(Model.) 2 Sheets—Sheet 1.

W. A. BABCOCK.

HYDRAULIC AIR COMPRESSOR.

No. 253,830. Patented Feb. 21, 1882.

FIG-1-

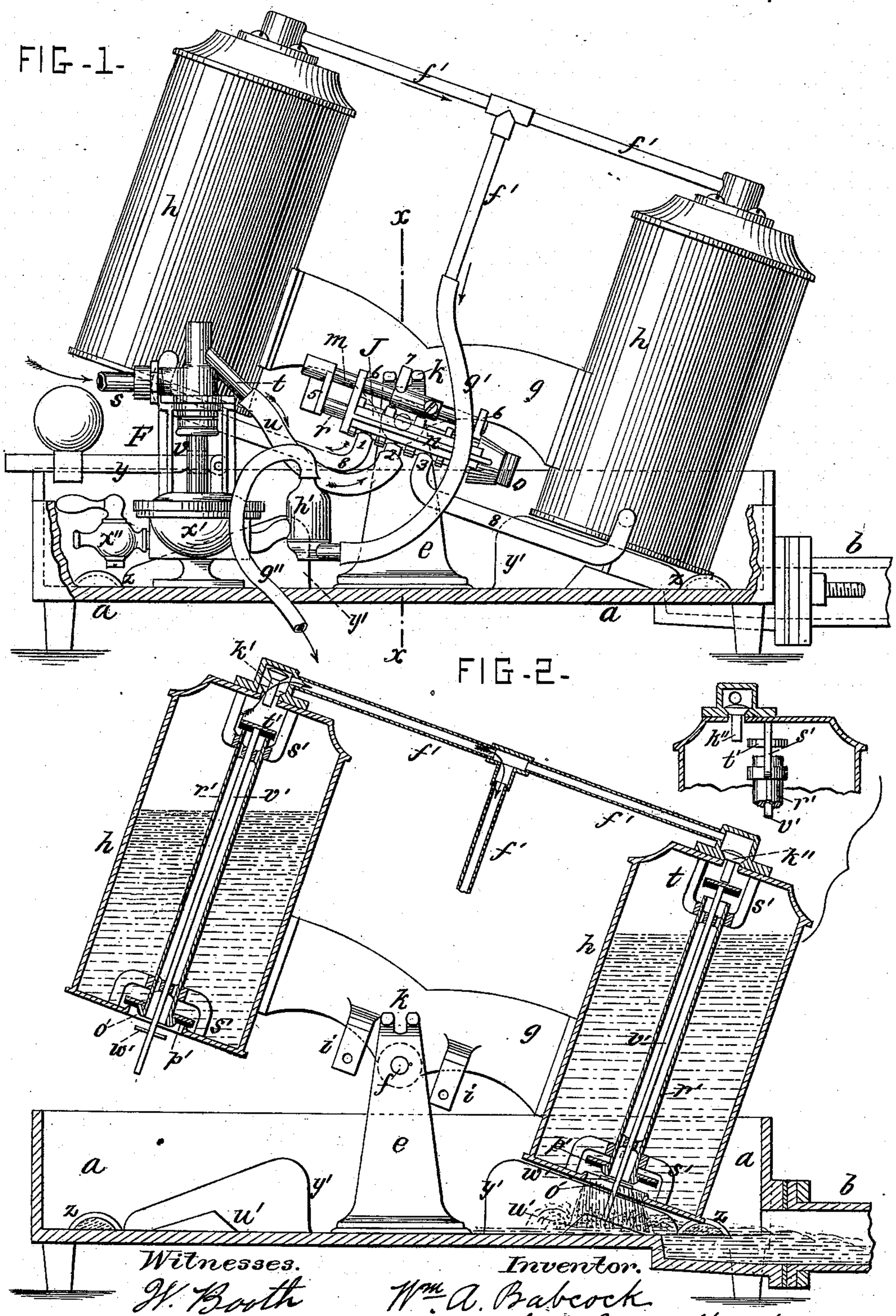

FIG-2-

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(Model.) 2 Sheets—Sheet 2.

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FIG-3-

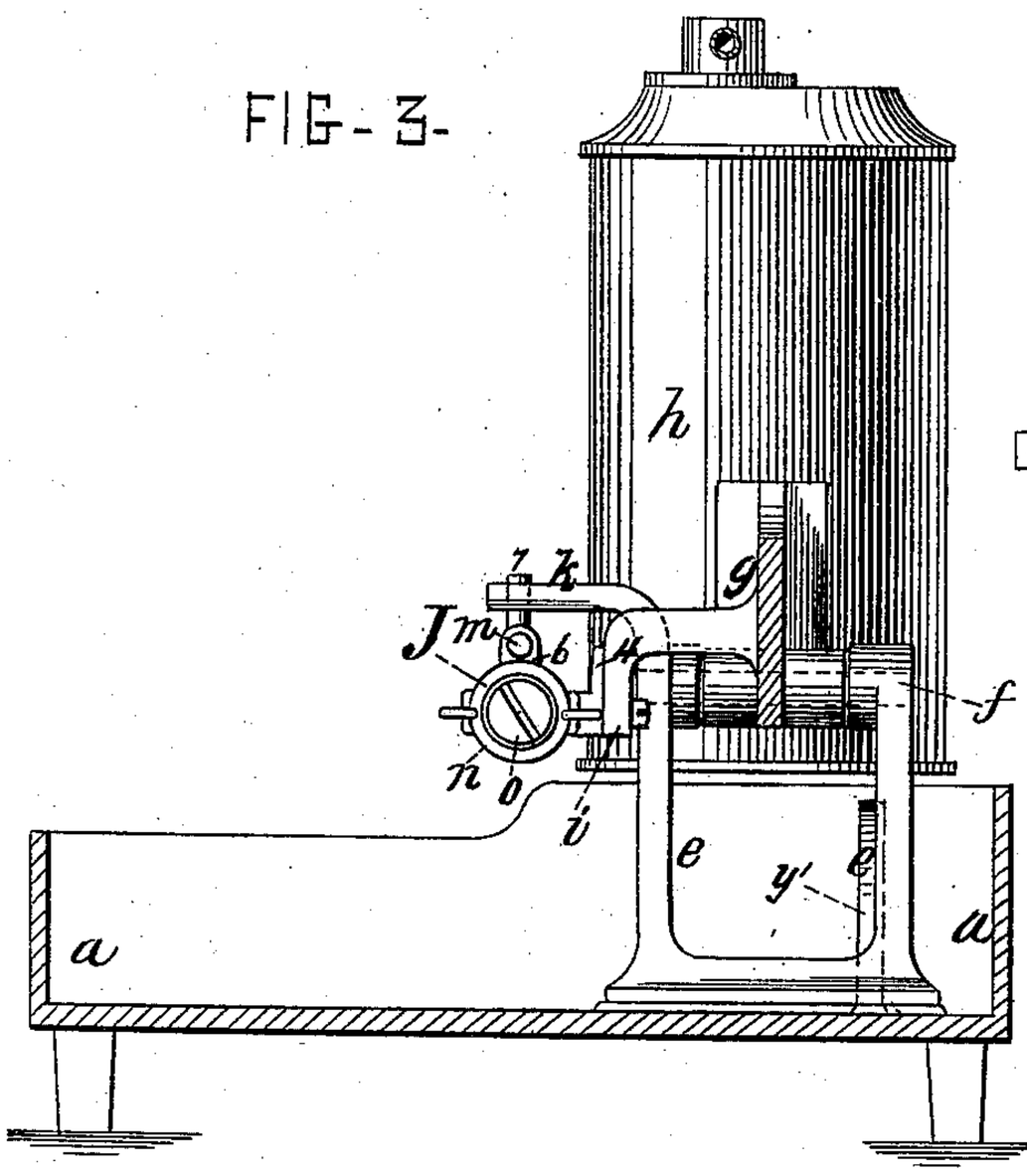


FIG-4-

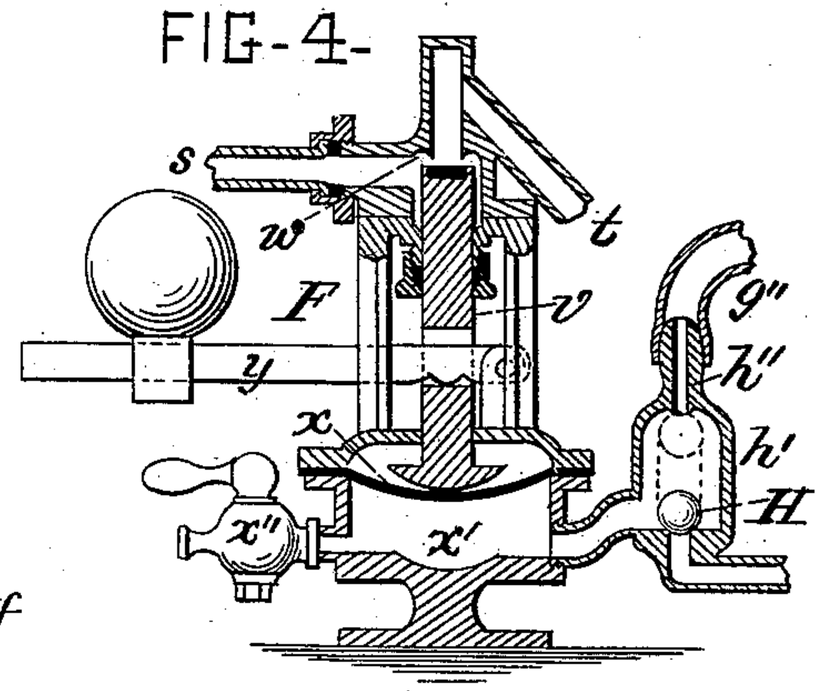
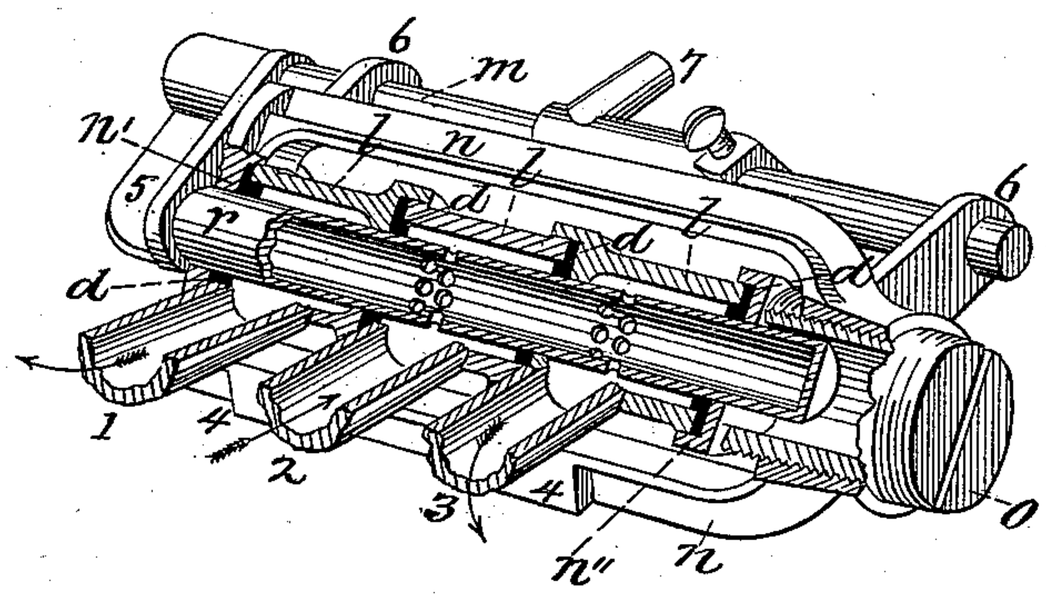


FIG-5-



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UNITED STATES PATENT OFFICE.

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HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 253,830, dated February 21, 1882.

Application filed June 22, 1881. (Model.)

To all whom it may concern:

Be it known that I, WILLIAM A. BABCOCK, of South Coventry, Tolland county, Connecticut, have invented certain new and useful Improvements in Automatic Hydraulic Air-Compressors, of which the following is a specification.

This invention relates to that class of small automatic air compressors or pumps operated by the water-pressure from the street-mains, and now employed as ale or beer pumps, for compressing air into the barrels or kegs, and thus expelling the liquid therefrom to the taps, as required, such as is shown in the patent to Bishop and Glass, June 22, 1880. These compressors usually consist of two cylinders or vessels mounted on the ends of a rocking beam, provided with a water-valve operated by the rocking motion of the beam to control the flow of water to each cylinder alternately, and thus produce a continued rocking motion of the beam and the expulsion of the air from each cylinder alternately. The water passes through an automatic throttle or regulator on its way to the cylinders, which operates either to shut off the water and stop the action of the pump when a determined pressure of air is accumulated, or to admit the water and again start the pump as soon as the pressure falls by a draft from the tap.

The present invention is an improvement on the aforesaid patent, and relates to the special construction of the water-valve of the cylinders, the regulator-valve or automatic throttle, and the air and water vents of the cylinders, whereby greater compactness, simplicity, and efficiency are secured, as hereinafter set forth.

Figure 1 of the drawings annexed gives a longitudinal elevation of the improved air-compressor with a part of the supporting tray or base broken away. Fig. 2 is a vertical longitudinal section of the tray and the rocking pump-cylinders, with the other parts removed. Fig. 3 is a cross-sectional elevation on line *x x* of Fig. 1. Fig. 4 is an enlarged vertical section of the water throttling or regulating valve; and Fig. 5, an enlarged perspective sectional view of the water slide-valve of the rocking cylinders.

The base of the apparatus, as shown in Figs. 1, 2, and 3, consists, as usual, of a large sink or tray, *a a*, into which the waste or exhaust water from the compressor-cylinders is discharged, and which tray has a coupling, *b*, to connect with the waste-pipes, whereby the exhaust-water is conducted off as fast as it is discharged from the cylinders.

From the middle of the base of the tray, and toward the rear side thereof, rise standards *e e*, on which the rock-shaft *f* of the rocking beam *g* is journaled, and the pump or compressor cylinders *h h* are fixed on the opposite ends of said beam in the usual manner, as illustrated.

From the middle of the beam project two lugs, *i i*, (see Figs. 2 and 3,) one on either side of the rock-shaft, on which lugs is fixed the water slide-valve J, which controls the flow of water to each cylinder alternately, and as this valve is thus fixed on the rocking beam, the valve thus rocks with the beam; but a forked projection, *k*, extending from the standards *e e*, as seen in Figs. 1, 2, and 3, engages the operating-rod *m* of the valve, and thus reciprocates the valve-plunger *r* at each oscillation of the beam, so as to cause the direction of the water to so change at each oscillation as to flow always into the cylinder which is the highest, as illustrated by arrows in Fig. 1. This valve acts in the same manner and its principal construction is the same as that shown in the previous patent referred to; but it differs chiefly in the construction of its sustaining-frame—that is, as seen in Fig. 5, the valve-casing consists of three cylindrical sections, *l l l*, fitting endwise into each other, as shown, with the section at one end fitting against the fixed head *n'* of the sustaining-frame *n*, and a movable head or cap, *n''*, fitting against the opposite end section, while a hollow screw, *o*, working through the opposite end of the frame *n*, bears against the said head and binds the said sections firmly together. The sustaining-frame *n* thus incloses or extends around the sections of the valve-cylinder in the form of an elongated

oval ring, as seen in Fig. 5, and as this frame may be cast in one piece, as shown, and as the sections of the valve-cylinder are thus held in firm position therein by the one screw *o*, this construction is hence a great improvement in simplicity, strength, and compactness over the loose end heads and connecting-bolts or "spacer-ports" heretofore used.

r is the sliding valve-plunger, which is hollow or tubular, closed at each end, and works centrally through the valve-cylinder and through small cup-leathers *d* introduced between each section of the cylinder and the end heads, which leathers form stuffing-boxes to prevent leakage at each protruding end of the plunger, and also water-tight partitions between the valve-ports 1 2 3, each of which extends from a distinct section of the valve-cylinder, as shown. It may therefore be seen that, as the valve-plunger protrudes at each end and exposes its cylindrical sides only to the pressure, it thus becomes balanced; and, furthermore, as all joints of the valve consist of leather packings, the valve is thus not only balanced, but is rendered very tight and easy moving, and is thus particularly suited for its purpose. The central port, 2, of the valve-cylinder connects with the water-supply, and the outer ports, 1 3, connect with the pump-cylinders *h h*, as shown in Fig. 1. The valve-plunger *r* has two rows of perforations, as shown in Fig. 5, at a distance equal to that between the central and outer ports, so that when the plunger is slid inward, as in Fig. 5, the water will flow out at the right-hand port and to the right-hand pump-cylinder, and when the plunger is slid outward, as in Fig. 1, the water will flow out through the left-hand port 1 and to the left-hand cylinder.

The base of the valve-frame *n* is formed with feet 4 4, by which the valve is screwed or fixed to the lugs *i i* on the rocking beam, as before described, and as shown best in Figs. 3 and 5. The actuating end of the valve-plunger *n* is connected by the rigid cross-bar 5 with the operating-rod *m*, which runs parallel with the valve, and is guided through wings 6 6 projecting from the valve-frame *n*, and on this rod is clamped a sleeve, from which a pin, 7, projects, which pin is engaged by the fixed fork *k* on the standards *e*, so that as the beam with the attached valve and cylinders rock the valve-plunger is shifted correspondingly to admit the water always into the cylinder on the highest side.

As the valve in the present improvement is fixed on the rocking beam and rocks with it, hence the pipes 8 8, which connect each cylinder with the corresponding valve-ports, may be made rigid and of metal soldered or screwed together at the connections, in lieu of rubber pipes heretofore used, which is an advantage. The pipe *u*, however, which conveys the water to the central port, requires to be flexible, as heretofore.

F indicates the automatic water throttle valve or regulator, which in this case is of improved construction, and is shown in elevation in Fig. 1 and in enlarged section in Fig. 4. This valve has a coupling, *s*, projecting from one side, which is connected by hose or lead pipe with the water-supply pipes, and from the opposite side extends a nozzle, *t*, which connects by the flexible pipe *u* with the central port of the slide-valve J, as before described. The passage through the throttle-valve is guarded by a throttle-valve or plunger, *v*, whose upper end, which is provided with a leather or rubber face, approaches the valve-seat *w*, so formed as to present a sharp edge for embedment in the soft valve-face, as will be understood. The valve-plunger passes through a stuffing-box and extends downward, having a convex head on its lower end, which rests on a diaphragm, *x*, in the diaphragm-chamber *x'*, which forms the base of the regulator. As the plunger *v* simply rests on the diaphragm, the construction is more simple and durable and the motion of the diaphragm more easy than when the plunger is fastened to the diaphragm. A weighted lever, *y*, arranged as shown, or in any equivalent manner, projects through a slot in about the middle of the plunger, and tends to constantly depress the plunger, so as to force down the diaphragm *x* and keep the throttle *v* open, so as to allow the water to flow to the slide-valve J, and thus keep the compressor in action. The air, however, which the water compresses in and expels from the cylinders is discharged through the pipes *f'* and flexible tube *g'*, (see Fig. 1,) which connects to a small check and float valve chamber, *h'*, which opens from the side of the diaphragm-chamber *x'*, as shown best in Fig. 4, and from a nipple on the top of this valve-chamber *h'* a flexible pipe, *g''*, is led to the barrels, kegs, or other vessels into which it is desired to force the compressed air. It will hence be seen that the back-pressure of this compressed air is constantly exerted on the underside of the diaphragm, tending to lift the same in opposition to the tendency of the weighted lever *y*, so as to close the throttle *v*, shut off the water, and stop the pump, which it will do whenever the pressure of the compressed air exceeds the pressure of the weighted lever, so that hence by adjusting the weight in or out on the lever the apparatus may be set to pump and charge the kegs up to a certain pressure, and then stop and start again as soon as this pressure is reduced by a draft from the beer-taps. In this regulator, moreover, the action is direct, for the air-pressure acts directly on the diaphragm *x* and throttle-valve *v*, which latter shuts off the flow of water by a direct throttling action, and not by the indirect manner of regulators heretofore used. It may be also noted that the position of the water-throttle is such that its seat is lateral to the flow of the water, and hence when the valve is closed the water-pressure has no tendency to open it; but the weighted lever

entirely controls the opening of the valve, whereby the adjustment of the weighted lever is rendered independent of the water-pressure, and hence the regulating action is rendered more sensitive and accurate.

An adjustable spring may of course be used in lieu of a weighted lever to load the valve; but the latter is preferable.

The valve H of the valve-chamber *h'*, (see Fig. 4,) which is preferably of ball form, not only acts as a check-valve, but also as a float-valve and water-trap to intercept and retain any water which may overflow from the pump-cylinders through the air-pipes *f' g'*. This valve is made lighter than water, preferably of rubber, in the form of a solid ball, but sufficiently pure, so as to float in water, and at the same time form an elastic and durable valve. It will hence be seen that should any overflow of water enter the valve-chamber the float-valve H will rise and close the orifice of the nipple *h''*, as indicated by dotted lines in Fig. 4, thus preventing the outflow of this water to the beer-barrels and causing it to run into and accumulate in the diaphragm-chamber *x'*, from which it may be removed by opening the pet-cock *x''*. This regulator and trap is thus not only of very simple and efficient construction, but is adapted to meet all the contingencies arising in the operation of these compressors, and forms a material part of my improvement.

Supposing the parts to be in the positions shown in Figs. 1, 2, and 4, the water will flow through the throttle or regulator to the central port of the slide-valve J, and thence through the open port on the high side to the raised cylinder *h*, into which it will flow, and thus compress the confined air therein, which will thence lift the check-valve *k'* in the head of the cylinder (see Fig. 2) and flow off through the pipes *f' g'*, valve-chamber *h'*, and pipe *g''* to the beer-barrel or other receptacle. At the same time the check *k''* in the depressed cylinder is closed by the back-pressure of the compressed air, and the air and water vents of this cylinder are opened, as illustrated in Fig. 2, so as to allow the water to escape and the atmospheric air to enter and again fill the cylinder, and as soon as the water under pressure has risen sufficiently high in the raised cylinder and the spent water has flown out of the depressed cylinder the raised end of the beam thus becomes overbalanced and descends, reversing the position of the cylinders, the position of the valve, the flow of the water, and the action of the several parts, as will be understood, so as to keep up the rocking motion of the beam.

The remaining features of my invention lie in the construction of the air and water vents of the cylinders, which are clearly shown by the sectional view in Fig. 2. Thus in the base of the cylinder is formed an opening, *o'*, over which is mounted a valve-disk, *p'*, which is secured to the lower end of a tube, *r'*, which rises through the cylinder into the top end thereof, and is guided through guides *s' s'* projecting from each end of the cylinder. The tube is open from end to end, and over the upper end, which opens in the top of the cylinder, is mounted a valve-disk, *t'*, which is arranged to seat against the upper end of the tube, and is fixed on the top of a rod or wire that extends centrally through the tube, and projects below the lower end thereof and below the base of the cylinder toward protuberances *u'* on the tray *a*.

The disk *p'* forms the water-vent valve, and the disk *t'* the air-vent valve, and it will be observed that when either cylinder is raised these valves will close first by their own weight and confine the air already in the cylinder, and will thence close tighter by the pressure of the entering water, so as to prevent the escape of the air or water while the cylinder is raised and becoming filled, as shown on the left of Fig. 2. As soon, however, as one cylinder becomes filled and descends, as on the right of Fig. 2, the wire *v'* strikes the protuberance *u'*, which first raises the air-vent valve *t'* from the top of the tube *r'*, and a projection or pin, *w'*, on the wire *v'* then strikes the base of the tube and raises the tube bodily, and thus opens the water-vent *p'*, thus allowing the spent water to flow out and the atmospheric air to flow in to supply its place, as shown in Fig. 2.

In lieu of the pin *w'*, a collar or other stop may be used, and by means of the play thus allowed between the wire *v'* and tube *r'* it will be observed that the air-vent, which is of small area, always opens in advance of the water-vent, which is of larger area, so as to allow the slight portion of compressed air in the top of the cylinder to escape, and thus relieve the pressure from the water-vent valve before the same is opened, so that both valves thus open easily and offer no appreciable resistance to the fall of the descending cylinder. It will thus be seen that by this construction of vents not only do I relieve the pressure on the water-vent before it is opened, but I render the construction and action of these vents very simple, easy, and certain, and have them placed and concealed entirely within the cylinders, obviating the cumbersome external air-vent with weighted valve-levers, as heretofore employed.

On the bottom of the tray *a* are fixed the usual cushions, *z z*, against which the cylinders strike when they descend, as shown in Figs. 1 and 2, thus softening and limiting their fall; and near these cushions triangular-shaped flanges *y' y'* arise under the cylinders, from the base of the tray *a*, and at one side of the water-exhaust ports of the cylinders, as fully shown in Figs. 1, 2, and 3. These flanges form one feature of my invention, and act as guards to prevent the splashing of the water over the side of the tray when it rushes out of the cylinder, as will be readily understood.

It will be obvious that most of the features

of my invention may be used in any form of hydraulic air-pump, whether of the single or double acting kind—that is, having either one or two cylinders—or of that kind in which the cylinders themselves rock, as herein illustrated, or of that class in which the cylinders are fixed, while pistons moving within them connect to a walking-beam which operates the valves.

What I claim is—

1. The combination, with a rocking pump substantially such as described, of a slide-valve governing the flow to each pump-cylinder alternately, mounted or fixed on the rocking beam at or near the axis thereof, with a fixed fork or projection extending from the support or base of the pump and engaging the sliding portion of the valve, so as to shift the same at each rock of the beam, substantially as herein shown and described.

2. The combination, with a rocking pump such as described, of a valve controlling the flow to each cylinder alternately, fixed on the rocking beam at or near the axis thereof, with a fixed projection engaging the operating part of the valve, so as to move and shift the same at each rock of the beam, with rigid pipes extending from the opposite ports of the valve directly to the corresponding pump-cylinders on the ends of the beam, substantially as and for the purpose set forth.

3. The combination, with a sliding valve-plunger, *r*, substantially such as herein described, having an inclosing-cylinder, *l l*, from which the ports proceed, formed in sections abutting one against the other, with a fixed sustaining-frame, *n*, formed to inclose or embrace said sections, with a fixed head at one end, against which the one end of the sections abut, and a fixed head at the opposite end, through which a clamping device extends, bears upon the opposite end of the sections, and binds the whole together firmly in said frame.

4. The combination, with the sliding valve-plunger *r*, substantially such as described, of the inclosing sectional cylinder *l l*, rigid sustaining-frame *n*, and hollow screw *o*, clamping said sectional cylinder in said frame and inclosing the protruding end of the valve-plunger, substantially as herein shown and described.

5. The combination, with the sliding valve-plunger *r*, of the parallel operating-rod *m*, coupled thereto, with the rigid sustaining-frame *n*, holding the inclosing-cylinder of said valve, and formed with the lateral guide-wings 6 6, through which said operating-rod slides, substantially as herein shown and described.

6. The combination, with a hydraulic air-compressor, of an automatic water-regulator constructed with an adjustably-loaded throttle-valve, arranged to directly throttle the flow of water to the pump, in combination with a diaphragm actuated by the direct pressure of the air compressed to close said throttle, substantially as herein shown and described.

7. The combination, with a hydraulic air-compressor, of an automatic water-throttle constructed with an adjustably-weighted throttle-valve forced to its seat by the pressure of the compressed air, and having its seat arranged lateral to the flow of water, whereby its movements are independent of the water-pressure, substantially as herein set forth.

8. The combination, with an automatic pump substantially such as described, of an automatic water throttle-valve formed with the valve-plunger *v*, having one end acting as the throttle-valve and the opposite end resting loosely or disconnectedly upon a diaphragm against which the back-pressure is exerted, substantially as and for the purpose set forth.

9. In an automatic hydraulic air-pump, the combination, with a supply of water under pressure and an air vessel or vessels into which said water is admitted to compress and displace the air therefrom, of a pipe leading from said air-vessels to a beer-barrel or other receptacle into which the air is discharged, with an accumulating trap or drip-chamber arranged on said pipe between the said air-vessel and the said receptacle, whereby any water overflowing from the air-vessel through the air-pipe may be accumulated and removed without being forced into the receptacle, substantially as herein set forth.

10. The combination, with an automatic pump such as set forth, of an automatic water-throttle having its diaphragm-chamber *x'* connected with the air-discharge pipes from the pump-cylinders, and arranged to form an accumulating drip-chamber on said pipes to receive overflowing water which may enter the same, with a cock, *x''*, on said diaphragm-chamber to allow said drip or overflow to escape, substantially as herein set forth.

11. The combination, with an automatic hydraulic air-pump substantially such as set forth, of an accumulating drip or trap chamber located on the air-discharge pipe between the pump-cylinders and the beer-barrel or receptacle into which the air is discharged, with a detached float inclosed thereby and adapted on the overflow of water into said chamber to rise against and close the outlet-orifice of said chamber, whereby one part forms both a float and valve and acts to confine or "trap" said overflow until removed from the chamber, substantially as herein shown and described.

12. In a hydraulic air-pump substantially such as set forth, the guards or flanges *y'*, arising from the sink or tray into which the cylinders discharge, and adjacent to and at one side of the discharge-ports of the cylinders, whereby splash is prevented, substantially as herein shown and described.

13. The combination, with the pump-cylinder of an automatic hydraulic air-pump substantially such as set forth, of air and water vent valves operatively connected through the same actuating device, with a play or interval between the two valves, whereby both valves

are opened by one action, but the air-vent in advance of the water-vent, substantially as and for the purpose set forth.

14. The combination, with the pump cylinder or chamber of a hydraulic air-pump, of an air-vent valve mounted on the top of a tube opening from the base of the cylinder and rising therein, with a wire or rod operating said valve through said tube from the base of the cylinder, substantially as herein shown and described.

15. The combination, with the pump cylinder or chamber of a hydraulic air-pump, of a water-vent valve opening in the base of said cylinder, with a tube, r', fixed to and rising from said valve into the top of the cylinder and open throughout, together with an air-vent valve, t', mounted on the top of said tube, and an operating device arranged to lift both valves successively, substantially as herein shown and described.

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