(No Model.) 2 Sheets—Sheet 1

H. C. ROLF.

AUTOMATIC HYDRAULIC COMPRESSOR OF AIR OR OTHER GASES.

No. 354,487. Patented Dec. 14, 1886.

Fig. 1.

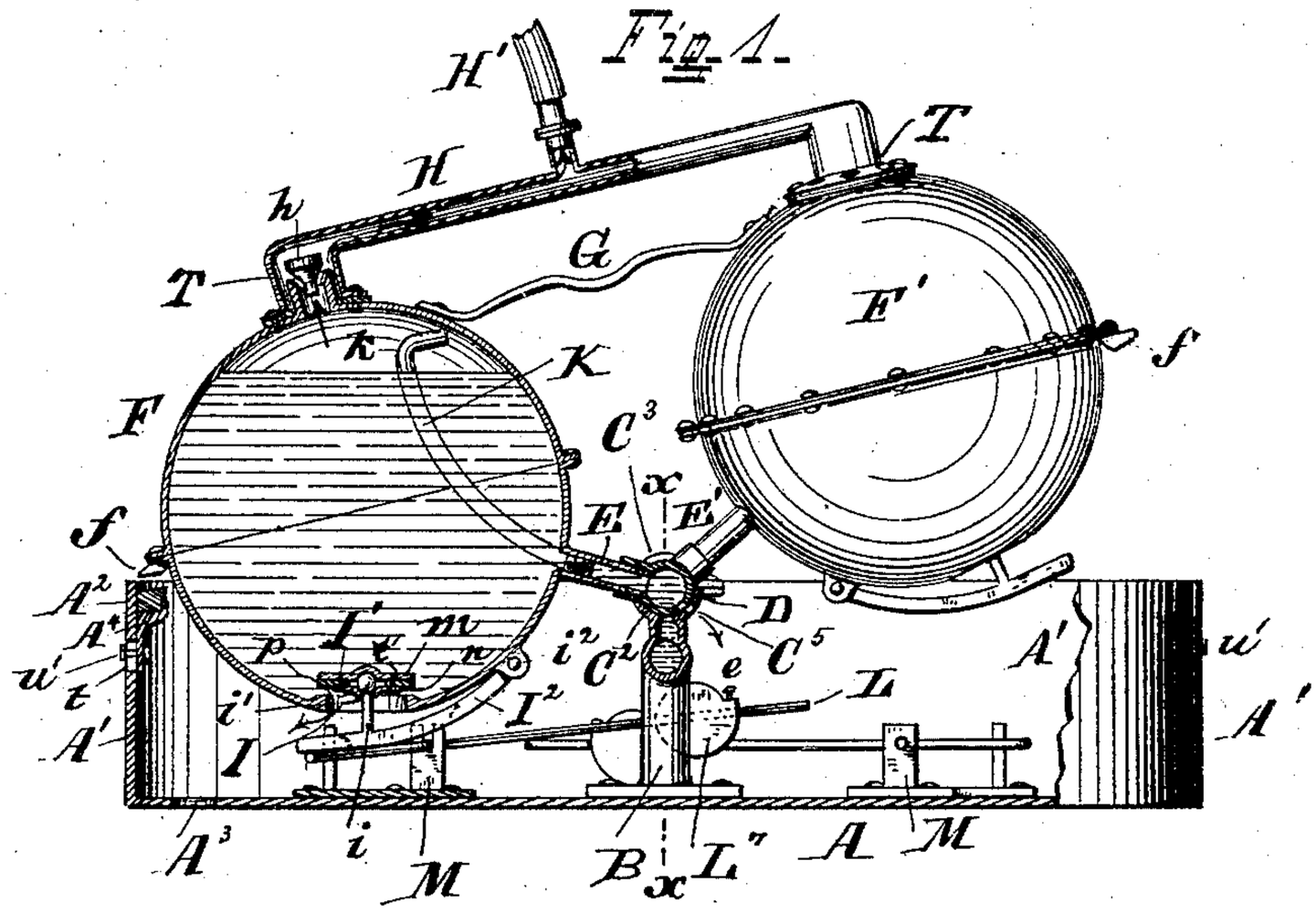


Fig. 2.

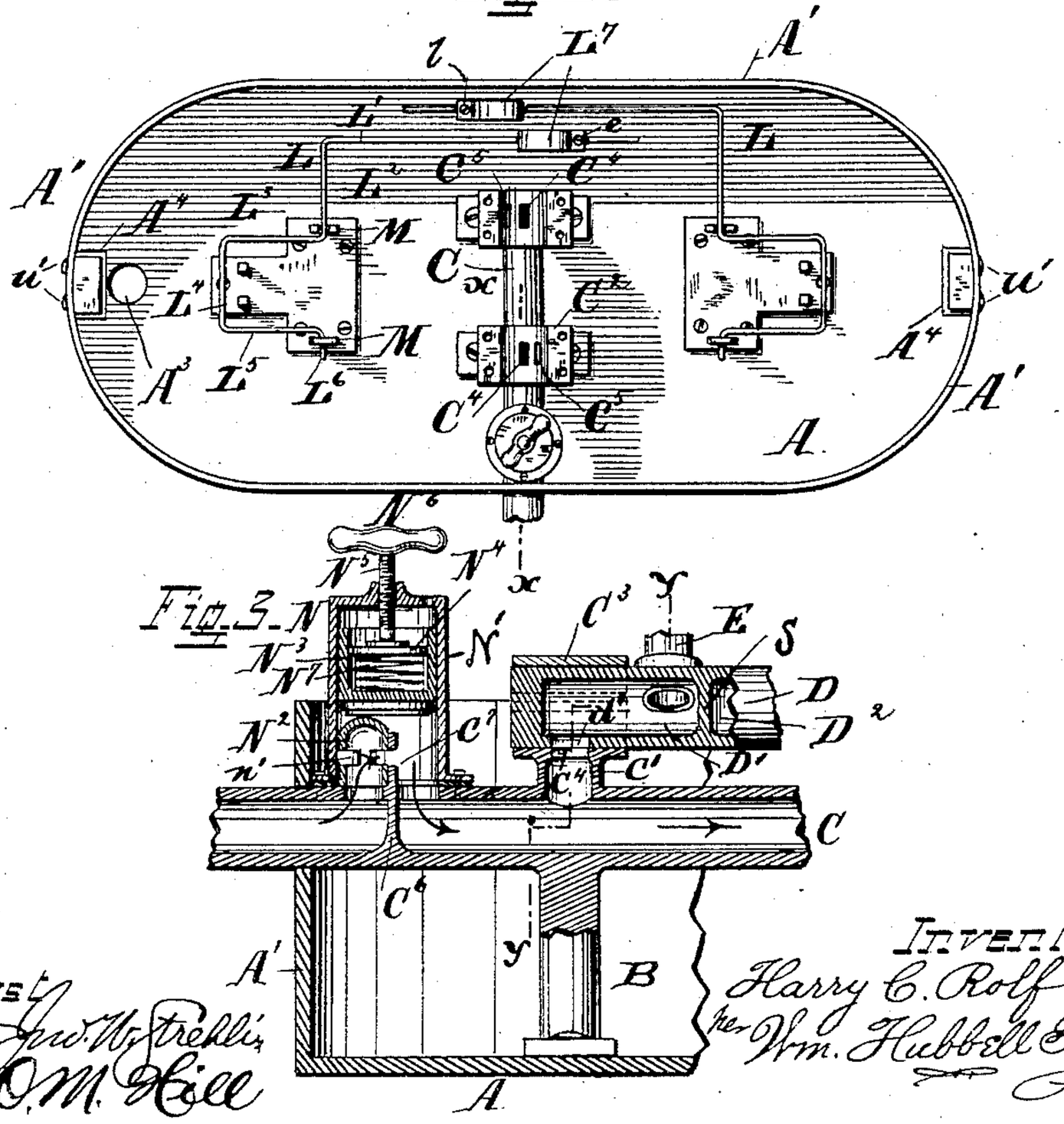


Fig. 3.

Attest
Jno. W. Strehlis
O. M. Hill

Inventor
Harry C. Rolf
by Wm. Hubbell Fisher,
Atty.

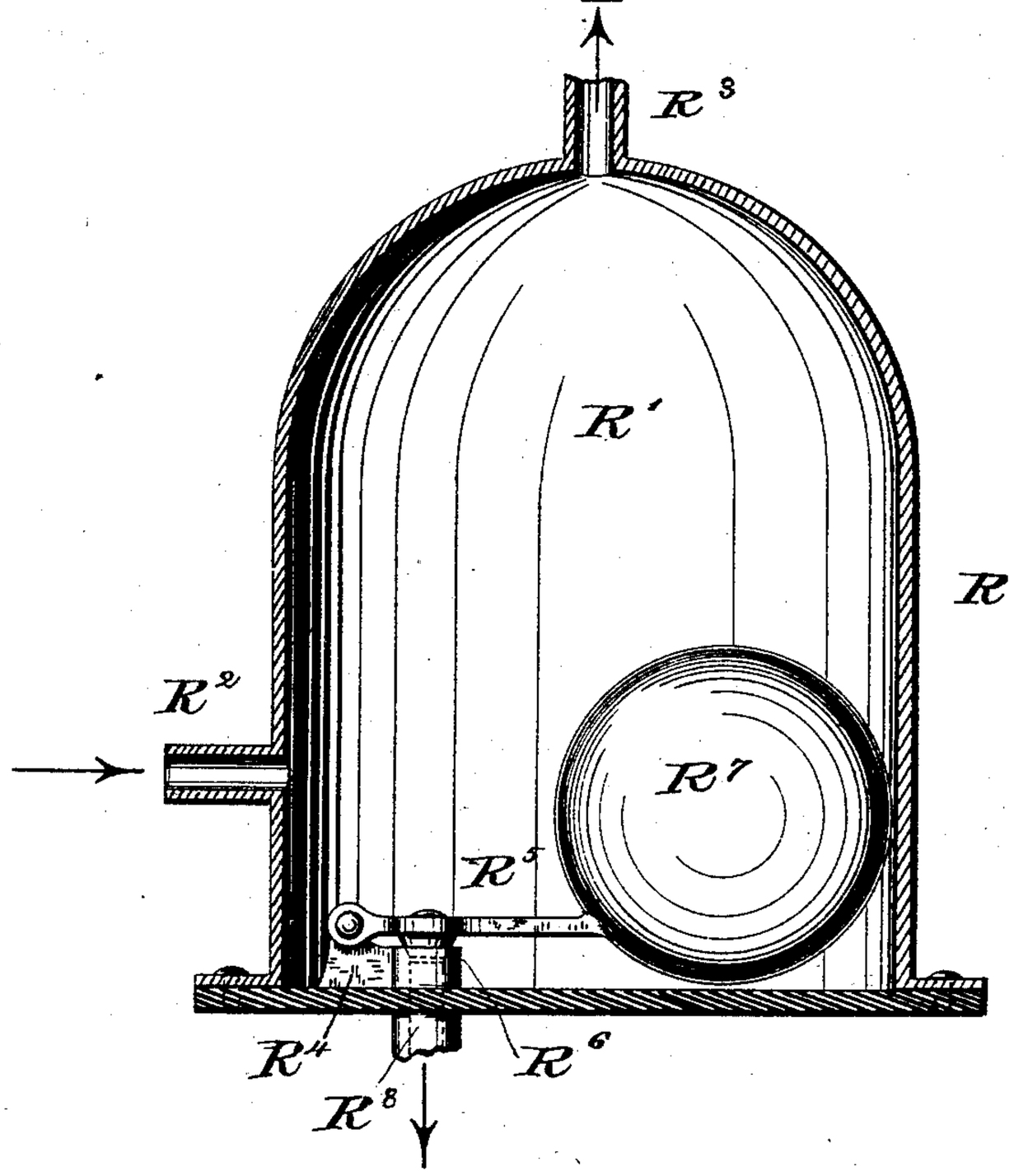
(No Model.) 2 Sheets—Sheet 2.

H. C. ROLF.

AUTOMATIC HYDRAULIC COMPRESSOR OF AIR OR OTHER GASES.

No. 354,487. Patented Dec. 14, 1886.

Fig. 4



Attest
Jno. W. Strehli
O. M. Hoe

Inventor
Harry C. Rolf
per Wm. Hubbell Fisher
Atty.

UNITED STATES PATENT OFFICE.

HARRY C. ROLF, OF CINCINNATI, OHIO, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE ACME MANUFACTURING STOCK COMPANY, OF SAME PLACE.

AUTOMATIC HYDRAULIC COMPRESSOR OF AIR OR OTHER GASES.

SPECIFICATION forming part of Letters Patent No. 354,487, dated December 14, 1886.

Application filed December 20, 1884. Serial No. 150,842. (No model.)

To all whom it may concern:

Be it known that I, HARRY C. ROLF, a citizen of the United States, and a resident of the city of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Automatic Hydraulic Compressors of Air or other Gases, of which the following is a specification.

The various features of my invention and their uses, conjointly or otherwise, will be apparent from the following description.

In the accompanying drawings, Figure 1, Sheet 1, is a side view of my device, part being shown in elevation and part in vertical section. This section follows the irregular line *y y* of Fig. 3. Fig. 2, Sheet 1, is a top view of my device, the oscillating spheres, with their immediate attachments, being removed. Fig. 3, Sheet 1, is a sectional elevation taken on the line *x x*, Figs. 1 and 2. The section does not extend entirely across the machine, but only so far as the line *x x* is drawn in Fig. 2. Fig. 4, Sheet 2, represents an attachment which may be applied to any machine, and which prevents water or other liquid from being blown through with the air or other gas.

The device is mounted on a base-plate, A, which is preferably provided with sides and ends A′. To this base-plate are secured two standards, B, (see Figs. 1 and 3,) which carry the pipe C, these three parts being preferably cast in one piece. Over each of the standards B a chock or neck, C′, extends upwardly and is furnished at its upper end with a semi-cylindrical concave flange, C^2, forming the lower half of the journal-box. A hollow rock-shaft, D, is supported by said flanges C^2 and held in position by the cap C^3. Each cap C^3 and its concave flange C^2 forms a journal-box, in which the rock-shaft turns or rocks. The joint between the rock-shaft and each concave flange forming the lower half of each journal-box must be air and water tight, and is preferably ground. From near each end of the rock-shaft D a stem projects upwardly and outwardly, one in one direction and the other in another direction, substantially as shown. These stems E E′ are hollow and communicate with the cavities in the rock-shaft D. Each end portion of the rock-shaft is hollow, one end portion having the chamber or passage D′ and the other end portion having the chamber or passage D^2. These passages do not communicate with each other, but are separated by the imperforate partition S. The stems E and E′ are hollow, having longitudinal passage-ways through them. The passage-way in stem E opens into passage D′ of shaft D and the stems E and E′. The passage-way in stem E opens into passage D^2 of rock-shaft D. The passage D′ is also provided with a port, *d′*, and the passage D^2 with a port similar to *d′*, (not shown.) The flanges—*i. e.*, lower halves of the journal-boxes C^3—each have two openings, viz: an opening, C^4, in each communicates with the pipes C, and the openings C^5 communicate with the external air, or in a suitable manner with a gas-reservoir.

Two chambers, (preferably spiral in form,) F and F′, are mounted on the stems E and E′, respectively, and can be steadied in their position by the brace G. The top of each chamber opens into the pipe H, the opening being guarded in each instance by a check-valve, T, arranged to allow the passage of air or gas from either chamber into pipe H, but preventing its return thereto. A pipe or hose, H′, leads off from the pipe H. An opening, I, in the bottom of each chamber is closed by a valve, I′. The preferred construction of this valve and its connections is as shown, viz: The valve I′ is mounted on the stem *i*, which terminates in the globular head *i′*, making with the valve I′ a ball-and-socket joint.

The valve I′ consists of an upper plate, *m*, and an annular plate, *n*, and between these, and extending out over the annular seat of the valve, is the packing *p*. The upper plate, *m*, and packing *p* and annular plate *n* are secured together by screws or bolts *t′*. The diameter of the circle described by the outer edge of the annular plate is less than the diameter of the passage-way through the valve-seat, so that when the valve is forced down the packing *p* rests on the seat, while the plate *n* is below the said seat. The center of this annular plate passes the shank or stem *i*, and the globular head *i′* is loosely held between the upper and lower plates, *m n*, and the valve can rock thereon and seat itself, but the head is too large to slip through the hole in plate *n*

through which stem *i* passes. The stem *i* projects upwardly from the curved lever I^2, which latter is fulcrumed at i^2 to the side of the chamber. In each chamber there is a pipe, K, which runs from the stem E or E′ to the upper part of the chamber, and there is preferably bent on itself to form the arm *k*. The arm *k* is shown as delivering the liquid toward the adjacent side of the chamber; but this arm may be bent at any other angle with relation to pipe K.

The main purpose of the arm *k* or any equivalent device is to prevent the water coming through pipe K into the chamber from entering the valve *h*, and also to cause the said water to flow down in a solid stream without mingling with the air in the chamber. Each chamber is provided with a bumper or stop, *f*, which impinges against a stationary stop, A^4. This stop A^4 is preferably provided with the cushion A^2, in order to prevent the stops *f* and A^4 from making a noise when they meet. The stop A^4 is preferably vertically adjustable, so as to regulate (within limits) the distance to which the chamber shall descend, and consequently regulate the height to which the water or other liquid shall rise in the opposite chamber.

The preferred mode of rendering the stop A^4 adjustable is to provide it with a vertical slot, *t*, and secure it to its support (in the present illustrative instance the side A′) by a bolt or bolts, *u*′. When desired, the slot may be in the side A or end A′.

To open the valves I, there is provided a pair of weighted levers, L, one for each valve respectively. Each lever L is preferably made of an iron or steel rod, bent, as shown in Fig. 2, to form the arms L′, L^2, L^3, L^4, L^5, and L^6. The fulcrum of the lever is formed by the arms L^2 and L^6 resting in the supports M. On the arm L′ is placed a weight, L^7, which is secured in position by the set-screw *l* at any desired point along said rod. When the weight rests on the bottom A, the lever is horizontal.

The mode of operation is as follows: Water or other liquid is admitted to the pipe C from a street-main or any other source where the water is under sufficient pressure, and when the chambers are in the position shown in Fig. 1 will enter the chamber F′, driving before it the air contained in the chamber. The air finds its exit through the pipes H H′, and under the pressure to which it is subjected by the incoming water is conveyed to the receptacle into which it is to be compressed. While this is going on in the chamber F′, the opposite takes place in the chamber F. Here the port *d*′ is opposite the port C^5, communicating with the open air or gas reservoir. Any remaining water in the pipe K of chamber F will now pass down and out through the ports *d*′ and C^5. The air now enters through the ports C^5 and *d*′ and passes up through the pipe K into the upper part of the chamber F, while the water in the said chamber escapes through its valve I and passes out through the opening A^3. As soon as the quantity of water in the chamber F′ becomes greater than that in the chamber F the device oscillates on the rock-shaft D, raising the chamber F and lowering the chamber F′. As the chamber F raises its port *d*′ comes over the opening C^4, and water enters through the pipe K, and the valve I now being closed the water forces the air which has accumulated in the chamber F out through the pipes H H′. As the chamber F′ descends its lever I^2 strikes against the arm L^4 of lever L. As soon as the extreme downward pressure of water and air in chamber F′ is relieved by the water remaining in the pipe K, and the air under extra pressure in chamber F′ passes down and out through pipe K, the weight L^7 will then be sufficiently heavy to open the valve I and permit the water in the chamber F′ to escape. Its port *d*′ is also in position to admit air to the chamber F. In this way each chamber is alternately filled with air, and this air is forced out by the pressure of the water.

It is not desirable that the air should be compressed beyond a certain pressure to be determined in each particular case, and I have provided the pipe C with a suitable valve which can be set for a certain pressure, and which closes automatically when this pressure is exceeded. The preferred valve for this purpose is a novel one of my own invention, to wit: A box, N, is secured to and opens into the pipe C. From this bottom of the pipe C a diaphragm, C^6, extends upwardly into the box N′, shutting off communication between the two parts of the pipe C. In its upper portion it is provided with a port or opening, C^7. On the inlet side of this diaphragm is placed a bucket-valve, N^2, open below, but closed over at the top, and provided with openings *n*′, which are opposite the foot C^7 when the valve is seated. A hollow piston-head, N^3, rests on the valve N^2 and is ground into the box N′ above, in which it moves up or down, according to circumstances. A piston-head, N^4, fits in the piston-head N^3, and is attached to the stem N^5, which screws through the top of the box N′, and is operated by the handle N^6. Between the two piston-heads N^3 and N^4 is sprung a strong spring, N^7, which, pressing against the under surface of the piston-head N^4, depresses the piston N^3 and keeps down the valve N^2. By screwing down the stem N^5 the pressure of the spring N^7 on the valve N^2 is increased, and by loosening it the pressure is diminished. The spring is set at the pressure which it is desired should not be exceeded in compressing the air. If, now, the pressure of the incoming water exceeds that of the spring N^7, the valve N^2 will be lifted by the water and the ports *n* lifted above the opening C^7, and thus shuts off the water and stops the operation of the machine.

The object of making the connection between the weight L^7 and the rod L′ such that the weight L^7 can be set at any suitable point

along the rod is for the purpose of enabling the weight to be so set as to promptly overcome the superincumbent weight of water in the chamber and lift the valve I′, which said weight L′ is intended to operate.

In reference to stop A^4, it may be remarked that when the stop A^4 is lowered the adjacent chamber descends lower and the other chamber ascends higher, and the stem connecting said latter chamber with shaft D is nearer vertical, and the water in said latter chamber must rise higher therein before the chamber will have sufficient weight to overbalance the other chamber and descend. For example, when the stop A^4 (on the left-hand side of Fig. 1,) is lowered the chamber F will descend lower, and chamber F will at the same time ascend higher, stem E′ will be more nearly vertical, and chamber F′ will be more nearly directly over shaft D. Consequently the water entering chamber F′ will have to rise higher in said chamber F than heretofore before it can overcome the weight of the opposing chamber F, and the increased resistance of the latter chamber to rising, consequent upon its lower position and the higher position of chamber F′. By means of these stops A^4 A^4, one being located at each end of the machine, the speed of oscillation of shaft D and the amount of water entering the chambers are regulated.

It may here be remarked that the passages D′ and D^2 and their ports may be in a pipe or pipes, shaft or shafts other than the supporting-shaft, as D, on which the weight of chambers F F′ rest to oscillate. When desired, a spring may be substituted for weighted lever L, and lever I^2 to open the valve; but I prefer to use the devices already shown and described. It sometimes happens that water in one of the chambers, F F′, is thrown over with the air through the pipe H′. To remedy this evil, I have provided the water catcher or trap R. (Shown in Fig. 4, Sheet 2.) This device consists of a receiver, R′, closed at top and bottom, and provided with an inlet-pipe, R^2, and an air or gas outlet pipe, R^3. To a suitable projection, as R^4, in the bottom or bottom portion of the receiver R′, is hinged the lever R^5, which has on its outer end a float, R^7, preferably consisting of a hollow ball. A pipe, R^8, leads away from the bottom of the receiver, and is closed by the valve R^6 in the lever R^5. The pipe R^2 is connected with the pipe H′, and the air entering the chamber or reservoir R′ passes out of the pipe R^3. Should any water happen to be blown from one of the chambers along with the air into the receiver R′, this water collects in the bottom of the receiver, and when a sufficient quantity has collected it lifts the float R^7, opens the valve R^5, and permits the excess of water to escape through said valve R^5.

The various features of my invention are preferably employed together; but one or more of said features may be used without the remainder. In so far as applicable, one or more of said features may be employed in connection with devices other than those particularly herein set forth.

What I claim as new and of my invention, and desire to secure by Letters Patent, is—

1. The combination of the chambers F F′, pipes K K, hollow stems E E′, hollow oscillating shaft D, having diaphragmic division S, and passage-ways D′ D^2, provided with ports *d*′ C^4 C^5, and valve-seats, journal-bearings C^2, having air or gas ports C^5, and liquid-inlet port C^4, as and for the purposes set forth.

2. The combination of lever composed of parts L′ L^2 L^3 L^4 L^5 L^6, and fulcrumed at M M L^2 L^6, and weight, valve I, and chamber, substantially as and for the purposes set forth.

3. The combination of lever having parts L′ L^2 L^3 L^4 L^5 L^6, and fulcrumed at M M L^2 L^6, and lever I^2, fulcrumed at i^2, and valve I′, substantially as and for the purposes set forth.

4. The combination of the moving chambers F F′, outlet-valve I′ in the bottom thereof, weight and lever for opening said valve, the weight being adjustable on the lever and provided with set-screw *l*, substantially as set forth.

5. As an outlet-valve for the chamber of an air-compressor, the valve I′, consisting of upper plate, *m*, annular plate *n*, provided with packing *p*, and mounted on stem *i*, which latter is provided with the ball-head *i*′, and made rigid at its lower end to the arm I^2, which latter is pivoted to the chamber, as and for the purposes set forth.

6. In combination with an automatic air-compressor, the pressure-regulator consisting of pipe C, having diaphragm C^6, provided with port C^7, appropriate housing inclosing bucket-valve N^2, provided with openings *n*′, and means whereby the pressure on the bucket-valve is regulated.

7. In combination with an air-compressor, the pressure-regulator consisting of pipe C, having diaphragm C^6, provided with port C^7, appropriate housing inclosing bucket-valve N^2, provided with openings *n*′, and held down by the pressure device, consisting of pistons N^3 and N^4, spring N^7, and screw N^5, substantially as and for the purposes set forth.

HARRY C. ROLF.

Witnesses:
JNO. W. STREHLI,
O. M. HILL.