C. MOORE.

HYDRAULIC ENGINE FOR COMPRESSING AIR.

No. 180,363. Patented July 25, 1876.

Fig. 1.

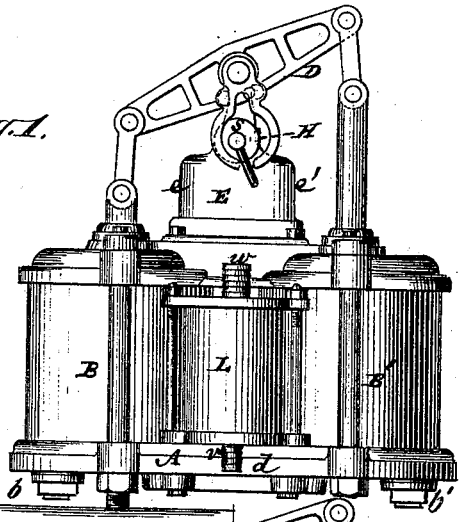


Fig. 4

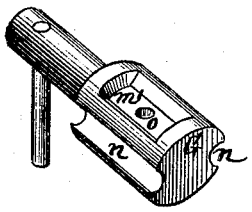


Fig. 2.

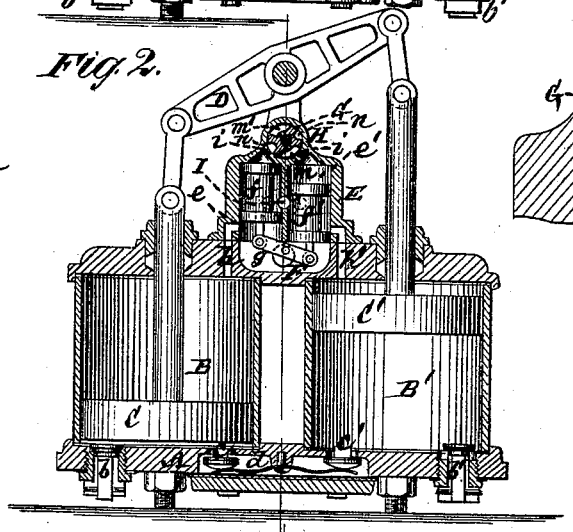


Fig. 5.

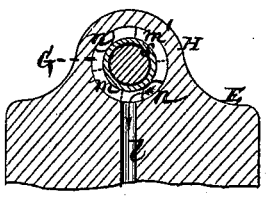
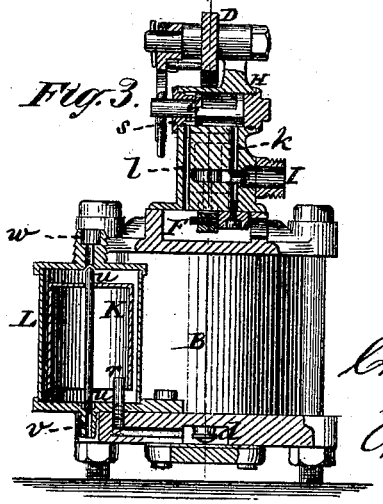


Fig. 3.



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IMPROVEMENT IN HYDRAULIC ENGINES FOR COMPRESSING AIR.

Specification forming part of Letters Patent No. **180,363**, dated July 25, 1876; application filed December 18, 1875.

To all whom it may concern:

Be it known that I, CHARLES MOORE, of the city, county, and State of New York, have invented certain new and useful Improvements in Hydraulic Engines for Compressing Air and other purposes; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, which forms part of this specification.

This invention is mainly designed as a hydraulic air-compressor, and will here be described exclusively with reference to such use.

The invention consists in a combination, with one or more air-compressing cylinders and their pistons, of a hollow relief-float, constructed to control an upper air-vent and lower water-escape, for the purpose of automatically relieving the engine of any excessive accumulation of water leaking past the pistons, and whereby the pistons may be fitted to work perfectly free or loose, and all packing of them may be dispensed with.

The invention also consists in a peculiarly-constructed primary valve, having a constant exposure to the exhaust, whereby outside leakage is prevented and the valve is balanced.

Furthermore, the invention consists in a novel and advantageous combination of primary and secondary valves, for controlling the motion of the pistons of the engine or hydraulic air-compressor.

Figure 1 is a front or side elevation of a hydraulic air-compressor constructed in accordance with my invention; and Figs. 2 and 3, central vertical sections of the same in planes at right angles to each other. Fig. 4 is a view, in perspective, of a peculiarly-constructed primary valve used in the compressor; and Fig. 5, an end view of said valve, and transverse section of its cylinder and stuffing-box from the exhaust end of the valve.

A is the bed-plate, on which are mounted, in suitable proximity with each other, two upright air-compressing cylinders, B B′. These cylinders are fitted with reciprocating pistons C C′, the rods of which project through the upper covers of the cylinders, and are connected by a walking-beam, D, whereby they are made to move simultaneously in reverse directions. Said pistons are only single-acting—that is to say, each piston alternately only operates to compress the air in its downstroke, and is only exposed on its upper surface to the action of the propelling fluid.

The air is admitted alternately to the cylinder, B B′ through inlet-valves *b b′* during the upstroke of the pistons, and is expelled during the downstroke of the pistons through outlet-valves *c c′* into a passage, *d*, which connects with any suitable compressed-air receiver, said valves *b b′* and *c c′* being arranged in the lower ends of the cylinders.

The propelling fluid, or water under pressure, is admitted to and exhausted from the upper ends of the cylinders B B′ alternately, as follows: E is a valve chest or box, arranged above the cylinders B B′ and intermediately of them. The water under pressure is freely admitted to this valve-chest by an inlet, I, which is in constant communication with two small upright valve-cylinders, *e e′*, between the heads of two double-headed pistons, *f f′*, or piston-valves arranged to work up and down simultaneously in reverse directions within the cylinders *e e′*, said piston-valves being connected by a rocking beam, *g*. These piston-valves *f f′* are automatic in their action, and their lower heads serve to control passages *h h′*, which communicate with the upper ends of the cylinders B B′, and so that, accordingly as either piston-valve *f* or *f′* is depressed, it admits water by the passage *h* or *h′*, to force down its respective main or engine piston C or C′, and accordingly as either piston-valve *f* or *f′* is raised, it opens its passage *h* or *h′* from the top of the cylinder B or B′, the piston of which is at the bottom of its stroke, to pass the spent water from such main cylinder to a general exhaust, F.

The double-headed piston-valves *f f′* are alternately raised and lowered by admitting and exhausting the supply water or fluid under pressure to and from the upper ends or heads of said piston-valves through the intervention of a primary valve, G, operated by the walking-beam D of the engine, or by other mechanical means connected with the engine.

Previously to describing the valve G, it may here be observed that the piston-valves *f f′* are virtually balanced, and the cylinders *e e′*, in which they work, are not only open above, but also below, so that any water leaking past

the piston-valves will escape by the exhaust F beneath. Consequently, where a little waste of water is of no consequence, said piston-valves do not require to be packed, but may work perfectly free or loose.

The valve G is an oscillating one, of circular construction, and is arranged to work within an upper cylinder or chamber, H, which has ports *i i*, communicating with the upper ends of the cylinders *e e'*, also which chamber communicates near its one end, by a passage, *k*, with the main inlet I, and at its other end, by a passage, *l*, with the exhaust-duct F. These passages *k l* are inside the end covers of the valve-chamber H, the one of which covers, *s*, may be a stuffing-box for the spindle of the valve to pass through, and, as the passage *l* is always open to the lower exhaust-outlet F, objectionable leakage of the water under pressure through the end covers of the valve-chamber H is prevented, and the valve G may be fitted to work perfectly free or loose. Furthermore, said valve is of peculiar construction, whereby it is perfectly balanced. Thus it is formed with a lower water-receiving cavity, *m*, and opposite side exhaust-grooves *n n*. It has also a cavity, *m'*, arranged opposite the cavity *m*, and in free communication with the latter by a through-aperture, *o*. This insures the balancing of the valve; and the exhaust-grooves *n n* extend throughout the whole length of the valve, and are radially outside of the inner projecting end of the stuffing-box *s*, whereby a free escape for the exhaust water from the cylinders *e e'* is provided, and leakage through either end cover of the valve-chamber is effectually prevented.

The valve G is oscillated to bring the inlet-cavity *m*, which is in communication with the inlet-passage *k*, and either exhaust cavity or groove *n*, which communicate with the exhaust-passage *l*, alternately over the ports *i i*, to pass and exhaust water from the upper ends of the cylinders *e e'*, for the purpose of working the secondary valves *f f'*.

A fork connected with the walking-beam D, and receiving within it a toe or arm on the spindle of the valve G, as shown in Fig. 1, constitutes a very convenient means for operating said valve.

K is what I term an inverted cup-shaped or hollow "relief-float." It is arranged within a cylinder or chamber, L, which may be placed at any desired distance from the cylinders B B', but not above them, or at least materially so, and which has a compressed-air inlet, *r*, in its bottom, projecting up within the lower end of the float. This inlet *r* is in free or constant communication with the general compressed-air duct *d*, so that the hollow float K is constantly supplied with compressed air each downstroke of the main pistons C C'. Said float has a central valvular stem, *u*, passing up through it, or is otherwise constructed to form upper and lower valves, which, in the operation of the float, serve to alternately open and close a water-escape, *v*, at the bottom of the chamber L, and an air-escape, *w*, in the top of the latter.

By means of this hollow relief-float K, I am enabled to fit the main pistons C C' so that they work perfectly free or loose within their cylinders B B', and thus reduce friction or economize power, leakage of water past said pistons being prevented by the relief-float from accumulating below, to permanently interfere with the working of the engine. Thus water leaking past the pistons C C' will be forced by the compressed air up through the compressed-air inlet or branch *r* into the chamber L for a certain distance or height, so as to seal the open bottom end of the float, and, aided by compressed air entering within the float, to buoy or support the latter. The water at first is thus allowed to accumulate in the chamber E; but when the engine is working it is not designed that the float should be lifted so as to close the air-vent *w*, or to open the water-escape *v*, excepting when there is an excessive leakage of water into the chamber L, the duct *r* ordinarily serving to supply the hollow float constantly with fresh charges of compressed air, which will keep the float lively or active. Should there be an excessive accumulation of water, however, by leakage past the main pistons, in the bottom of the cylinders B B', and from thence into the chamber L, the relief-float K will be raised, so as to close the air-vent *w*, and to open the water-escape *v*, and the engine will be automatically stopped, or at least temporarily so—that is, until sufficient water has escaped by the outlet *v* to allow of the float to adjust itself to its normal position.

The air, in passing through such water as settles in the bottoms of the cylinders B B' and passage *d*, will be purified or cleansed, which will be an advantage in certain cases.

I claim—

1. The combination, with one or more air-compressing cylinders and their pistons, of the hollow relief-valve L and its chamber K, the pipe or inlet *r*, and the upper air-vent *w* and lower water-escape *v*, substantially as and for the purposes herein set forth.

2. The oscillating valve G, constructed with a receiving-cavity, *m*, and opposite connected balancing-cavity *m'*, also with exhaust-grooves *n n*, extending throughout the length of the valve, in combination with the ports *i i*, the inlet-passage *k*, the exhaust-passage *l*, in communication with the exhaust-outlet F from the valve-chamber, and the valve cylinder or chamber H, essentially as described.

3. The combination, with the primary valve of the engine, its upright cylinders B B', pistons C C', and the passages *h h'*, of the double-headed piston-valves *f f'* and the inlet I, by which the valves *f f'* are supplied with the propelling fluid, substantially as specified.

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Witnesses:

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