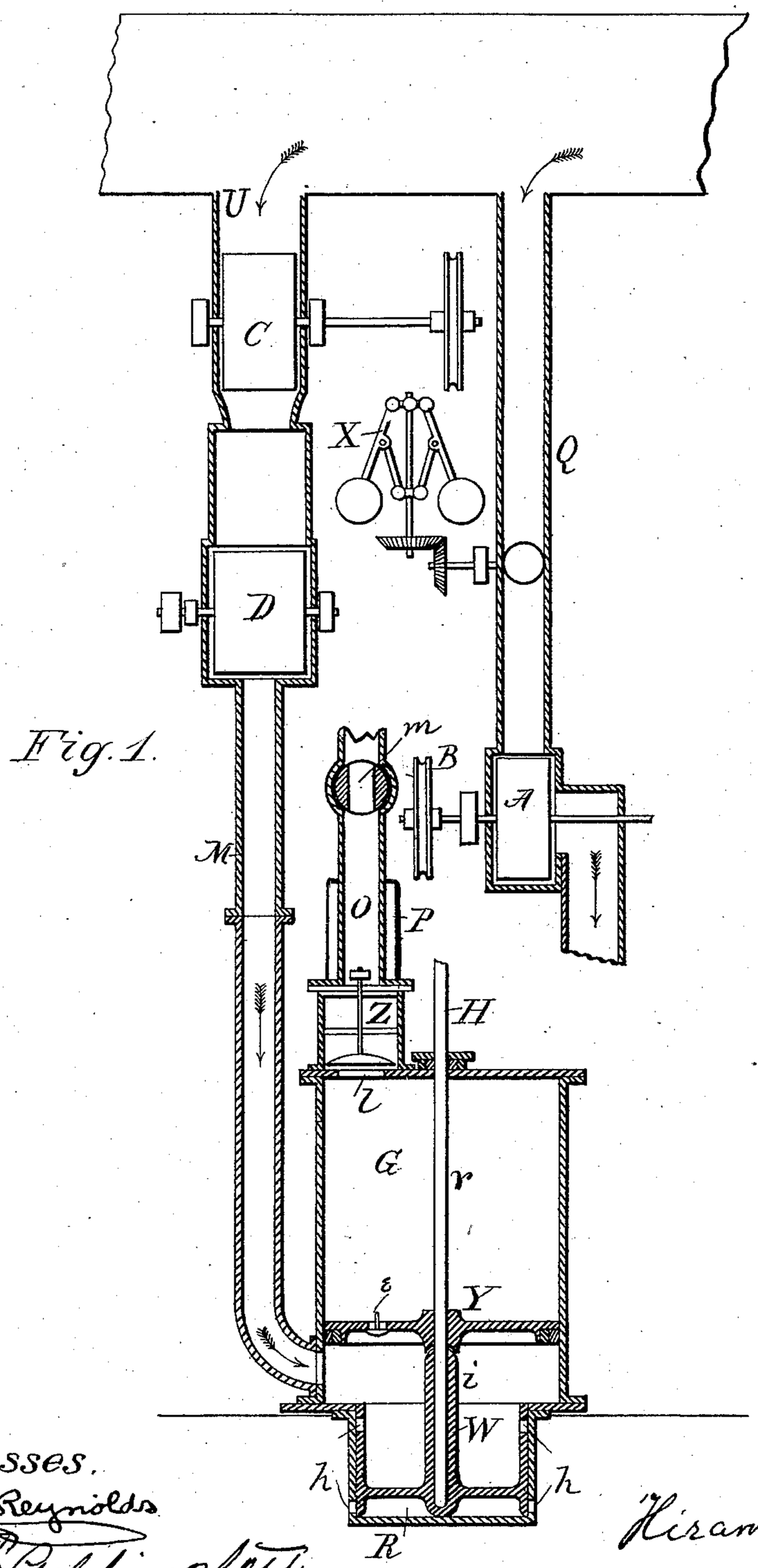
(No Model.) 2 Sheets—Sheet 1.

H. WEBSTER.

HYDRAULIC AIR COMPRESSOR.

No. 286,751. Patented Oct. 16, 1883.

Fig. 1.



Witnesses.
Chas. B. Reynolds.
C. H. Redlingplatt

Inventor.
Hiram Webster

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

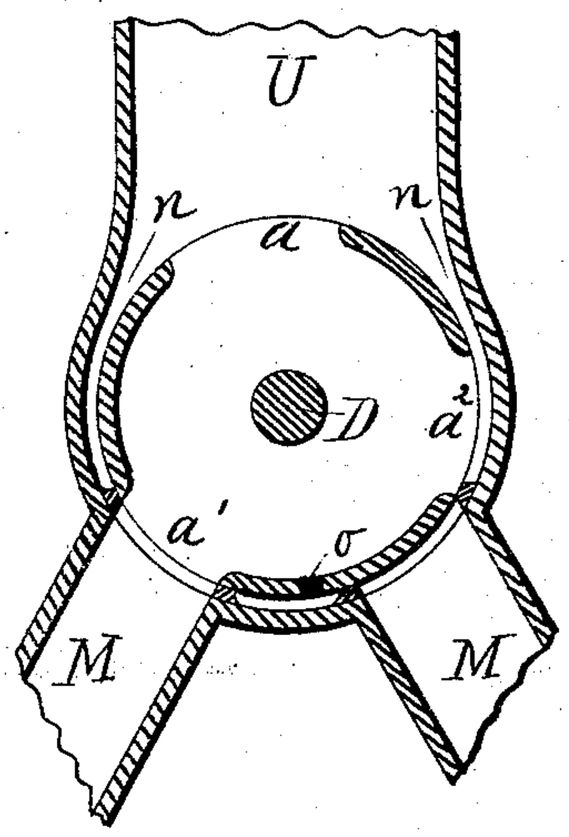


Fig. 2.

Fig. 4.

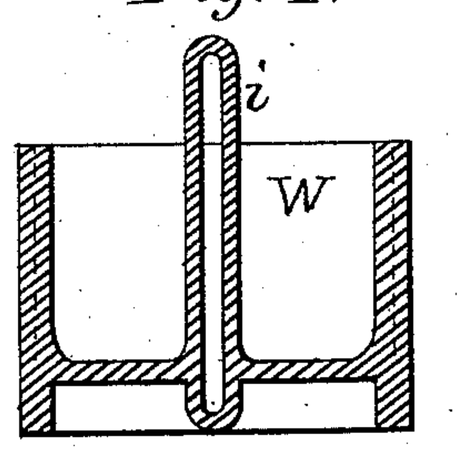
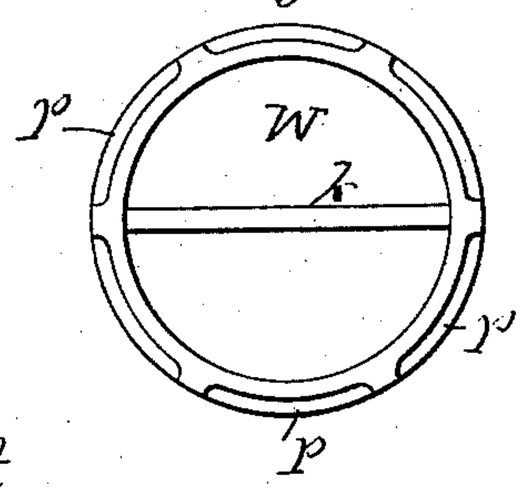


Fig. 5.



Witnesses.

Chr. B. Reynolds

C. H. Aldrington

Inventor

Hiram Webster

N. PETERS. Photo-Lithographer. Washington, D. C.

UNITED STATES PATENT OFFICE.

HIRAM WEBSTER, OF EAST AURORA, NEW YORK.

HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 286,751, dated October 16, 1883.

Application filed May 31, 1882. (No model.)

To all whom it may concern:

Be it known that I, HIRAM WEBSTER, of East Aurora, Erie county, New York, have invented a certain new and useful Improvement in Air-Compressors; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section in line *x x* of Fig. 2. Fig. 2 is an elevation, partially in section, looking at right angles to Fig. 1. Fig. 3 is an enlarged section through the three-way valve and its pipe-connections. Figs. 4 and 5 are a section and plan of the cut-off piston in the bottom of the cylinder.

My improvement relates to air-compressors in which a water-wheel, a pump, two cylinders with air-compressing pistons, and a three-way shifting-valve with pipe-connections leading to the cylinders are employed, with suitable mechanism for producing alternate action in the cylinders, as hereinafter more fully described.

In the drawings, A shows the water-wheel, which may be of any desired kind—placed horizontal or upright, as the case may be—run by water supplied by a pipe, Q, from any suitable source.

B is a pulley on the shaft of the water-wheel, from which a cable or band extends to a similar pulley on the shaft of the pump. The water-wheel and pump may be attached or geared together by cog-wheels; or the water-wheel and pump may be run together on the same shaft.

C is the pump, which may be rotary or other kind, and receives its supply of water through a pipe, U, from any suitable source.

G G are two upright cylinders, and M M are two branch pipes, which connect the bottoms of the cylinders with the induction-pipe U. The pump forces the water down through the branch pipes and into the bottom of the cylinders, in the manner hereinafter described.

D is a three-way shifting-valve located in the pipe U below the pump and above the ends of the branching pipes M M, where it is fitted in a seat to turn easily. It has three ports or openings, a a' a^2, the upper one, a, serving to receive the water from the pipe above, and the lower ones, a' a^2, coinciding alternately with the ends of the branching pipes as the valve is rocked.

Y Y are pistons in the cylinders G G, attached to rods r r, which pass up through the tops of the cylinders, and are connected by pitmen or links t t to a centrally-pivoted working-beam, T, attached to a supporting-frame, S. It will be seen that as one piston is forced up the other one will be forced down, and vice versa, through the medium of the connections before described. Each of the pistons has a small valve, e, which opens downward, as shown.

F F are small cylinders on top of the main cylinders G G, and communicating therewith through ports or openings covered by valves c c on the under side and opening downward, said valves having arms d d, weighted to close the valves, or provided with springs for the same purpose.

K K are small pistons in the cylinders F F, and u u are rods extending up through the small cylinders, and pivoted at their tops to a working-beam, J, attached to the shaft of the three-way valve D. It will be seen that as the pistons K K are forced up alternately in the cylinders F F the valve will be correspondingly rocked forward and back, thereby shifting the ports a' a^2 from one branching pipe, M, to the other. Near the top of the small cylinder are small holes or openings, for the air to escape or exhaust when the piston comes to the end of its stroke.

R R are short discharge cylinders or chambers bolted to the bottom of the main cylinders G G. The bottoms of these discharge-cylinders are closed; but at the sides, near the bottom, are discharge-openings h h, as shown.

W W are cut-off pistons or plungers, which rest and slide in the cylinders R R. Each of these pistons has a high flange, forming the periphery, and on this piston is a high stem, i, which is hollow, and receives the lower end of the main piston-rod r, producing a link movement. The action is such that when the main piston Y is elevated, as in Fig. 2, the cut-off piston W will also be drawn up above the discharge-openings h h, and when the main piston is forced fully down, as in Fig. 1, the cut-off piston will also be forced down to the bottom of the cut-off cylinder, thus cutting off the discharge-openings h h. The sliding motion of the piston-rod r in the stem i allows this action to take place, and the main

piston moves down nearly its whole stroke before the cut-off piston will be closed. The center portion of the cut-off piston is open, having only a bar, *k*, across it, so that the water in the main cylinder can flow down through the cut-off piston and out at the openings *h h* in the back stroke of the main piston.

O is a discharge-pipe for the compressed air on top of each of the main cylinders G G, said pipe leading to a receiving-tank, or to any other point where the air is to be used.

Z is a valve located in a small chamber between the cylinder and pipe, shutting downward and closing a port, *l*, in the top of the cylinder. This valve closes and holds the pressure of the air in the pipe while the piston makes its reverse stroke.

m is a stop-cock, which may also be used in pipe O when desired.

N N are valves in the tops of the cylinders G G, opening inward to supply air to the cylinders in the reverse movement of the pistons. L L are corresponding valves in the upper ends of the branch pipes M M.

X is a governor, of any suitable kind, for regulating the flow of water to the water-wheel.

P is a water-jacket surrounding a portion of the pipe O, to keep the compressed air cool.

If desired, a safety-valve may be used on each of the main cylinders G G, to allow escape of air at any given pressure.

The valve D is fitted into its seat in such a manner as to leave a thin water-space, *n*, all around, and in the bottom of the valve is a small hole, *o*, which allows water to pass through into that portion of the space between the two ports $a' a^2$. The cut-off piston W also has similar recesses, *p p*, on its periphery, extending nearly to its bottom, as shown in the plan view, Fig. 5. By this means the water can pass outside of the valve and the pistons, so as to partially balance them, thereby preventing friction to a great degree.

The operation is as follows: Motion is given to the pump by means of the water-wheel, and water is thereby pumped through pipe U into one of the branch pipes M, and thence into bottom of the cylinder G under the piston Y, the other branch pipe being closed by the valve D. The water forces the piston Y up, and thereby compresses the air in the cylinder. The compressed air passes out through the air-pipe O. The piston in the opposite cylinder is at the same time forced down and drives the water beneath it out through the discharge-openings *h h*, as before described, at the same time drawing air in at the top of the cylinder through the valve N. When the piston, which is rising, reaches the top of its cylinder, it strikes the lever *d* of the valve *c*, and opens the latter and admits a portion of the compressed air above the piston into the small cylinder F, thereby forcing up the piston K and shifting the valve D, so as to turn the water into the opposite pipe, M, and cylinder G, thereby reversing the operation. In this manner the operation of compressing the air is continuous and uninterrupted.

Various modifications may be used without changing the invention. Steam-power may be used in place of water-power for imparting motion. The apparatus may be horizontal instead of vertical. The pump may be arranged to pump back the water which escapes from the cylinders, thereby using the water over and over again.

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

1. In an air-compressor, the combination, with the cylinders G G, pistons Y Y, and shifting-valve D, of the small cylinders F F on top of the main cylinders, the pistons K K, resting in said small cylinders, the rods *u u*, attached to the pistons, and the walking-beam J, attached to the upper ends of the rods and to the shaft of the valve, as herein shown and described.

2. In an air-compressor, the combination, with the cylinder G, provided with the compressing-piston Y, of the discharge-cylinder R at the bottom of the main cylinder, provided with discharge-openings *h h*, and the cut-off piston W, resting in the discharge-cylinder, the rod or link of the main piston entering a socket of the cut-off piston and sliding therein to a limited extent to allow proper working of the parts, as herein shown and described.

HIRAM WEBSTER.

Witnesses:
C. H. ADDINGTON,
CHS. B. REYNOLDS.