No. 682,811. Patented Sept. 17, 1901.

J. PATERSON.

HYDRAULIC AIR COMPRESSOR.

(Application filed Nov. 3, 1900.)

(No Model.)

Fig. 1

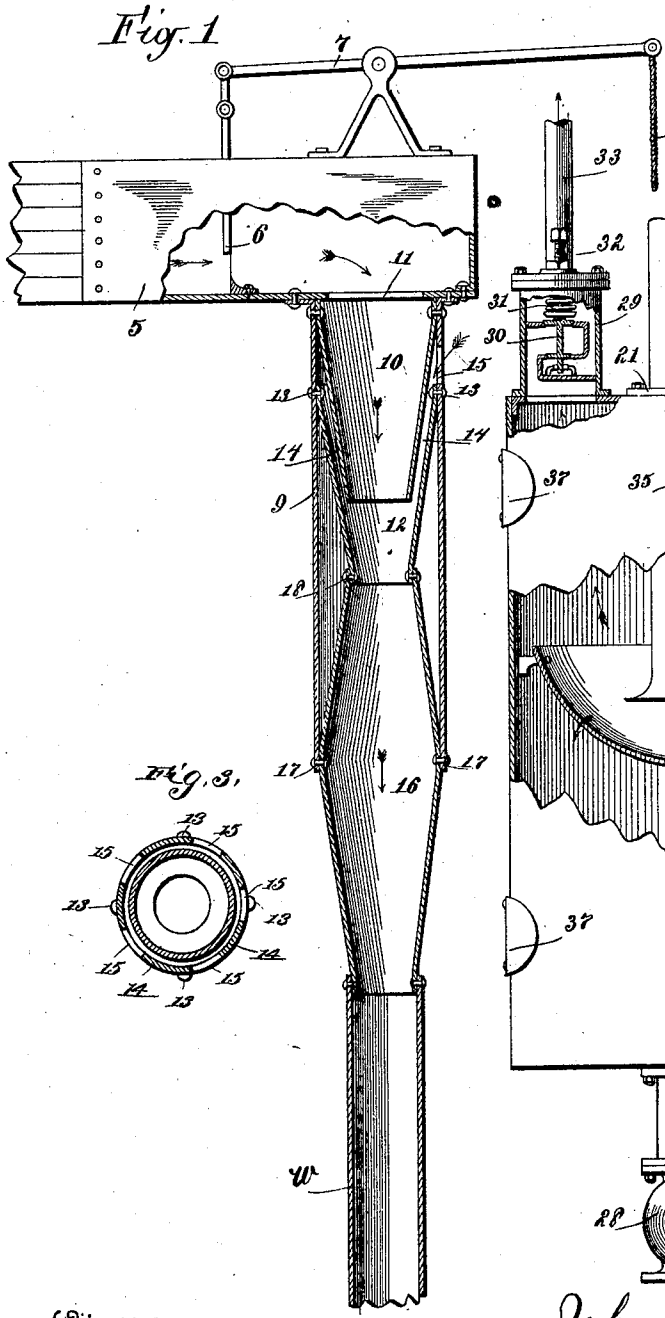

Fig. 2.

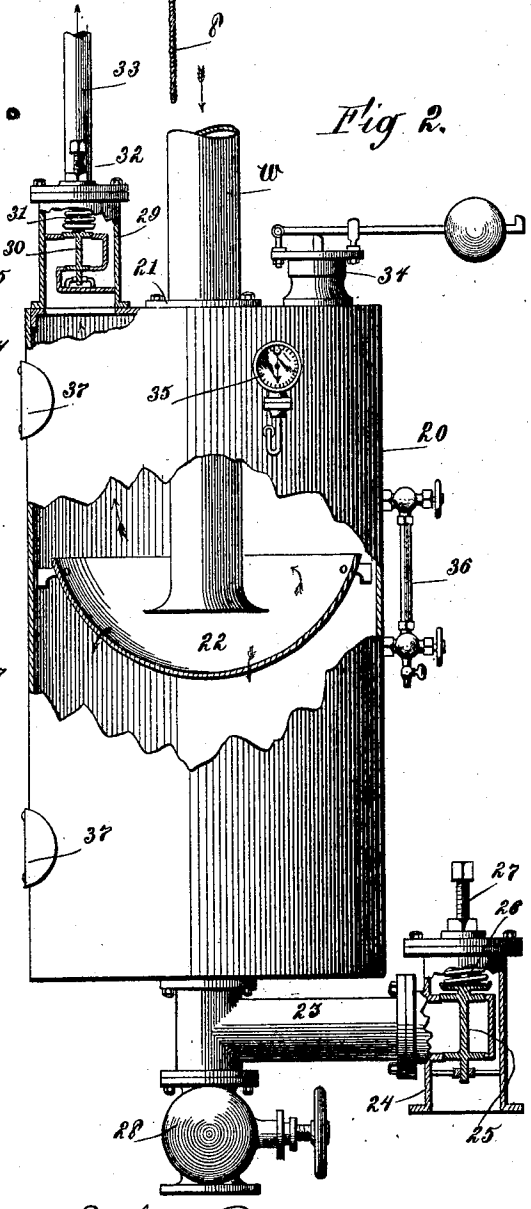

Fig. 3.

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HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 682,811, dated September 17, 1901.

Application filed November 3, 1900. Serial No. 35,385. (No model.)

To all whom it may concern:

Be it known that I, JOHN PATERSON, a subject of Her Majesty the Queen of Great Britain, residing at Nelson, in the county of Kootenai, Province of British Columbia, Canada, have invented certain new and useful Improvements in Hydraulic Air-Compressors; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in hydraulic air-compressors; and the important object of the invention is to provide a simple and efficient apparatus for compressing air at mines and at other places in districts where there are streams of water having a high head and whose energy is available for the purpose of compressing air, the latter adapted to be utilized for operating drills, hoists, and other mechanical appliances.

A further object of the invention is to provide an apparatus of a portable nature which necessitates the construction of certain of the parts of comparatively light material, which is a feature of considerable importance in a mountainous country, because of the fact that the apparatus must ofttimes be transported by pack-animals, and, furthermore, to provide means for reinforcing these comparatively light parts of the apparatus in order to secure the requisite strength and stiffness to withstand the service.

Further objects and advantages of the invention will appear in the course of the subjoined description, and the novelty in the combination, construction, and arrangement of parts will be defined by the claims.

In the drawings hereto annexed, forming a part of this specification, Figure 1 is an elevation, partly broken away and with certain parts in section, of the upper part of my apparatus adapted to be installed at the head of the water-supply and intended to primarily receive the water-current the energy of which is to be utilized for compressing air. Fig. 2 is an elevation, partly broken away and in section, of the lower part of the machine or the apparatus and other appliances associated therewith. Fig. 3 is a transverse section taken in the plane of the annular series of openings in the external tube or pipe 9.

The same characters of reference denote like parts in all the figures of the drawings.

The water received at the upper part of the machine (shown by Fig. 1) is allowed to come in contact with the free air as it traverses a long pipe or conduit, (indicated by the reference character W,) and during its progress through the upper section of the machine the water becomes impregnated or commingled with the air which passes through the conduit with it, said conduit being provided to convey the air and water from the upper part of the machine to the lower part thereof. This water and air conduit may be laid down in the most convenient manner to suit the inclination of a mountain or other elevation. The commingled water and air on arriving at the lower part of the machine is there separated, the water being allowed to escape, while the air, being under compression, is conveyed away from the apparatus to the machine which is to be operated by its energy.

I will now proceed to describe in detail the preferred construction shown by the figures of the drawings, reference being first had more particularly to Fig. 1.

5 designates a flume, preferably of metallic construction and rectangular form both in side elevation and in cross-section. A sluice-gate 6 is provided in the flume for regulating the flow of water therethrough, said gate being connected with an operating-lever 7, to which is attached a cable 8, the latter leading from the lever to a point near the lower part of the machine, where the end of the rope may be connected to a suitable device (not shown) for operating the sluice-gate as desired.

A cylindrical pipe 9 is attached in a suitable way to the under side of the flume 5, and within the upper part of this pipe is arranged a funnel-shaped or conical tube 10, the latter having its upper larger end in communication with the chamber of the flume by the provision of a suitable opening 11 in the bottom of the latter, whereby the water from the flume is adapted to pass directly into the inverted conical tube 10. Another funnel-shaped tube 12 is inserted or arranged within the cylindrical reinforcement-pipe 9, said

tube 12 being connected or united, as at 13, to the reinforcement-pipe in any approved way. Furthermore, the funnel-shaped tube 12 encircles or surrounds the similar tube 10 for a part of the length of the latter, thereby forming between the concentric conical tubes 10 12 a narrow annular passage 14. The reinforcement-pipe 9, which is external to the conical tubes, has a series of air-ports 15, of any suitable number, produced therein on a line above the upper extremity of the lower conical tube 12, which air-ports open into or communicate directly with the annular air-passage 14, so as to provide for the inflow of a current of air through the ports and the passage by the energy developed by the downwardly-moving column of liquid flowing through the tubes 10 12. The air-ports 15 have a collective area about equal to one-half of the area of the lower end of the upper conical tube 10.

A double funnel-shaped tube 16 is arranged for its portion of greatest diameter to fit snugly within the lower open extremity of the external cylindrical pipe 9. The bellied portion of the double funnel-shaped tube is united at 17 to the foot of said pipe 9, while its upper extremity is united at 18 to the lower portion of the conical tube 12, whereby the tube 16 is disposed in axial alinement with the conical tubes 10 12 for the current of mingled air and water to flow directly into said tube 16. It is to be understood that the tube 16 has a tight connection with the tube 12 and that each of the tubes 10, 12, and 16 is attached to the cylindrical pipe 9. This construction enables each of the tubes to be made of comparatively light material, a feature of considerable importance when it is necessary to transport the apparatus in a mountainous country; but the requisite strength and stiffness of the parts when they are assembled for use are secured by the provision of the pipe 9, the latter having individual union with each of the series of funnel-shaped tubes.

The water entering the flume passes through the opening 11 down the tube 10. As it emerges from the base of this tube it comes in contact with the free air, which is admitted through the ports 15, and the downward motion of the column of water induces or draws the air along with it, the commingled current of air and water forcing its way through the double funnel-shaped tube 16 and through the pipe or conduit W to the separating-chamber below.

I will now proceed to describe that part of the apparatus shown by Fig. 2, in which the letter W indicates a continuation of the water-conduit, the latter adapted to enter the separating-chamber 20, to which it is united by a tight joint 21, that prevents the escape of any air from the vessel. This chamber is preferably a large cylindrical metallic vessel standing with its axis vertical, into which chamber the column of commingled air and water is conducted to a point a short distance above the center of the vessel by the conduit W. The water is deposited into a large basin 22, which is secured in the chamber by any approved means and is arranged just below the foot of the water-conduit. The water overflows this basin, so as to be deposited in the lower portion of the separating-chamber, from whence it flows through a short length of pipe 23 into the chamber of the valve-shell 24, said valve-chamber containing a double balanced valve 25, the latter being loaded by a spring 26, which is placed inside the chamber, the pressure of the spring on the valve being regulated by an adjustable screw 27. A drain-cock 28 is connected to the pipe 23 below the separating-chamber, said cock adapted to be opened whenever it is desired to draw off the water for any particular purpose. The air is separated from the water by the basin 22, thus freeing the air and allowing it to rise into the upper portion of the separating-chamber, from whence it passes into the chamber of the valve-casing 29, the latter containing a double valve 30, which is loaded by a spring 31, the latter being controlled by a screw 32, from which description it will be seen that the air-valve is similar in principle to the water-valve. The air is conducted from the separating-chamber and the air-valve chamber, when it attains a pressure sufficient to overcome the resistance of the spring 31, by an offbearing pipe 33. A blow-off valve 34 is connected to the separating-chamber, at the top portion thereof, to permit the machine to continue in operation in case the connections above the air-valve are shut off. A pressure-gage 35 and a water-gage 36 are connected to the shell of the separating-chamber in order that the machine may be regulated. Two manholes 37 are provided in the separator-chamber, near the upper and lower portions thereof.

Changes within the scope of the appended claims may be made in the form and proportion of some of the parts, while their essential features are retained and the spirit of the invention is embodied. Hence I do not desire to be limited to the precise form of all the parts as shown, reserving the right to vary therefrom.

The double funnel-shaped tube 16 is advantageous in my apparatus, because it tends to check or retard the downward flow of the commingled column of air and water and permits the desired separation of the air from the water to take place at the basin, whereby the necessary rapidity of movement of the water column in the upper part of the apparatus to induce the inward flow of air is attained. It is therefore to be understood that the upper and lower parts of the apparatus are combined together to secure a unitary result in the operation of the hydraulic air-compressor.

Having thus described my invention, what I claim as new is—

1. A hydraulic air-compressor comprising

a cylindrical tube having an annular series of air-inlet openings, a tapered tube 10 extending into the cylindrical tube, another tapered tube 12 secured at its upper end to the cylindrical tube below the openings therein and arranged in parallel relation to the tube 10 and partially surrounding the latter to form therewith an annular air-space which is in communication with said openings, and a double-tapered tube disposed in axial alinement with the aforesaid tube and arranged to receive the contents of the tube 12, substantially as described.

2. A hydraulic air-compressor comprising an external tube 9 provided with an annular series of air-inlet openings, a tapered water-feed tube 10 secured in said tube 9, another tapered tube 12 secured at its upper end to the tube 9 below the openings therein and arranged to extend below said tube 10, the said tube 12 surrounding the tube 10 and forming therewith an annular air-space which is in communication with the openings, and a double-tapered tube 16 secured at its bellied portion to the tube 9 and at its upper end to the tube 12, said tube 16 arranged in axial alinement with the tubes 9, 10, 12 and adapted to receive, above the line of its greatest diameter, the contents of the tube 12, substantially as described.

3. A hydraulic air-compressor comprising a closed tank forming a separating-chamber, a cross-sectionally-curved basin having an open top and secured in said tank, a water and air combining pipe leading through the tank and terminating centrally within the basin at a point below the open top thereof and leaving ample space for the water to flow freely into the basin, a water-drain pipe connected to the bottom of the tank and having a double valve, and an air-outlet pipe connected to the upper portion of the tank and also having a balanced double valve, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

JOHN PATERSON.

Witnesses:
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W. H. LEE.