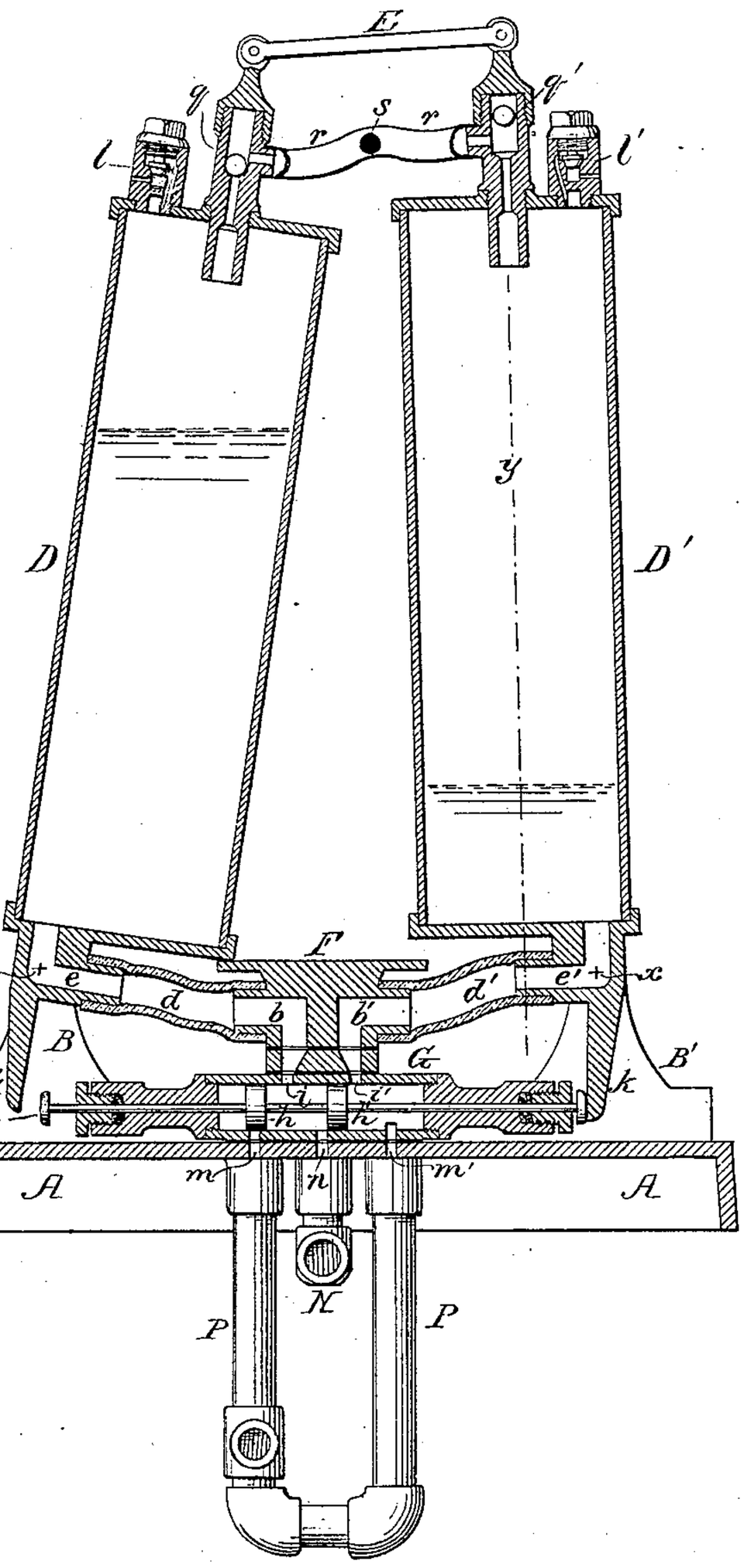
(No Model.) 2 Sheets—Sheet 1.

W. WANG.

HYDRAULIC AIR COMPRESSOR.

No. 262,157. Patented Aug. 1, 1882.

FIG. 1.



Witnesses:
Harry Smith
Hubert Howson

Inventor
William Wang
by his attorneys
Howson and Jones

(No Model.) 2 Sheets—Sheet 2

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HYDRAULIC AIR COMPRESSOR.

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FIG. 2

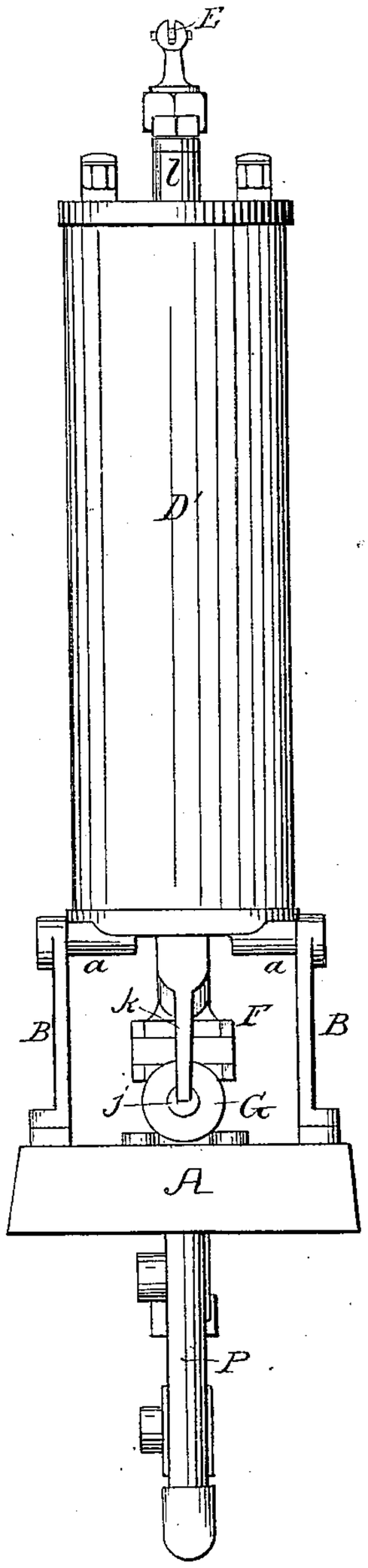
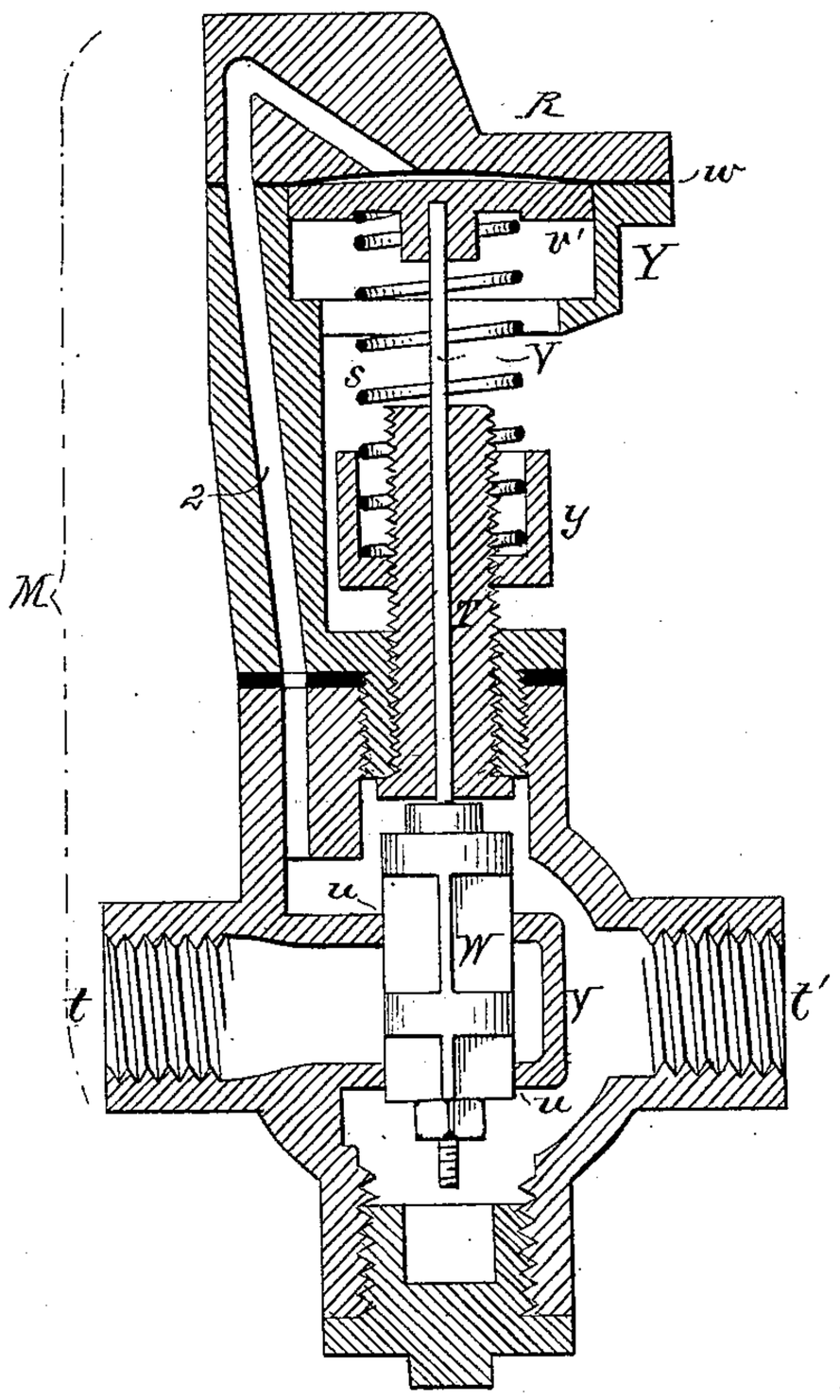


FIG. 3.



Witnesses:
Harry Smith
Hubert Howson

Inventor:
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by his attorneys
Howson and Sons

UNITED STATES PATENT OFFICE.

WILLIAM WANG, OF PHILADELPHIA, PENNSYLVANIA.

HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 262,157, dated August 1, 1882.

Application filed May 10, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WANG, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Hydraulic Air-Compressors, of which the following is a specification.

My invention relates to improvements in mechanism whereby water under pressure is caused to furnish a supply of compressed air, my improvements consisting mainly of two vessels pivoted out of center and combined with valves, pipes, and passages, substantially as described hereinafter, whereby the water rising and falling alternately in the said vessels is caused to force air under pressure therefrom, the vessels being alternately tilted by the rising and falling water, and being caused to operate the valves by which the admission of the water to and its discharge from the vessels is determined.

My invention further consists of a regulating-valve, described hereinafter, and applied to the said air-compressor.

In the accompanying drawings, Figure 1, Sheet 1, is a vertical section of my improved automatic air-compressor; Fig. 2, Sheet 2, an end view of the same; and Fig. 3, a full-sized vertical section of the regulating-valve used in connection with the compressor.

In Figs. 1 and 2, A is the base of the machine, to which are secured two frames, B B′.

D D′ are two vessels, preferably of cylindrical form, the lower ends of these vessels being pivoted out of center to the frames B B′—that is to say, the trunnions or pivots *a a* of each vessel are adapted to bearings in the frames at *x*, Fig. 1, which is away from the central line *y* of the vessel—so that the tendency of both vessels is to tilt over toward each other; but they are connected together at the top by a link, E. Hence when one vessel is in an inclined position, with its base resting on the chest F or other fixed part of the machine, the other vessel is in a vertical or preferably in a slightly-inclined position.

In air-compressors of which rocking vessels form a part it has been usual to connect the two vessels rigidly together, so that they will rock together on a pivot common to both, whereas in my invention, as will be observed by the foregoing description, each vessel has its own pivot, and this is away from the center of the vessel—an arrangement which insures prompt action as well as compactness.

In the chest F are two passages, *b b′*, the former communicating through a flexible pipe, *d*, with a passage, *e*, formed in the base of the vessel D, the passage *b′* communicating through a similar flexible pipe, *d′*, with a passage, *e′*, formed in the base of the vessel D′. The passage *b* also communicates with a port, *i*, in the valve-chest G, and the passage *b′* with a similar port, *i′*, in the same chest, which has two inlet-ports, *m m′*, and an outlet or exhaust port, *n*, the latter communicating with the waste-pipe N, and the ports *m m′* with the inlet-pipes P P, which meet at a single pipe, the latter being in communication with the regulating-valve described hereinafter.

A valve, consisting in the present instance of two pistons, *h h*, is adapted to slide in the valve-chest G, the pistons being secured to or forming a part of a valve-rod, *j*, which passes through a stuffing-box at each end of the valve-chest, the rod projecting at each end far enough beyond each stuffing-box to be struck by the arms *k*, extending downward from the bases of the two vessels, first one arm and then the other striking the valve-rod as the vessels are tilted, in the manner described hereinafter.

As shown in Fig. 1, water has reached such an altitude in the vessel D′ and has fallen so low in the vessel D that both vessels have been tilted, the vessel D′ having been raised to nearly a vertical position and the vessel D having been tilted to the inclined position shown. Owing to this movement of the two vessels, the valve in the chest G occupies the position shown, thereby permitting the water in the vessel D to run to waste through the exhaust-ports *i* and *n* and into the waste-pipe N, while water under pressure is passing from the pipe P through the chests G and F and into the vessel D′. Meanwhile a small vent-valve in a chest, *l*, at the top of the said vessel D, has opened, thereby permitting the water to pass freely therefrom, and a valve in the chest *q* has closed, while the pressure of air in the vessel D′, due to the rising of water therein, has closed the vent-valve in the chest *l′* and opened the valve in the chest *q′*, so that

the compressed air will pass through the said chest and through a flexible pipe, *r*, to the delivery-pipe S, and thence to its destination, for it should be understood that the chests *q q'* of the vessels are connected together by the said flexible pipe *r*, and that the latter communicates with a suitable pipe, S, through which the compressed air is delivered to the point desired. The water will be reduced in the vessel D and rise in the vessel D' until the latter is so far overbalanced that it will tilt over and raise the vessel D to nearly a vertical position, when the position of the valve in the chest G will be so changed that the water will be discharged from the vessel D' and will rise in the vessel D, forcing the air in the latter into the delivery-pipe S.

It is important that means should be furnished for regulating the volume and pressure of air forced by the rising water in the vessels. The regulating-valve used for this purpose in connection with the above described mechanism is illustrated in Fig. 3, M being the valve-chest, and *t t'* its two branches, the former being in direct communication with the supply of water under pressure and the latter communicating with the inlet-pipes P P.

A balanced cylindrical valve, W, is adapted to circular openings *u u* in the partition V within the valve-chest, and the rod *v* of this valve is connected at its upper end to a piston, *v'*, adapted to a cylinder, Y, which is open at one end and closed by a cap, R, at the other, a flexible diaphragm, *w*, being preferably confined at and near its edges only between the cap and cylinder.

A spiral spring, *s*, intervenes between the piston *v'* and a nut, *y*, on a screw, T, secured to the chest M, the tendency of this spring being to move the piston *v'* toward the cap R, and to so move the valve that there will be a free communication for the water between the two branches *t t'*, and hence from the general supply-pipe to the inlet-pipes of the air-compressor.

Between that part of the interior of the valve-chest M which is in direct communication with the branch *t'* and the inlet-pipes of the air-compressor and the cylinder Y beyond its piston there is a passage, 2, so that the said piston will be subjected to the pressure of the water which has passed the valve W, and, if this pressure is excessive, it will act on the piston to close or partly close the valve W, and thus diminish the supply of water admitted to the air-compressor. The rigidity of the spring may be so increased or diminished as to induce the piston and valve to operate under any pressure which is desired for the air forced from the vessels D D'.

It will be noticed that there is between the end of the valve-spindle *j* and the arm *k* of the vessel D a space, which permits the vessel D to move to a certain extent before the arm strikes the end of the spindle. By this means there is no resistance to the movement of the vessel at the commencement of the tilting operation, and the vessel acquires a certain momentum before it is called upon to actuate the valve. The same is true, also, of the action of the arm *k* of the vessel D' on the opposite end of the spindle.

I claim as my invention—

1. The combination, in a hydraulic air-compressor, of the following elements, namely: first, two connected vessels, each hung out of center to a pivot separate from that of the other; second, a valve, ports, and passages, whereby water under pressure is directed to one vessel simultaneously with the exhaustion of water from the other vessel; third, mechanism whereby the vessels during the act of tilting are caused to operate the valve, and, fourth, discharge-valves for permitting the compressed air from one vessel to be forced to the delivery-pipe while the discharge-valve of the other vessel is closed, all substantially as set forth.

2. The combination of the two vessels D D', each pivoted out of center to its own pivot-pin, the connecting-rod E, the flexible tubular connections *r r* of the discharge-valve chests, with the delivery-pipe, and the flexible tubular connections *d d'*, forming inlet-passages, all substantially as specified.

3. The combination of the two connected vessels D D' and arms *k k*, one on each vessel, the valve-chest G, and its valve, having a spindle projecting from each end of the said valve-chest, substantially as set forth.

4. The combination of a hydraulic air compressor and a pipe for directing water thereto with a regulating-valve controlled in one direction by a spring and in the other direction by the pressure of water which has passed the valve, all substantially as described.

5. The valve-chest M, its inlet and outlet branches *t t'*, the valve W, the piston *v'*, connected to the valve and adapted to a cylinder, Y, with the passage 2, forming a communication between the cylinder and interior of the valve-chest M, and spring *s*, interposed between an adjustable bearing, *y*, and the said piston, all substantially as set forth.

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

WILLIAM WANG.

Witnesses:
HARRY DRURY,
HARRY SMITH.