(No Model.)

W. THOMAS.

HYDRAULIC AIR COMPRESSOR.

No. 337,209. Patented Mar. 2, 1886.

Fig. 1.

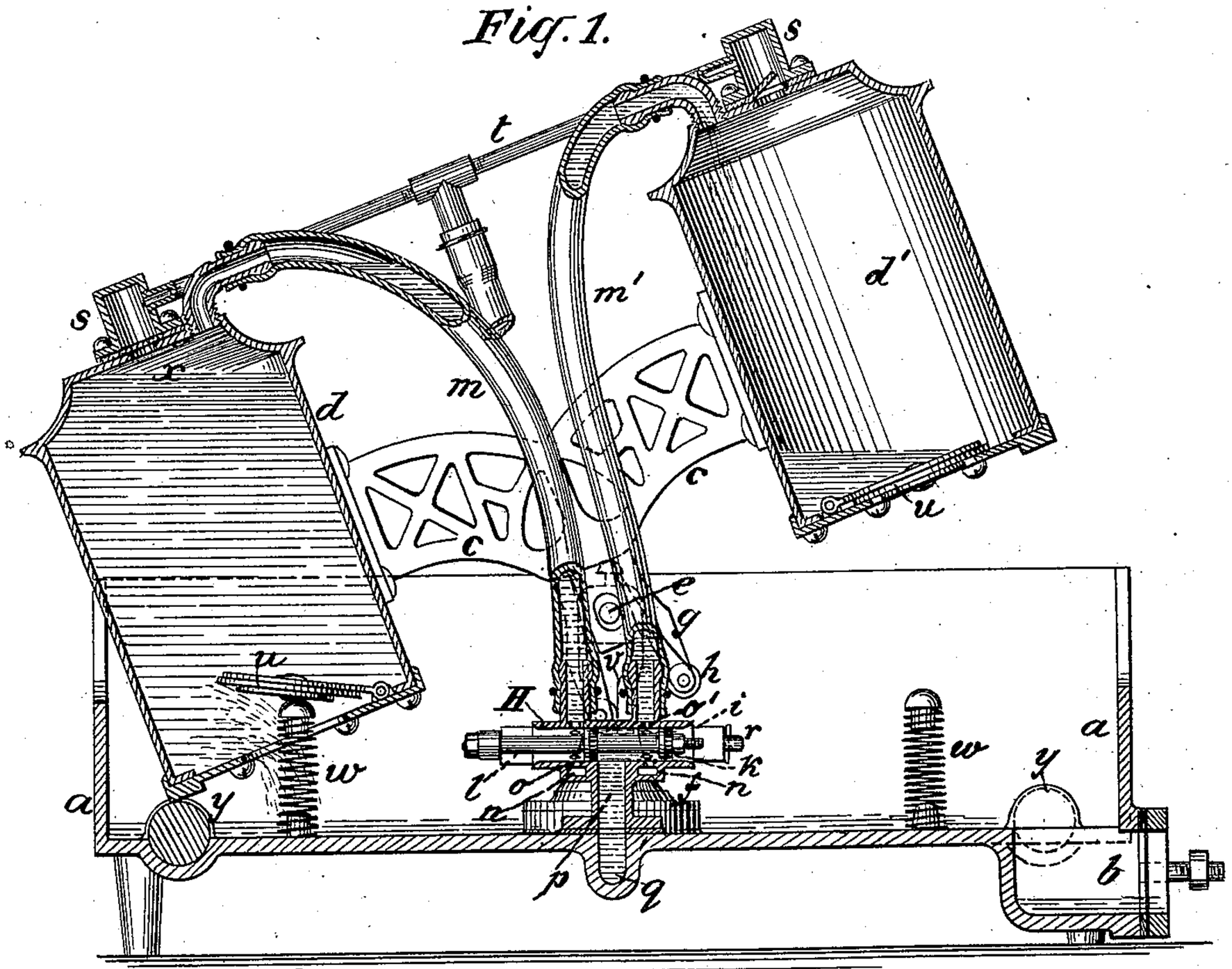


Fig. 2.

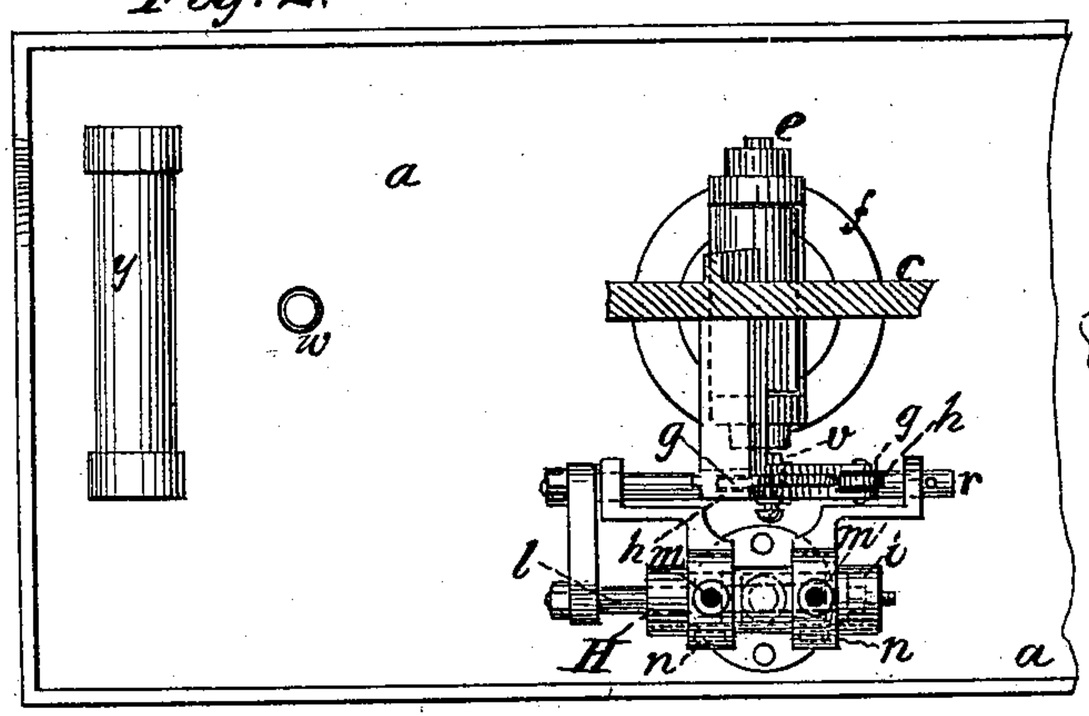
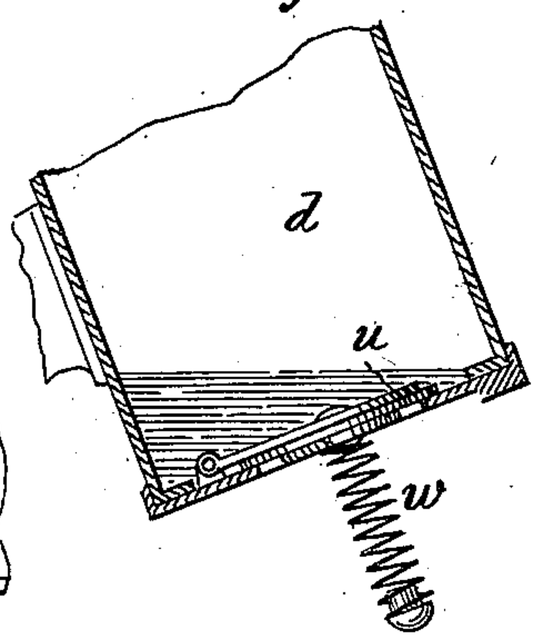


Fig. 3.



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HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 337,209, dated March 2, 1886.

Application filed October 2, 1885. Serial No. 178,799. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM THOMAS, a citizen of the United States, residing at Jersey City, Hudson county, New Jersey, assignor to BISHOP & BABCOCK, of Cleveland, Ohio, have invented certain new and useful Improvements in Hydraulic Air-Compressors, of which the following is a specification.

My improvements relate more particularly to that class of air-compressors shown in the patents to W. A. Babcock, No. 253,830, of 1882, and No. 287,358, of 1883, in which two vessels or cylinders are mounted on the ends of a rocking beam, and arranged to be alternately filled with water under pressure to compress and expel the air from the vessels, the alternate filling of the vessels causing the rocking motion of the beam, which operates a valve that controls the flow of the water to and the exhaust of the spent water from the vessels. In these cases a balanced double-acting piston-valve is used, which controls the flow to the cylinders alternately. In the first-mentioned patent the water-valve acts only to admit the water into the cylinders, the water being exhausted from the cylinders through separate valves in the bottoms of the cylinders. In the last-named patent the water is admitted to one cylinder and exhausted from the other through the same valve, while the air is admitted to the cylinders by separate valves, as usual, in the tops of the cylinders; but the bottoms of the cylinders are valveless, the exhaust being made through the water-valve. Now, in my present invention I employ identically or substantially the same form of valve as is shown in the latter Patent, No. 287,358; but instead of connecting the eduction-pipes of the valve with the bottoms of the cylinders, as heretofore, I connect these pipes with the tops of the cylinders, and I dispense with the air-valves in the tops of the cylinders, but provide the bottoms of the cylinders with water-exhaust valves; hence by this means I combine the water-inlet valve and air-vent valve in one, the water being admitted to one cylinder and the air to the other alternately through the same valve. This simplifies the construction, and improves the operation, and enables the pump to be operated much more rapidly than was formerly the case, for where the exhaust-water has to be discharged through one port of the water-inlet valve, as in the last-named patent, it cannot escape fast enough to allow the pump to run rapidly unless the valve be made inordinately large.

In order to render the action of the exhaust-valves in the bottoms of the cylinders more smooth and certain, I provide them with projecting springs, on which they fall or collide when the cylinders tilt, which puts an elastic pressure on the valve, which eases and cushions the fall and insures the opening of the valve as soon as the air-pressure is removed from the water within.

My invention therefore consists, mainly, in the features above outlined, as hereinafter fully set forth.

In the drawings annexed, Figure 1 represents a sectional elevation of a pump of the described class made with my improvements. Fig. 2 is a plan of the valve portion, and Fig. 3 shows a modification of the exhaust-valve and its collision-spring.

In the drawings, *a* indicates the sink or trough forming the base of the pump, and in which the pump proper is mounted, and which receives the exhaust-water therefrom, which flows off to the waste-pipe at the connection *b*.

c indicates the rocking beam on which the pump cylinders or vessels *d d'* are mounted. This beam is pivoted, as usual, on an axis, *e*, to a pillar, *f*, rising from the center of the sink, and the beam is provided with the fork *g*, having rollers *h* on its prongs, which engage and operate the stem of the water-inlet valve H when the beam rocks, so as to admit the water to the cylinders alternately, and thus keep up the rocking motion of the beam and the pumping action of the vessels. This valve is like that shown in Patent No. 287,358, having a cylinder, *i*, in which are fitted two cup-leather pistons, *k*, cupped toward each other and secured on the piston-rod *l*. The cylinder is perforated in two circumferential zones, *o o'*, at a distance apart equal to the distance of the pistons, and these perforated zones, which form the eduction-ports, are surrounded by annular chambers *n n*, from which the eduction-pipes *m m'* lead, while an induction-port, *p*, connected with the inlet *q*, leading to the supply of water under pressure, opens into the cylin-

der between the pistons and the eduction-ports *o o'*. The ends of the valve-cylinder are freely open to the atmosphere, and the piston-rod projects freely from the open ends, and is connected to the operating rod or stem *r*, having a projection, *v*, which is engaged by the operating-fork *g* of the rocking beam *c*. Now, the eduction pipes *m m'*, (which are preferably flexible rubber tubes,) instead of being connected with the bottoms of the cylinders *d d'*, as heretofore, are connected with the tops of the cylinders, as seen in Fig. 1. The tops of the cylinders are also provided with the usual air-outlet check-valves *s*, connected with the compressed-air pipe *t*, through which the compressed air escapes, but is prevented from returning to the cylinders. The usual air inlet or vent valves on the tops of the cylinders are, however, entirely dispensed with; but the bottoms of the cylinders are provided with an ordinary form of water-exhaust valve, *u*, opening inward, similar to what has been used in other pumps of this class.

From the base of the sink *a* two springs, *w w*, arise in line with the exhaust-valves to a sufficient height, so that at each tilt of the beam and its cylinder one of the exhaust-valves will be forced against its corresponding spring, which will serve not only to cushion the tilting movement, but put a strong elastic pressure on the valve, which will effectively open the same and allow the spent water to run out, as shown on the left of Fig. 1.

At *y y* are shown rubber cushions fixed to the base of the sink, on which the edge of the cylinders will strike elastically at each tilt of the beam.

The general construction having been now set forth, the operation will be readily understood. Thus, in Fig. 1 the parts are illustrated in the positions assumed just at the instant that the beam has tilted to the left and shifted the valve. In this position it will be seen that the pistons *k k* will be shifted to the right, so as to uncover the eduction-port *o'* to the water-inlet *p*, and hence the water under pressure will flow through the right eduction-tube *m'* into the raised cylinder *d'*, which, in accumulating in the same, will compress the air therein and force it out through the check-valve *s* into the air-pipe *t*. At the same time it will be seen that the eduction-port *o* on the left will be open to the atmosphere, and the small compressed-air remnant *x* in the top of the water-charged vessel *d* on the left will first eject the water in the eduction-tube *m*, and spurt it out of the open end of the valve-cylinder and escape, thus taking off the pressure from the water in the cylinder, after which the spring *w*, which had been compressed under the exhaust-valve *u* by the fall of the charged cylinder, will now expand and lift the valve, and thus allow the exhaust-water to flow freely out of the cylinder at the same time that atmospheric air flows through the open end of the valve and through the port *o* and eduction-tube *m* into the top of the cylinder, to supply the place of the exhaust-water. By a proper proportion of the exhaust and inlet valves the exhaust-water will of course flow out of one cylinder faster than the water under pressure flows into the other, so that after one cylinder is exhausted the other cylinder will have become filled, and will then fall or tilt in the opposite direction, thus reversing the action of the valve and causing the same operations to be repeated on the other side of the pump. It will thus be seen that by my improvement the one water-inlet valve H, which is substantially what has been heretofore used, serves not only as the water-valve, but also as the air-vent or air-inlet valve for both cylinders, and also as the valve to allow the compressed-air remnant to escape from the charged cylinder, for which latter purpose a separate valve has been heretofore used, thus enabling one simple valve to perform the functions of three separate valves heretofore used. It will be seen that as the eduction-tubes and eduction ports of the water-inlet valve are used to discharge the compressed-air remnant and draw in the fresh air the pump can operate very fast, which is not the case when the exhaust-water has to be forced through these same passages, as in the former patent referred to, for it is obvious that water will pass very slowly through a passage which will discharge air very rapidly.

It will be now readily understood that the essential idea of my invention is not confined to any particular method of mounting or arranging the cylinders *d d'*, whether on a rocking beam or otherwise, and is not confined to any special form of inlet-valve, although the form shown is specially adapted; nor to any special form of exhaust-valve or means of operating it, for the essential point of my improvement consists in the combination, with the two cylinders, of a double-acting valve arranged to open one port to the water-pressure and the other port to the atmosphere, with eduction-pipes leading from said ports to the tops of the cylinders, and exhaust-valves in the bottoms of the cylinders, whereby the water and air are admitted to the respective vessels alternately through the same inlet-valve, and separate air-vent and relief valves dispensed with, as set forth.

Instead of having the springs *w w* fixed to the sink *a* and projecting toward the exhaust-valves, they may be fixed to the exhaust-valves and project toward the sink, as seen in Fig. 3, with about the same effect.

Instead of having the inlet-valve H mounted on the base and operated by a fork on the beam, it may be mounted on the beam and connected by inflexible pipes to the cylinders, and operated by a fixed fork projecting from the base, as in the Patent No. 253,830.

What I claim as my invention is—

1. In a hydraulic air-compressor, substantially such as described, the combination, with vessels or cylinders *d d'*, of a double-acting water-inlet valve, substantially such as H,

arranged to open one eduction-port to the water under pressure and the other eduction-port to the atmosphere, with eduction-tubes *m m'*, leading from said ports to the tops of the vessels, and water-exhaust valves *u* in the bottoms of the vessels, arranged and operating substantially as shown and described.

2. In a hydraulic air-compressor, the combination, with the alternately-filling vessels *d d'*, of the water-valve H, having a cylinder, *i*, open to the air at the ends, pistons *k k*, inlet-port *p*, and outlet-ports *o o'*, arranged as shown, with eduction-pipes *m m'*, leading from said ports to the tops of the cylinders, air-outlet valves *s* in the tops of the cylinders, and water-exhaust valves *u* in the bottoms of the cylinders, with suitable means to shift the valve as the cylinders alternately fill and empty, substantially as herein set forth.

3. The combination of the vessels *d d'* and rocking beam *c*, a double-acting valve, substantially as set forth, arranged to open one eduction-port to the air and the other to the water under pressure, an operating connection between the beam and the valve, eduction-pipes *m m'*, extending from the eduction-ports to the tops of the cylinders, air-outlet valves *s* in the tops of the cylinders, and water-exhaust valves *u* in the bottoms of the cylinders, arranged and operating substantially as shown and described.

4. In a hydraulic air-compressor, such as set forth, the combination, with the rocking or tilting vessels *d d'* and exhaust-valves *u* in the base thereof, of the springs *w*, interposed between the valves and the supporting-base, and on which the valves fall when the vessels tilt, substantially as and for the purpose set forth.

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Witnesses:
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