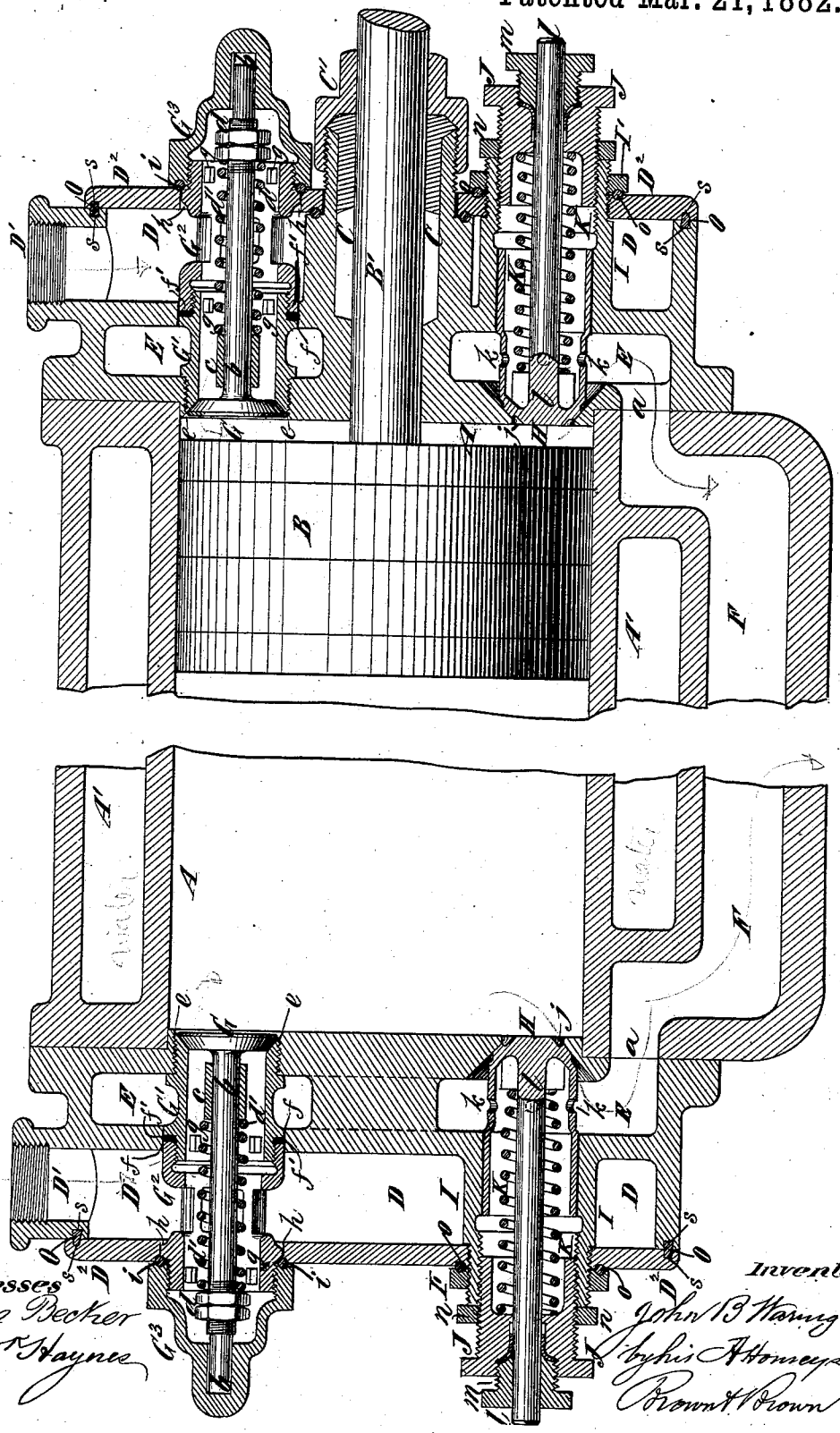
(No Model.)

J. B. WARING.

AIR COMPRESSOR.

No. 255,400. Patented Mar. 21, 1882.



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UNITED STATES PATENT OFFICE.

JOHN B. WARING, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO MILAN C. BULLOCK, OF CHICAGO, ILLINOIS.

AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 255,400, dated March 21, 1882.

Application filed September 14, 1880. Renewed January 28, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. WARING, of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in Air-Compressors, and in Valves for the Same and for other Purposes, of which the following is a specification.

In using compressed air as a motive power a large number of rock-drills, pumps, or other machines are frequently supplied with compressed air from a common reservoir or receiver, an air-compressor being used which is of sufficient size and power to maintain a steady uniform pressure in the reservoir or receiver when all the drills, pumps, or other machines are at work. When one or more of the drills, pumps, or other machines are stopped, the supply of air to the reservoir or receiver should be correspondingly lessened, so as to prevent waste of air through the safety-valve, and this result has commonly been attained by checking the speed of the engine, so as to work the compressor at a slower speed.

The principal object of my invention, however, is to regulate the supply of air to the reservoir or receiver by means of the discharge-valves of the air-compressor; and to this end my invention consists in the combination, with an air compressor or cylinder and piston, of a discharge-valve which is so constructed that when the pressure in the discharge-chest of the air-compressor exceeds the maximum pressure desired it will remain open during the back-stroke of the air-compressing piston and the compressed air circulated through the cylinder, thus preventing the opening of the inlet-valves and the compression of a fresh supply of air until the air has fallen to the desired pressure, whereupon the discharge-valves will close and perform their functions in the ordinary way as long as the pressure does not exceed the maximum pressure desired.

Another part of my invention relates to air-compressors wherein the cylinder-heads, which are hollow and are preferably provided with removable covers, are constructed with suction and discharge chambers or chests for the air, and have the suction and discharge valves arranged in them, and consists in a novel manner of securing the valves in place, whereby any one of the valves may be removed and replaced by another valve without the necessity of removing the cover of the cylinder-head, and whereby the said cover may be conveniently secured in place.

The invention also consists in details of construction hereinafter explained.

The accompanying drawing represents a central longitudinal section through an air-compressing cylinder embodying my invention, all of the parts being represented in a state of rest, and both the suction and discharge valves being closed.

A designates the cylinder, which is constructed with a surrounding water-jacket, A′, to keep the cylinder cool. B designates the piston, and B′ designates the piston-rod. The two heads of the cylinder are both alike, save that in one is constructed a stuffing box, C, through which passes the piston-rod B′. In each head is a suction or inlet air chamber or chest, D, having a suitable air-inlet, D′, and a removable cover, D^2, and also a chamber, E, for compressed air, which communicates by means of a passage, *a*, with a common discharge-chest, F, from whence the compressed air passes to a reservoir or receiver. (Not here shown.) In the meeting faces of the head D and the removable cover D^2 are opposite grooves, *s*, and in said grooves is inserted a packing-ring, O. It will be observed that the groove in the head D is dovetailed or wider at the bottom, and that the packing is correspondingly dovetailed, so that when the cover D^2 is removed the packing-ring will always be retained in the head, and therefore will not be mislaid or lost. This form of packing and the manner of applying the same may be employed for closing vessels or chambers of various kinds, and is very advantageous, inasmuch as the pressure upon one side of the packing-ring presses it tightly against the opposite sides of the grooves and prevents leakage.

Communicating with the suction or inlet air chamber D are suction or inlet valves, which may be of any desirable form.

The valves G and their appurtenances which I prefer to use possess certain novel features which enable any one of them to be readily removed for repair or to be replaced by another

valve without the necessity of taking off the cover D^2, which closes the suction chamber or chest D.

Although only one of the suction-valves is shown in each head, the proper number to admit the quantity of air desired are employed—say about five valves for each head of the cylinder here shown.

The casing of each of the valves G is composed of two parts or sections, G' G^2, the latter of which projects through the removable cover D^2, and has secured to it, outside the cover, a cap, G^3, which constitutes a nut. The valve is provided with a stem, *b*, which fits in a suitable bearing, *c*, in the part G', and in a socket in the cap G^3. Around this stem, between the bearing *c* and nuts *d* on said stem, is a spiral spring, *d'*, for insuring the prompt closing of the valve, and the tension of this spring may be varied by adjusting the nuts *d* along a screw-thread on the stem. The part G' of the casing forms a seat for the valve, and is secured in the head of the cylinder by means of a screw-thread, *e*, while at its other end it is provided with an external screw-thread, with which engages a screw-thread upon the part G^2. The valve-casing G' G^2 extends through a hole or aperture, *f*, leading from the chest D to the chest E; and in order to prevent air from leaking from one chest to the other I interpose a packing, *f'*, between the two parts G' G^2, as clearly shown. In the sides of the part G^2 are openings communicating with the inlet-chamber D, for the entrance of air, and in each of the parts of the casing are inwardly-projecting lugs *g*, with which a wrench may engage to unscrew the two parts of the casing from the head and from each other.

It will be seen that the removable cover D^2, which constitutes the outer wall of the head, is provided with a cylindrical hole, *h*, and that the part G^2 is constructed with a cylindrical portion fitting in said hole. Upon the joint between the hole and the casing is placed a packing-ring, *i*, which is secured and clamped over the joint by means of the cap G^3, the parts being preferably furnished with concave grooves to fit an annular packing of round transverse section. It will be observed that the packing *i* forms a tight joint between the cover D^2 and the part G^2 of the valve-casing, and also between said cover, valve-casing, and cap G^3.

When it is desirable to remove any one of the valves the cap G^3 is first unscrewed, a wrench of proper form to engage with the lugs *g* is then employed for unscrewing the part G^2, after which the same wrench may be applied to the part G' to unscrew it from the head.

It is obvious that to remove the cover D^2 of the head it is only necessary to unscrew the caps G^3 of all the valves, and that said cover may be removed without disturbing the valves or any other of their appurtenances.

It will be observed that the cap C' of the stuffing-box C may be readily removed, so as not to interfere with the removal of the cover D^2, through which it passes.

H designates discharge-valves of peculiar construction, of which two are necessary at each end of the cylinder, although only one is here shown. Each of the valves H is composed of a hollow cylinder, closed at one end, so as to form a valve-face, (shown as conical,) which fits a corresponding seat, *j*, in the head of the cylinder. The cylindrical portion of the valve fits within and is adapted to move longitudinally in a socket, I, (here represented as comprised in the head of the cylinder,) and which projects through the removable cover D^2 and forms a valve-casing. In the said cylindrical portion of the valve are holes *k*, which provide for admitting the compressed air to the back of the valve; and it will be observed that, as the portion of the valve in which are the holes is slightly smaller in diameter than the portion fitting the socket I, air may have free access to the back of the valve even if said holes are carried by the opening of the valve into the socket I.

From the valve H projects a stem, *l*, which fits in a stuffing-box, *m*, and the end of which is exposed to the atmosphere. This stuffing-box is contained in a plug or nut, J, which is screwed into the end of the socket I and forms a guide for the valve-stem. The plug J may be locked in place, when adjusted, by means of a jam-nut, *n*.

K designates a spiral spring arranged around the stem *l* and between the back of the valve and the plug J, and adapted to aid in closing the valve. The tension of this spring, when the valve is closed, is intended to just equal the pressure which would be exerted upon the area of the valve-stem *l* by air of the maximum pressure desired; and this tension may be increased or diminished by adjusting the screw-threaded nut or plug J as may be necessary, and then clamping it in place by the jam-nut *n*. The air on the back of the valve and the spring K tend mutually to impel the valve in the same direction.

As clearly shown, the exterior of the socket I is screw-threaded and provided with a nut, I', between which and the cover of the head is inserted a packing, *o*.

It will be observed that when the spring K is adjusted to compensate for the difference in pressure upon the two sides of the valve due to the exposure of the end of the valve-stem *l* to the atmosphere the pressure upon both sides will be equal, and the valve will therefore be just balanced.

Referring now to the operation of these discharge-valves, we will suppose that the maximum pressure desired is one hundred pounds, and that the tension of the springs K has been adjusted to compensate for the difference in the pressure upon the two sides of the valves due to the exposure of the end of the stems *l* to the atmosphere. So long as the pressure in the reservoir or receiver does not exceed

one hundred pounds the valve will perform its natural functions as a discharge-valve, receding from its seat during the movement of the piston B toward it and returning to its seat as the piston recedes from it, and, as it is so nearly balanced, will work with little noise or jar. If, however, the pressure in the reservoir or receiver reaches anything materially above the desired pressure—say one hundred and four pounds—the pressure upon the faces of the valves would more than equal the pressure upon their backs, inasmuch as the pressure of the springs K would be less than that which would be exerted upon that portion of the faces of the valves corresponding to the area of the exposed ends of the valve-stems, and hence the tendency of the discharge-valves at both ends of the cylinder will be to remain open; and as the compressed air will circulate through the cylinder the pressure upon both sides of the piston will be balanced throughout its stroke and the engine will have no work to do save that incident to friction, the air simply being impelled back and forth. In such case of course the suction or inlet valves would not open and no fresh air would be compressed until the pressure shall fall to or below one hundred pounds. It will be seen that as soon as the desired air-pressure is exceeded the discharge-valves remain open, thus relieving the compressing-engine of all work except that incident to friction. The tendency of the engine to run faster will be controlled by the speed-governor of the engine, and hence waste of steam is prevented.

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

1. The combination, with the cylinder and piston of an air-compressor, of a discharge-valve provided with means for balancing it when working under a pressure not materially in excess of that desired, but which will have an excess of pressure upon its face and remain open when the desired pressure is exceeded, substantially as and for the purpose specified.

2. The combination, with an air-compressor cylinder and a discharge-chest, of a discharge-valve which is subjected to the action of compressed air upon both sides, a valve-stem therefor, the end of which is exposed to the atmosphere, a spring for acting upon the back of said valve, and means for adjusting the tension of said spring to suit different pressures, substantially as and for the purpose specified.

3. The combination, with the hollow cylindrical valve H, provided with openings *k* for admitting air to the back of the valve, of the stem, *l*, the end of which is exposed to the atmosphere, and the spring K, contained within the valve, substantially as and for the purpose specified.

4. The combination of the socket I, the packing-nut I′, the packing *o*, the valve H, having in its cylindrical portion holes *k*, the stem *l*, the plug or nut J, and the spring K, all substantially as specified.

5. The combination, with an air-compressor cylinder and a hollow head therefor, of a removable cover for said hollow head, a valve-casing secured in said hollow head and projecting through said cover, and a screw-threaded nut applied to said casing outside said cover and serving as the means whereby the latter is held in place, substantially as specified.

6. The combination, with an air-compressor cylinder and a hollow head therefor, of a removable cover for said hollow head, a valve-casing secured in said hollow head and projecting through said cover, and a closed screw-threaded cap secured to said casing outside said cover and serving as the means whereby the latter is secured in place, substantially as specified.

7. The combination, with the hollow head of an air-compressor cylinder the outer wall of which is provided with a cylindrical hole, of a valve-casing comprising a cylindrical portion fitting said hole, a packing-ring placed upon the joint between the hole and the casing, and a cap for clamping said packing-ring upon said joint, the said packing forming a joint between said head and said casing, and also between said head and casing and said cap, substantially as specified.

8. The combination of the hollow head D, the removable cover D^2 therefor, the valve-casing composed of the detachable parts G′ G^2, comprising a bearing or bearings for the stem of the valve, and screwed together, and the detachable cap G^3, screwed upon the part G^2 and serving to secure the removable cover in place, substantially as specified.

9. The combination, with the head of an air-compressor cylinder constructed with the two chambers or chests D E and the hole or aperture *f*, leading from one to the other, of the valve casing composed of the parts G′ G^2, connected by a screw-thread, and the packing *f′*, interposed between them and serving to prevent leakage through the hole or aperture *f*, substantially as specified.

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