S. B., C. E. & W. R. HILL.

AIR COMPRESSOR.

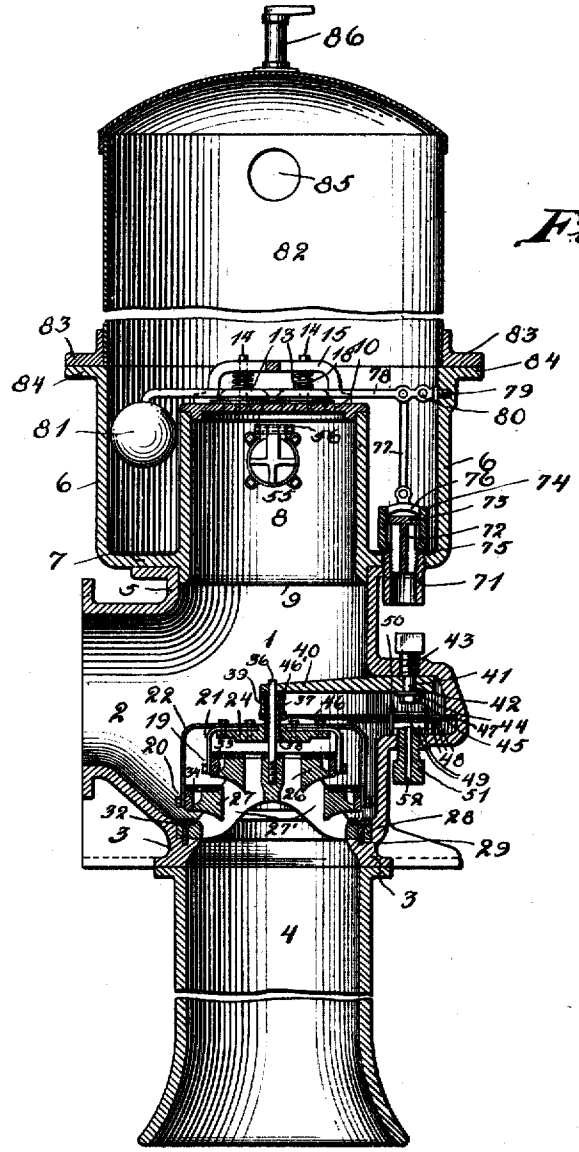
APPLICATION FILED FEB. 11, 1911.

1,005,212.

Patented Oct. 10, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 2.

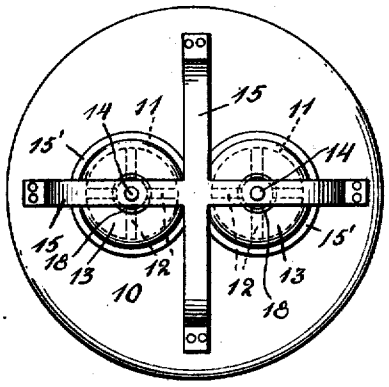


Fig. 4.

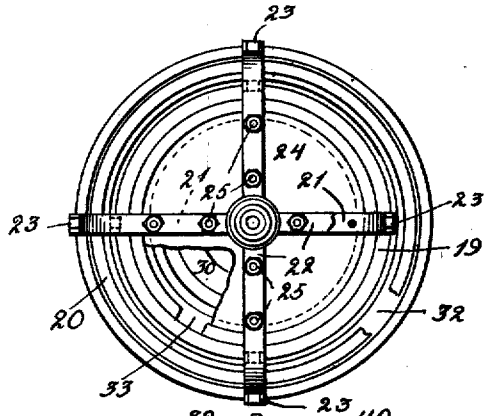


Fig. 3.

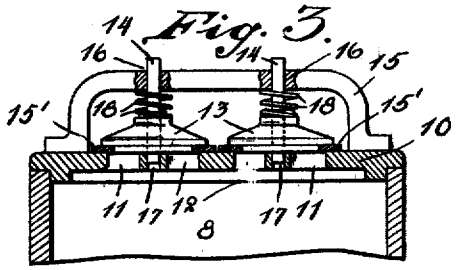
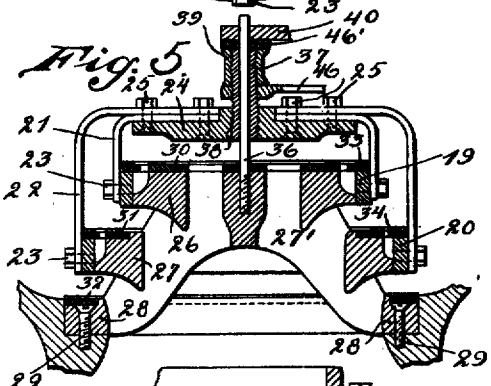


Fig. 5



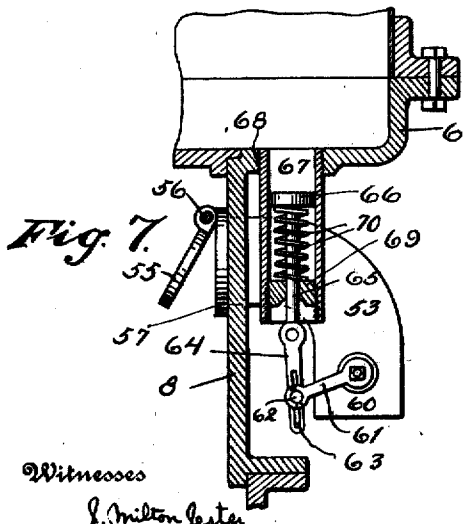


Fig. 7.

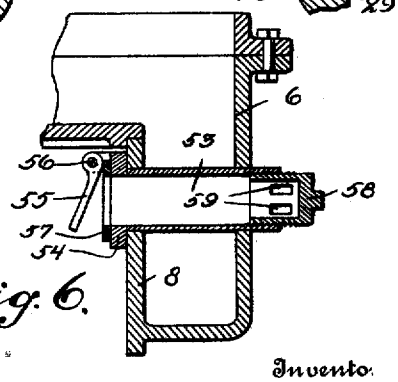


Fig. 6.

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UNITED STATES PATENT OFFICE.

STIRLING B. HILL, CLIMIE E. HILL, AND WILLIAM R. HILL, OF SEATTLE, WASHINGTON.

AIR-COMPRESSOR.

1,005,212. Specification of Letters Patent. **Patented Oct. 10, 1911.**

Application filed February 11, 1911. Serial No. 608,076.

To all whom it may concern:

Be it known that we, STIRLING B. HILL, CLIMIE E. HILL, and WILLIAM R. HILL, citizens of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Air-Compressors, of which the following is a specification.

Our invention relates to air compressors and particularly to such a device employing air compressing means in the embodiment of a hydraulic ram.

An important object of this invention is to provide means whereby the hydraulic ram principle may be employed to compress air.

A further object of this invention is to provide an air compressor of the above character, which is positive, continuous, and automatic in operation.

A further object of this invention is to provide an air compressor including a hydraulic ram, and means for automatically varying the amount of air conducted to the ram to be compressed, whereby as the pressure fails in the air storage tank said means is operated to admit a larger amount of air into the ram.

Other objects and advantages of this invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same, Figure 1 is a central vertical sectional view taken through a device illustrating our invention. Fig. 2 is an enlarged plan view of the air discharge valves, Fig. 3 is a side view of the same, and its associated members shown in section, Fig. 4 is a plan view of the waste valve structure, Fig. 5 is a central vertical sectional view taken through the same, Fig. 6 is a longitudinal sectional view taken through the air supply pipe, and Fig. 7 is a side view of a different form of air supply pipe, together with automatic means for controlling the outer valve, said means being shown partly in section and partly in elevation.

In the drawings wherein is illustrated a preferred embodiment of our invention, a hydraulic ram is shown, comprising a central body casing 1, having one side thereof provided with a flanged nipple 2, which is adapted for connection with a drive pipe, (not shown). The lower end of this body casing is provided with a flanged nipple 3, which is suitably connected with a waste pipe 4. The upper end of the body casing 1 is provided with a flanged nipple 5, upon which is mounted a preferably cylindrical water-collecting receptacle 6, which is secured thereto by any suitable means. The lower end of this water-collecting receptacle is partially closed by an annular bottom 7, centrally upon which is formed an upstanding preferably cylindrical casing 8. This casing 8 is concentrically arranged with relation to the casing 6, and extends downwardly below the annular bottom 7 to form an annular flange 9, which snugly fits within the nipple 5. The casing 8 forms in effect a continuation of the nipple 5. The casing 8 has its upper end closed by a head 10, secured thereto by any suitable means. This head is provided with a suitable number of openings 11 formed therethrough, within which openings are disposed spiders 12, having suitable connection with said head 10. The passage of material through the openings 11 is controlled by upwardly opening valves 13, which are rigidly mounted upon stems 14. Rigidly mounted upon the upper surface of the head 10, is a large spider 15, having openings 16 formed therethough to slidably receive the stems 14. The lower ends of these stems are movably mounted within openings 17, which are formed through the spiders 12, as clearly shown in Fig. 3. Disposed upon the upper surface of the head 10 are packing rings 15′, surrounding the openings 11 and engaged by the valves 13. The valves 13 are urged into engagement with the packing rings by compressible coil springs 18, as shown.

The discharge of water through the nipple 3 is controlled by a waste valve structure, comprising a plurality of annular valves 19 and 20, the valve 19 being disposed above the valve 20 and spaced therefrom in concentric relation. The annular valves 19 and 20 are rigidly connected with preferably diametrically disposed pairs of curved rods 21 and 22 respectively, as shown at 23. The pairs of curved rods 21 and 22 are bolted together and with a vertically movable disk-valve 24, as shown at 25. The valves 19 and 20 are disposed outwardly of and have slidable engagement with annular

superposed spaced valve-seats 26 and 27, respectively. The annular valve-seats are preferably cast integral with a spider 27', the lower ends of the diametrically arranged arms of which have connection with a ring 28, which ring is connected with the nipple 3 by means of screws 29, or the like. The ring 28 serves as a valve-seat for the valve 20. The valve-seats 26, 27 and 28 have respectively, packing rings 30, 31, and 32, suitably secured upon the upper faces thereof, as shown. The annular valves 19 and 20 have packing rings 33 and 34 respectively, suitably secured upon their upper faces, which packing rings extend inwardly beyond such valves for engagement with reduced outer portions of the valve-seats 26 and 27. The spider 27' has rigid connection at its upper central portion with a vertical rod 36, and a sleeve 37 is slidably mounted upon this rod, as shown. The sleeve 37 has screw threaded engagement with the disk-valve, as shown at 38. Disposed above the disk-valve 24 is a spool 39 which has screw threaded engagement with the sleeve 37, as shown. The upper end of the vertical rod 36 is slidably mounted within an opening formed through the inner end of a stop-arm 40, which has its outer end provided with an opening 41 formed therethrough, for rotatably receiving a cylindrical end portion 42 of a bolt 43. The lower end of the portion 42 is provided with a washer and nut 44 and 45, respectively. The bolt 43 is screw threaded through the body casing 1 and may be rotated to raise and lower the stop-arm 40. The spool 39 carries shock absorbing material 46' upon its upper end and such material is also secured upon the spider 27' adjacent the rod 36. The limit of upward movement of the disk-valve 24 is regulated by the relative position of the stop-arm 40. Disposed adjacent the lower end of the spool 39 is a leaf-spring 46, the inner end of which has slotted engagement with the sleeve 37. The leaf-spring is formed of a plurality of spring leaves. The outer end of the leaf-spring 46 is disposed under a shoulder 47 formed upon the casing 1. The leaf-spring 46 is formed of a plurality of spring leaves 48, as above stated, which carry plates 49, said plates being secured together by clamps 50. The lower plate 49 is provided with a curved recess to receive the upper curved end of a bolt 51, having screw-threaded engagement with the casing 1, and provided with an axial opening 52, formed therethrough. The leaf-spring is tensioned to hold the disk-valve 24 in its uppermost position. The tension of the leaf-spring may be changed by manipulating the bolt 51, or by raising said leaf-spring by inserting a tool through the opening 52.

As shown in Fig. 6, an air supply pipe 53 is provided, the same passing through the collecting receptacle 6 and the cylindrical casing 8. The inner end of the pipe 53 discharges through a ring 54, to which is pivotally connected an inwardly opening check valve 55, as shown at 56. This check valve engages a packing ring 57. The amount of air supplied through the pipe 53 is regulated by a rotatable valve 58, having screw-threaded engagement with the outer end of the pipe 53. This valve is provided with openings 59 formed therethrough. By rotating the valve 58 the openings 59 may be partially closed or opened to regulate the amount of air passing through the pipe 53.

In Fig. 7, we have shown automatic means for regulating the amount of air supplied through the pipe 53. In this form of the invention the pipe 53 may preferably be curved and has communication with the interior of the upper end of the cylindrical casing 8. The collecting receptacle 6 is slightly modified to afford a space for the pipe 53. The passage of air through the pipe 53 is controlled by a valve structure 60, which is operated by a crank 61. This crank carries a pin 62 operating in a slot 63, which is formed through a link 64. This link has its upper end pivotally connected with a rod 65, having connection with a piston 66, which is slidably mounted within a cylinder 67. The cylinder 67 has its upper open end screw-threaded into the collecting receptacle 6, as shown at 68. The rod 65 operates through a nut 69, which is externally screw-threaded for engagement with the internally screw-threaded lower portion of the cylinder 67. The downward movement of the piston 66 is opposed by a compressible coil spring 70, having engagement with the nut 69. It will thus be seen that the tension of this coil spring may be varied by rotating the nut 69. From the construction of the above referred to parts, it is obvious that when the air pressure in the collecting receptacle 6 reaches a certain degree, the piston 66 will be forced downwardly to oscillate the valve structure 60, whereby the air supply through the pipe 53 is reduced proportionally. As the pressure falls in the collecting receptacle 6, the piston 66 is raised by the spring 68 and a larger amount of air is supplied through the pipe 53.

The lower closed end of the collecting receptacle 6 (see Fig. 1) is provided with a screw-threaded opening for receiving a section of pipe 71, which has its upper end internally screw-threaded for engagement with a stationary guide 72, which is approximately X-shaped in cross-section. This guide carries a circular head 73 about which is slidably mounted an annular valve 74. The valve 74 engages a packing ring 75. The valve 74 is pressure balanced. The upper end of the annular valve 74 is connected with an arch 76, having pivotal con-

nection with a link 77. This link has its upper end pivotally connected with a horizontal swinging rod 78, which in turn is pivotally connected with a stationary bolt 79, as shown at 80. The swinging rod 78 extends across the head 10 and the free end thereof is connected with a float 81, which is disposed within the annular space of the collecting receptacle 6. An air pressure storage tank 82 is disposed above the collecting receptacle 6 and has free communication therewith. The lowor end of the receptacle 82 carries an annular flange 83, which is suitably secured to a corresponding flange 84 carried by the upper end of the collecting receptacle 6. The compressed air is discharged through an opening 85 into a suitable pipe (not shown). The opening 85 is disposed near the upper end of the receptacle 82. The upper closed end of the receptacle 82 is provided with a pressure equalizer or safety valve 86 of any well known or preferred type.

In the operation of the device, assuming that the waste valve is open, as shown in Fig. 1, the water in the drive pipe will begin to travel and flow through said waste valve to discharge into the pipe 4. As the water increases in velocity, the same by impinging against the disk-valve 24, will close the waste valve. The pressure then rises in the casing 1 and said waste valve is retained in its closed position. As the water is discharging through the waste valve, as above described, the same creates a partial vacuum in the casing 8, whereby the check valve 55 is unseated and said casing 8 filled with air. As soon as the pressure begins to increase in the casing 8, caused by the waste valve being closed, as above described, the check valve 55 will be closed. As the water rises in the casing 8 the air contained therein is compressed and forced past the normally closed upwardly opening valves 13. This compressed air is collected within the receptacles 8 and 82. Should the water also pass the valves 13, the same will be collected in the lower portion of the receptacle 8. When a certain amount of water is collected within the receptacle 8, the float 81 is raised and the valve 74 raised, to discharge the water from the receptacle 6. It will thus be seen that automatic means are provided to prevent the amount of water held by the receptacle 8 from exceeding a certain amount. As soon as the velocity of the water in the drive pipe falls off, the pressure in the casing 1 is accordingly reduced so that the leaf-spring may return the waste valve to its open position. The operation is then repeated, as above described. The amount of air supplied into the upper end of the casing 8, may be regulated by the operation of the valve 58 (see Fig. 6). This supply of air may be automatically controlled according to the increase or decrease of pressure in the tank 82, by the device shown in Fig. 7, and hereinabove described.

We wish it understood that the form of our invention herewith shown and described is to be taken as a preferred example of the same and that certain changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of our invention or the scope of the subjoined claims.

Having thus described our invention, we claim:—

1. In an air compressor, the combination with a hydraulic ram structure including a casing and a waste valve for controlling the passage of water from one end of the casing, of a shell connected with the casing and comprising a smaller inner shell whereby an approximately annular space is provided between the inner and outer shells, the inner shell forming in effect a continuation of said casing, means for supplying air within the inner shell, means for controlling the passage of material from the inner shell to the outer shell, means for discharging water from the lower end of the outer shell, a valve for controlling the passage of the water through the last named means, and means to move the last named valve, including a lever having one end thereof pivotally connected with one side of the outer shell and extending across the inner shell and provided at its free end with a float.

2. In an air compressor, the combination with a hydraulic ram structure, of an air pressure storage tank having communication therewith, a pipe to supply air to the upper portion of said hydraulic ram structure, a check valve to control one end of said pipe, and a valve to regulate the amount of air passing through said pipe when the check valve is open.

3. In an air compressor, the combination with a hydraulic ram structure, of a receptacle having communication therewith, means for supplying air within said hydraulic ram structure, and means actuated by the pressure within said receptacle to regulate the amount of air passing through the first named means.

4. In an air compressor, the combination with a hydraulic ram structure, of a receptacle having communication therewith, means for supplying air within said hydraulic ram structure, a valve to regulate the amount of air passing through said means, a cylinder connected to and having communication with said receptacle, a piston to operate within said cylinder, and means connecting said piston and valve.

5. In an air compressor, the combination with a hydraulic ram structure, of a receptacle having communication therewith,

a pipe for supplying air to the hydraulic ram structure, a valve to regulate the amount of air passing through said pipe, a cylinder connected to and having communication with said receptacle, a piston to operate within said cylinder, means connecting said piston and valve, and a spring to oppose the movement of said piston caused by pressure in said receptacle.

6. In an air compressor, the combination with a hydraulic ram structure, of a receptacle having communication therewith, a pipe for supplying air within said hydraulic ram structure, a valve to regulate the amount of air passing through said pipe, a cylinder connected to and having communication with said receptacle, a piston to operate within said cylinder, means connecting said piston and valve, a spring to oppose the movement of said piston, and means to change the tension of said spring.

7. In an air compressor, the combination with a hydraulic ram structure, of a receptacle having communication therewith, a pipe for supplying air to said hydraulic ram structure, means for regulating the amount of air passing through said pipe, a valve for controlling the discharge of water from said receptacle, and means to move said valve.

8. In an air compressor, the combination with a hydraulic ram structure, of a receptacle having communication therewith, a pipe for supplying air to said hydraulic ram structure, means actuated by the pressure within said receptacle to vary the amount of air passing through said pipe, a valve to control the discharge of water from said receptacle, and a float to move said valve.

9. In an air compressor, the combination with a hydraulic ram structure, of a receptacle connected therewith, comprising inner and outer walls, the inner wall forming in effect a continuation of said hydraulic ram structure, a head for closing the opening of the inner wall, valves for controlling the passage of air through said head, means to supply air to the interior of said inner wall, a valve to control the discharge of water from the space formed between the inner and outer walls of said receptacle, and a float disposed within said space to move said valve.

10. In an air compressor, the combination with a tank, of a second tank disposed therein, means for controlling the communication between the first and second named tanks, a pipe for supplying air within the second named tank, a valve to control the amount of air passing through said pipe, means actuated by the pressure within the first named tank to move said valve, and means to compress air within the second named tank.

In testimony whereof we affix our signatures in presence of two witnesses.

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WILLIAM R. HILL.

Witnesses:
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