulic ram, the combination with the air-dome, and the drive-pipe, of an automatic air-supply for the air-dome, consisting of a stand-pipe having its lower end in open communication with the drive-pipe and its upper end opening into the air-dome, said stand-pipe having an inwardly-opening air-valve intermediate its length, and having above said air-valve a nozzle a glass sight-tube and one or more check-valves opening upwardly into the air-dome, substantially as and for the purposes described.

2. In a hydraulic ram, the combination with the air-dome and the drive-pipe, of an automatic air-supply for the air-dome consisting of a stand-pipe having its lower end in open communication with the drive-pipe and its upper end opening into the air-dome, said stand-pipe having an inwardly-opening air-valve intermediate its length, a check-valve and nozzle with sight-tube above the air-valve and at a higher point a relief-valve and a second check-valve opening into the dome, substantially as shown and described.

3. In a hydraulic ram, the combination with the waste-valve having a vertical rod and a valve-seat arranged above said valve, of an opening-spring for the same arranged to be put under a resilient tension only by the last part of the movement of the valve in closing, and means for adjusting the valve-stem while in action.

4. In a ram, a waste-valve, a frame, a rod having yielding connection with the waste-valve, a sleeve adjustable in the frame and through which said rod passes, a collar on the rod above the sleeve, a spring arranged between said collar and the sleeve, a spring on the rod above the collar, and an adjustable abutment in the frame with which said last-named spring is designed to engage, substantially as specified.

5. In a ram, a spout arranged on the receiving-casing and having ports communicating therewith, a valve for controlling said ports and a supplemental quick-opening valve having a rod extended upward from the same, and a pointer on said rod above the spout, substantially as specified.

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

CHARLES C. WENTWORTH.

Witnesses:

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W. L. ANDREWS.