(No Model.) 2 Sheets—Sheet 1.

W. F. STARK.

HYDRAULIC AIR COMPRESSOR.

No. 602,247. Patented Apr. 12, 1898.

FIG. 2.

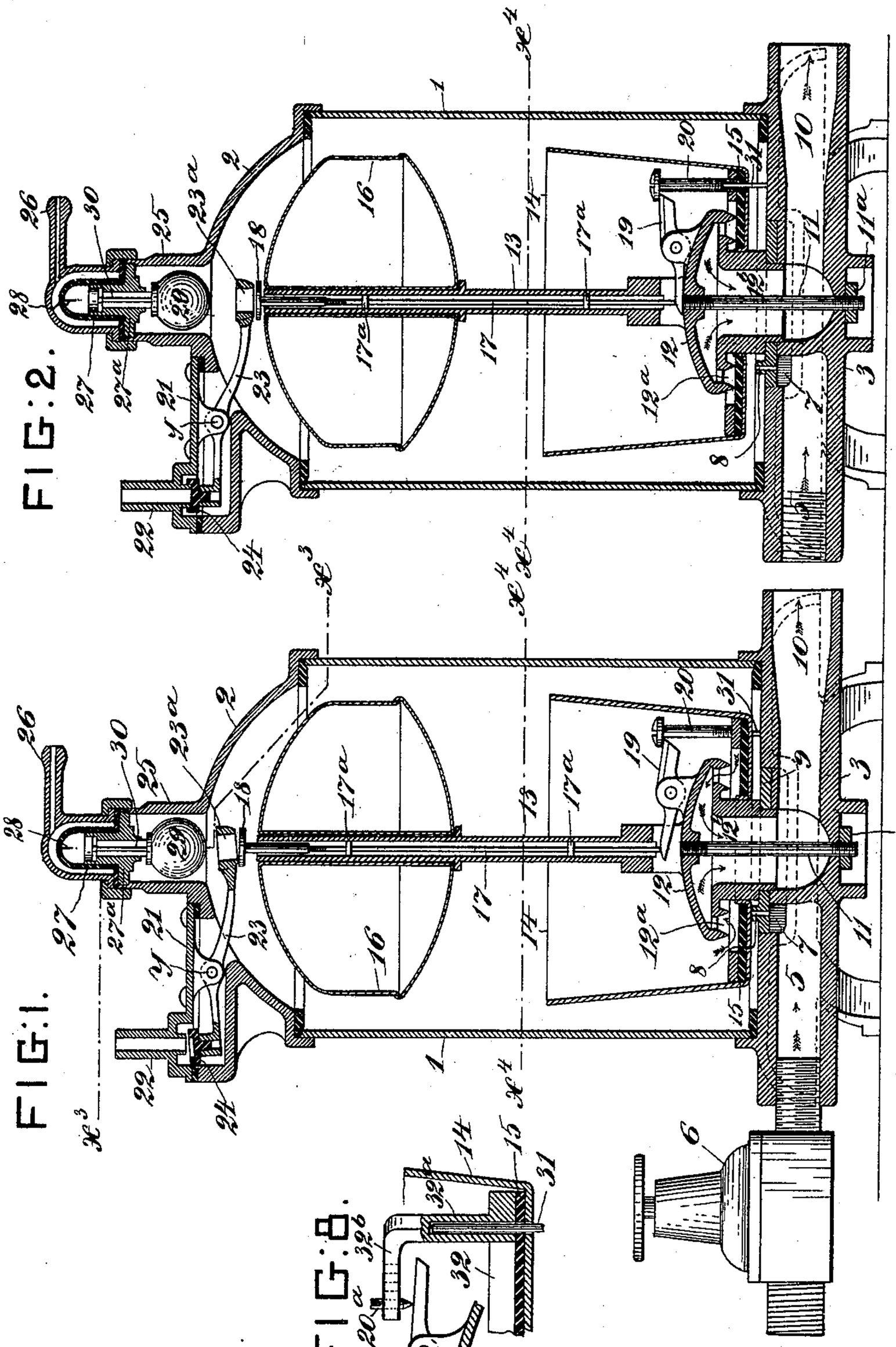

FIG. 1.

FIG. 3.

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FIG. 4.

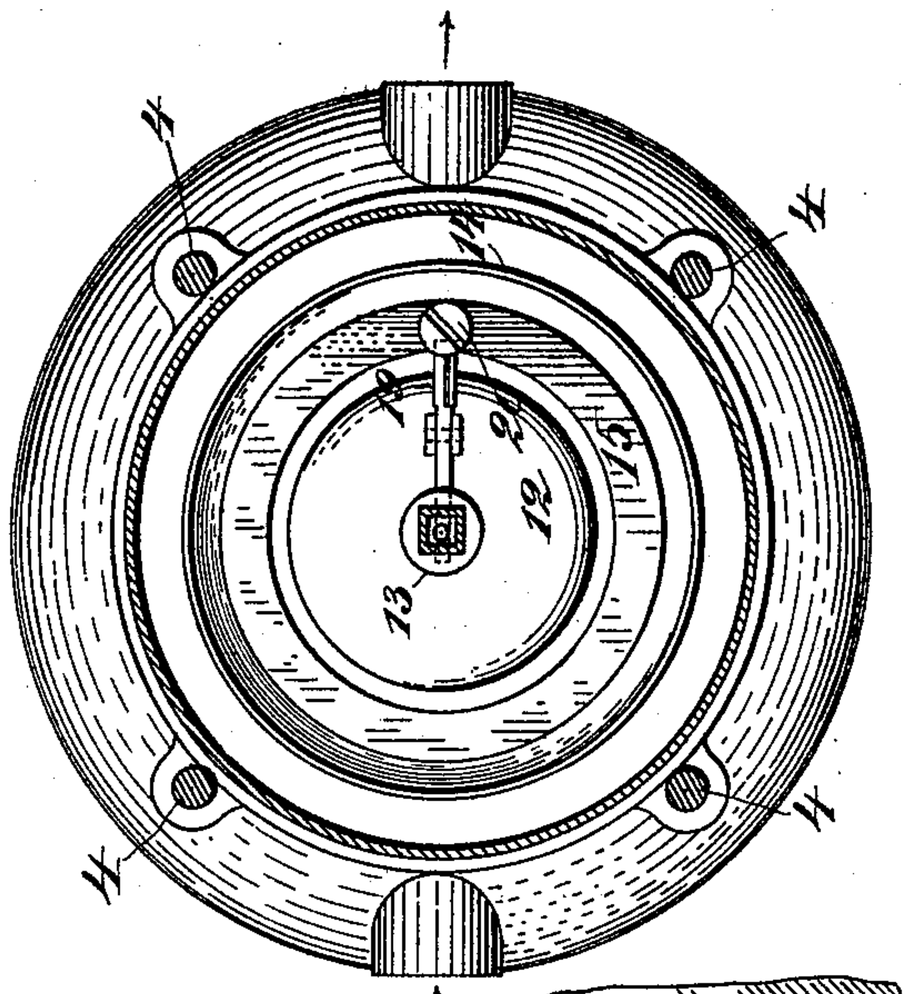


FIG. 5.

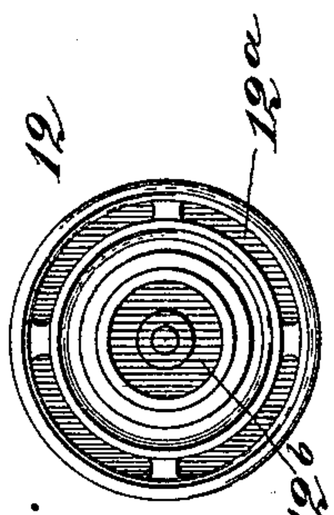


FIG. 6.

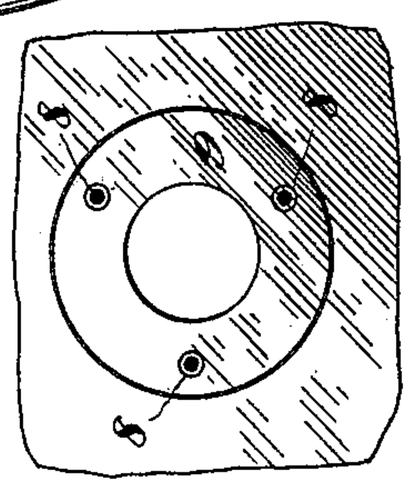


FIG. 7.

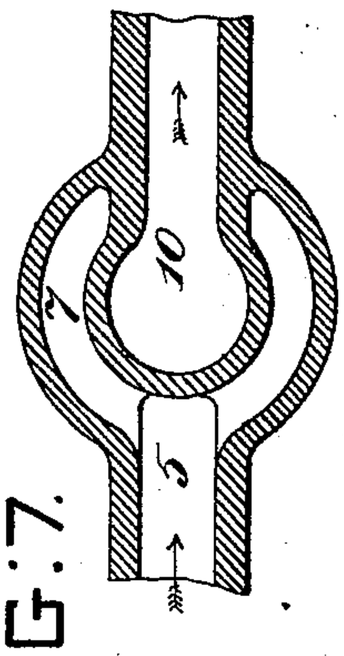
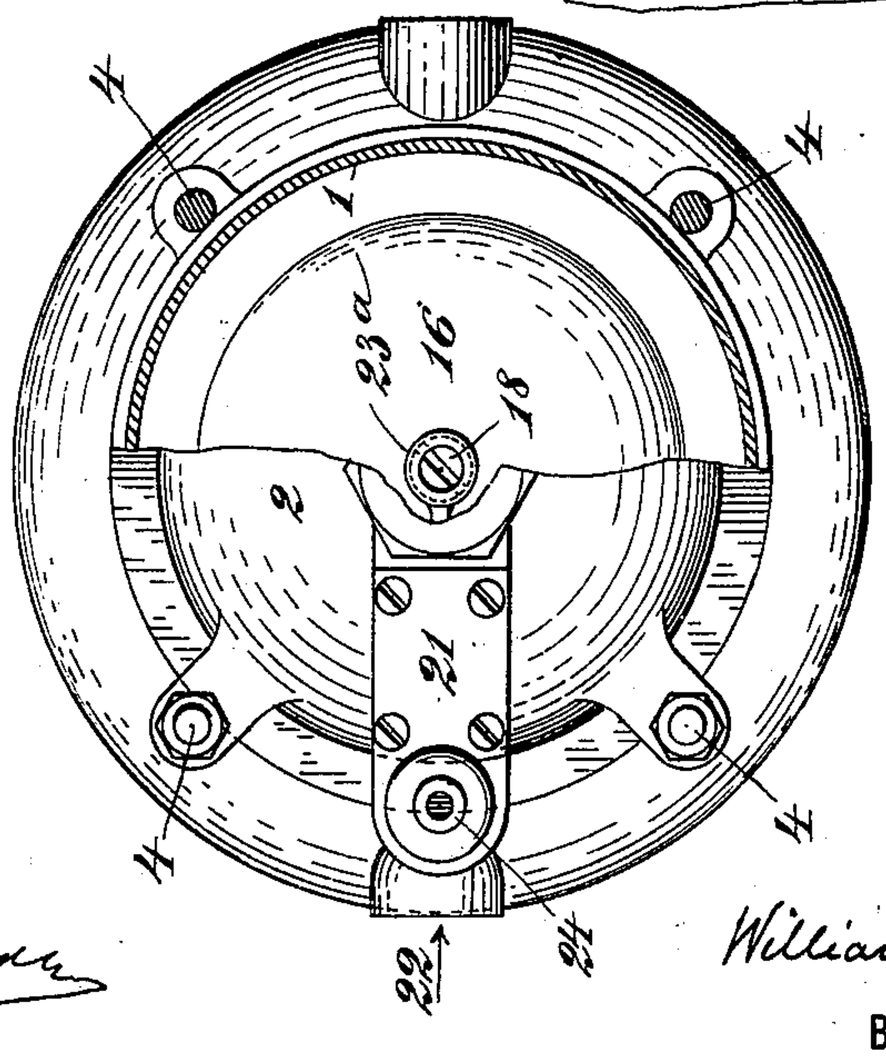


FIG. 3.



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UNITED STATES PATENT OFFICE.

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HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 602,247, dated April 12, 1898.

Application filed May 21, 1897. Serial No. 637,504. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. STARK, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Hydraulic Air-Compressors, of which the following is a specification.

This invention relates to the class of hydraulic air-compressors of which the compressor shown in the patent to E. M. Hugentobler, No. 342,798, dated June 1, 1886, is a type. In fact, the present compressor operates on the same principle as that described in said patent; but the object of the present invention is in the main to simplify the construction, avoid a multiplicity of mechanical parts and valves, provide better access to the parts, and avoid loss of water by waste.

The accompanying drawings illustrate an embodiment of the invention.

Figure 1 is a vertical axial section of the compressor, showing the cup-float seated downward and closing the inlet parts for the liquid. Fig. 2 is a similar view to Fig. 1, but showing the cup-float seated upward and closing the outlet for the liquid. Figs. 3 and 4 are horizontal sections in the broken planes indicated, respectively, by the lines x^3 and x^4 in Fig. 2. Fig. 5 is an under side view of the shell 12. Fig. 6 is a plan view of a part of the base, showing the inlets 8. Fig. 7 is a horizontal section through the water inlet and outlet in the base. Fig. 8 illustrates a modification of the means for operating the lever 19.

It may be said, primarily, that this compressor is automatic in its action, the water rising in the compression-chamber and displacing the air, which is forced by way of the air-outlet to the air holder or reservoir. When the water shall have risen to a predetermined level, the air-inlet is opened and the water flows off, being replaced by air. The operation is then repeated and will continue so long as the pressure in the holder is less than that of the incoming water.

1 is a casing or cylinder clamped between a head 2 and a base 3 by rods and nuts 4. (Seen in Fig. 3.) In the base is an inlet 5 for the water or other liquid, provided, as seen in Fig. 1, with an ordinary pressure-regulator 6, which will require no description. The inflowing water enters an annular chamber 7, formed in the base, and rises into the compression-chamber of the casing 1 through ports 8 in a ring 9, which forms a cover for said annular chamber 7. The base 3 has also an outlet 10 for the waste water from the compression-chamber, as will be more fully hereinafter explained.

In the bottom of the chamber of the casing 1 is fixed, by a rod 11 and nut 11^a, a hollow shell 12 of a mushroom shape, which has an annular marginal opening or port 12^a in its lower face, leading to a central passage 12^b in the stem of the shell, and thence to the outlet 10. Rising from the crown of the shell 12 is a tubular stem 13, the function of which will be hereinafter explained.

14 is the cup-float, open at the top and having an aperture in its bottom through which passes the cylindrical stem of the shell 12, the margin of the aperture fitting snugly, but not tightly, about the said stem. When the cup-float is in the position seen in Fig. 1, its bottom rests on and closes the inlet-ports 8, and when it rises a rubber packing 15 on the upper surface of its bottom bears on the under surface of the hollow shell 12 and closes the annular port 12^a. To effect a perfect closure, the margins of the port 12^a may be beveled or brought to an edge, as shown. The movement up and down of the cup-float need not be great, about a quarter of an inch or even less serving the purpose.

On the stem 13 is mounted to slide freely an upper float 16, supported when in its lower position on a slight shoulder or stop on the stem 13. In this stem is loosely fitted a lifter-rod 17, and on the upper end of this rod is secured an adjustable head 18, which is in substance a nicked button, to receive a screw-driver having a tubular shank which screws onto the upper end of the rod 17. To keep the rod from turning when the head 18 is screwed down or up thereon for adjustment, it is preferred to make the bore in the stem 13 square in cross-section and to fix on the rod 17 one or more square blocks 17^a to fit loosely in said bore. The button of the head 18 is large enough to take over the float 16,

so that when the float rises it will take under the button and lift the rod 17.

The stem 13 is connected to the shell 12 by a fork at its base, and fulcrumed on the shell is a lever 19, one end of which takes under the lower end of the rod 17 and the other under some part of the cup-float. For convenience of adjustment a screw 20 is set in the bottom of the cup-float, and the end of the lever 19 takes under the broad head of this screw.

In the head 2 of the casing is formed a chamber or recess provided with a removable cap-plate or cover 21, in which is formed the air-inlet 22 and on the under side of which is fulcrumed at *y* a lever 23. At its outer end this lever carries a valve 24, preferably of rubber, which closes upwardly against the air-inlet to stop it, and at its inner end it has an apertured head 23ª, arranged directly over the head of the rod 17 and directly under the air-outlet neck 25 in the head 2. Screwed onto the neck 25 is the usual nipple 26 to receive the air pipe or hose which conducts the air from the compressor to the holder, and on a nipple 27 within the body of the nipple 26 is the ordinary slitted rubber check 28, which prevents the air from returning to the compression-chamber.

The operation of the compressor will now be described. Premising that the compression-chamber is primed (as it will always be when in use) with water about the cup-float sufficient to buoy it up to the position seen in Fig. 2 the water is turned on, and flowing in at the ports or inlets 8 it rises about the cup-float, thus holding it up firmly to the shell 12. As the water continues to rise it first fills the cup-float and continues to rise in the chamber, displacing the air above it and compressing the latter or forcing it to the holder. It will be noted that during this operation the valve 24 is closing the air-inlet 22, the head 23ª on the opposite end of the valve-lever sufficing to keep the valve up to its seat about the inlet. As the water continues to rise, however, it begins to submerge the upper float 16, and when the submergence suffices to buoy up said upper float the latter rises, and carrying with it the rod 17 it lifts the inner end of the valve-lever 23 and moves the valve 24 from its seat. Instantly the air tension is relieved and the cup-float 14 falls to the position seen in Fig. 1, thus closing the inlet-ports 8 and stopping the further influx of water. This it is enabled to do by the cup-float being made relatively heavy and the aggregate area of the inlet-ports 8 relatively small. When the cup-float falls, the annular outlet-port 12ª in the shell 12 is opened and the water flows out thereat, thus allowing the upper float 16 to descend and the air to enter at the air-inlet 22. It will be obvious, however, that but for some means of keeping the air-inlet open it would be closed when the float 16 descended. The lever 19 and the screw 20 on the cup-float provide such means. When the cup-float drops, the head of the screw 20 draws down the outer end of the lever 19, and the other end of said lever takes under the lower end of the rod 13 and thus supports said rod in its elevated position under the valve-lever, so keeping the air-inlet valve from its seat. As soon as the water shall have been drawn off through the hollow of the cup-float the water incarcerated in the compression-chamber exterior to said float and which rises to the level of the top of the float will again buoy up or lift the cup-float, and the operation above described will be repeated. This operation will go on automatically until the tension of the air in the holder or reservoir becomes too great, when the operation will cease until this tension is reduced. Then the operation will proceed again as before.

In this class of devices it is very important that easy access should be had to certain parts for adjustment, and in my construction this easy access is afforded. For example, to adjust the head 18 of the rod 17 up or down without removing the head 2 the operator has only to remove the air-outlet nozzle, lift out the inner nipple on which is the rubber check-valve, and pass down a screw-driver through the aperture in the head or end of the air-valve lever in order to rotate the head 18. The air-inlet valve may be reached and adjusted by removing the cap-plate 21, as the lever 23 is fulcrumed on and connected to this cap-plate. These features of construction are important, as it frequently happens that these adjustments must be made and the valve 24 renewed after the compressor has been set up and at work.

By weighting the floats 14 and 16 the proper regulation may be effected. If the float 16 be made heavier, the water will rise higher in the chamber before said float is lifted. Normally during the usual operation of the compressor the water stands in the compression-chamber exterior to the cup-float at about the level of its top, and the cup-float should be so weighted that it requires the water to stand at about this level in order to lift it. Otherwise the cup will lift and close the outlet before the whole of the water flows out.

The adjustment of the head 18 on the rod 17 and the adjustment of the screw 20 are necessary to cause the air-inlet 22 to be opened at the proper time. If the air-inlet valve 24 should stick and remain closed from any cause, the water may continue to rise in the compression-chamber and eventually pass the air-check valve at the outlet. To prevent this and as a precautionary device, a ball-float 29, furnished with a rubber disk valve, is fixed to a grooved or fluted stem 30, which is suspended in the outlet-bore in the inner nipple 27. This device does not prevent the outflow of air, but when the water rises it raises the ball-float 29 and closes the

outlet. The nipple 27, it will be seen, has a disk-like base 27ª, which fits in and rests on a shoulder in the neck 25 and is held down in place by the screw-cap formed with the nipple 26. The float 29 fits loosely in the neck and may be withdrawn by first removing the outer nipple 26, thus leaving a free passage through the neck for the insertion of a screw-driver.

To prevent the rotation of the cup-float, there is a pin 31, Fig. 2, in the base, which passes up into the hollow screw 20.

Fig. 8 illustrates a slightly different construction of the means for operating the lever 19 on the shell 12. In this construction a ring-like weight 32 is fixed in the bottom of the cup-float, and it has formed on it or fixed to it an upright 32ª, having an arm 32ᵇ, which projects out over the lever 19, and in this arm is set a screw 20ª, which impinges on the lever 19. The arm 32ᵇ may have several screw-holes, in either of which the screw 20ª can be set so as to impinge on the lever at different distances from its fulcrum. In this case the pin 31 passes up into a hole or socket in the upright 32ª. It should, perhaps, be explained that the cup-float when it rises exposes a much greater area to pressure on the lower face of its bottom than on the upper face thereof, the mushroom-head of the shell 12 occupying considerably more area than the stem of said shell, and hence when there is tension on the air above the rising water in the compression-chamber in excess of atmospheric pressure the differential pressure on the submerged cup-float holds the latter in its elevated position; but the float 16, being pressed upward by the rising water, finally forces the air-inlet valve from its seat and the small amount of incarcerated air at the top of the compression-chamber instantly escapes with a puff. At this instant the relative specific gravities of the water and the submerged and properly-weighted cup-float come normally into play and the latter falls to the position seen in Fig. 1, opening the water-outlet and seating itself directly over and closing the water inlets or ports 8.

Having thus described my invention, I claim—

1. A hydraulic air-compressor of the character described having a water-inlet port opening into the compression-chamber at its bottom, a water-outlet port opening downward, and a submergeable cup-float having its bottom between said ports and adapted to close the water-outlet port when buoyed up by the water, and to seat itself directly on and close the water-inlet port when it sinks by gravity, said cup-float having sufficient weight when submerged to prevent the influx of water and being guided in its up-and-down movements, substantially as set forth.

2. In a hydraulic air-compressor of the character described, the combination with the base, having in it a main liquid-inlet communicating with liquid-inlet ports 8, opening into the compression-chamber from the bottom, and a main outlet for the liquid, of the shell 12, having an outlet-port 12ª, communicating with the main liquid-outlet through the upright stem of said shell, and a cup-float 14, adapted to move up and down on the stem of the shell 12, and to close the outlet-port 12ª when buoyed up, and to seat on and close the inlet-ports 8 when it sinks to the bottom of the compression-chamber, substantially as set forth.

3. In a hydraulic air-compressor of the character described, the combination with the fixed, upright stem 13, forming a guide for the rod 17, the said rod, having a head 18, the valve controlling the air-inlet, and the lever 23, carrying said valve and having its arm arranged over the head 18, of a lever 19, fulcrumed on a fixed part, one arm of which takes under the rod 17, the cup-float having a projection which takes over the other arm of the lever 19, and the upper float 16, guided on the stem 13 and adapted to take under the head 18, when the float rises, whereby the air-inlet is opened by the rise of the upper float and kept open by the descent of the cup-float, substantially as set forth.

4. In a hydraulic air-compressor of the character described, the combination with the head or cover of the compression-chamber, and the removable plate 21, having in it the air-inlet 22, of the valve-lever 23, fulcrumed on said plate 21, and the valve 24 mounted on one arm of said lever, the other arm of the lever being weighted to keep said valve up to its seat whereby ready access to said valve and lever is provided, substantially as set forth.

5. In a hydraulic air-compressor of the character described, the combination with the upright, fixed stem 13, the float 16, guided thereon, the rod 17, guided non-rotatively on said stem and having a screw-adjustable head, 18, adapted to take over a part of the float, of the valve controlling the air-inlet, and the lever 23, carrying said valve, said lever having an apertured head 23ª, which takes over the nicked head 18, and said head 23ª being arranged directly beneath the air-outlet, whereby the head 18 may be conveniently adjusted on its stem.

6. In a hydraulic air-compressor, the combination with the casing containing the compression-chamber, having a cover or head 2 and a base 3, having a main inlet 5, a chamber 7, ports 8, for the admission of water to the compression-chamber, and a main outlet 10, of the shell 12, having a hollow stem, fixed in the base, and an annular outlet-port 12ª, communicating with the outlet 10, the cup-float 14, having an aperture in its bottom embracing the stem of the shell 12, and adapted to move up and down thereon to seat on and close, respectively, the outlet and inlet for the water, an inlet for the air, a valve and

lever controlling said air-inlet, a float adapted, when buoyed up, to open said valve, and means, controlled and operated by the cup-float whereby, on the descent of the latter, the air-inlet valve is kept open, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM F. STARK.

Witnesses:
HENRY CONNETT,
PETER A. ROSS.