(No Model.)

G. H. WALKER.

HYDRAULIC AIR COMPRESSOR.

No. 491,232. Patented Feb. 7, 1893.

FIG. 1.

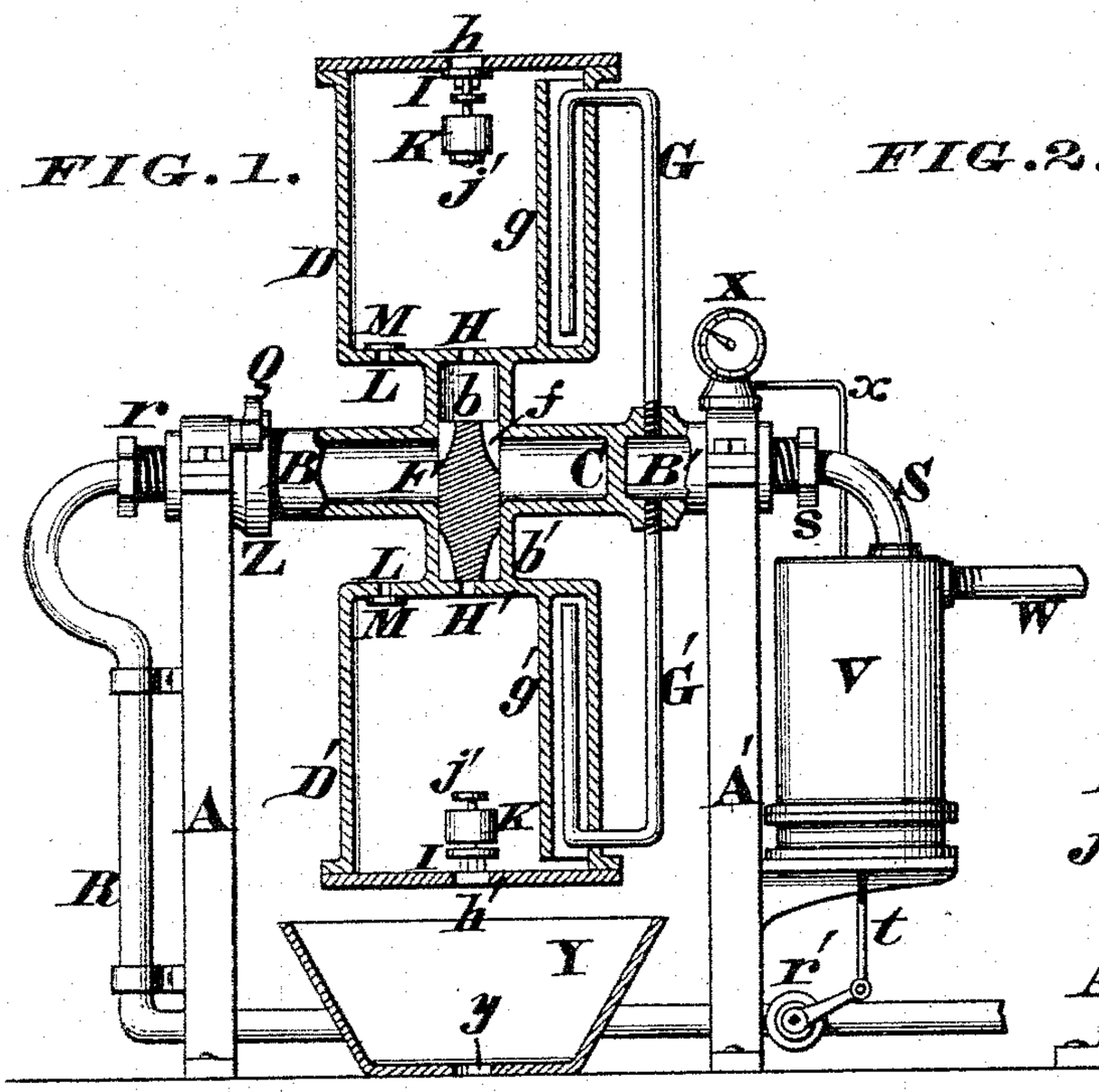


FIG. 2.

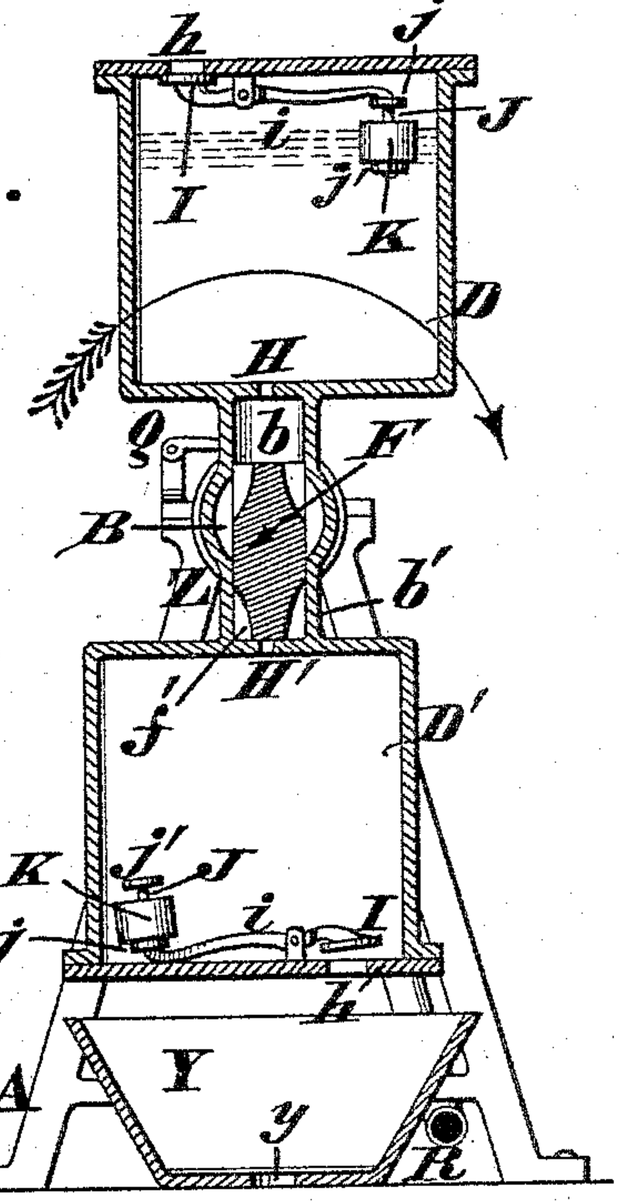


FIG. 3.

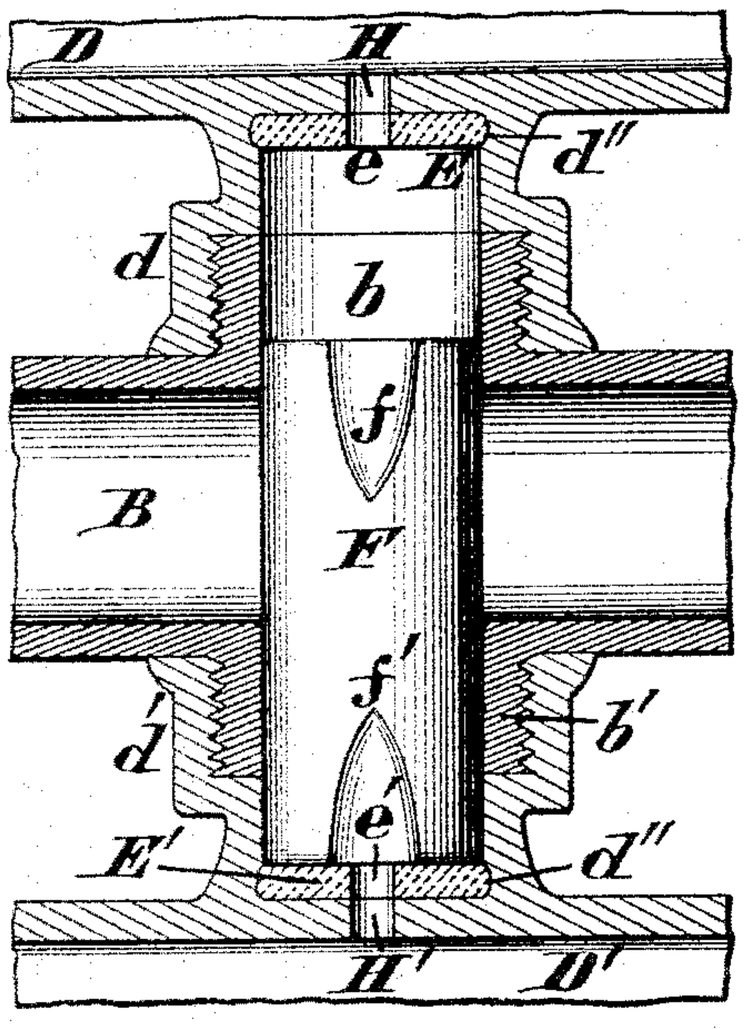


FIG. 4.

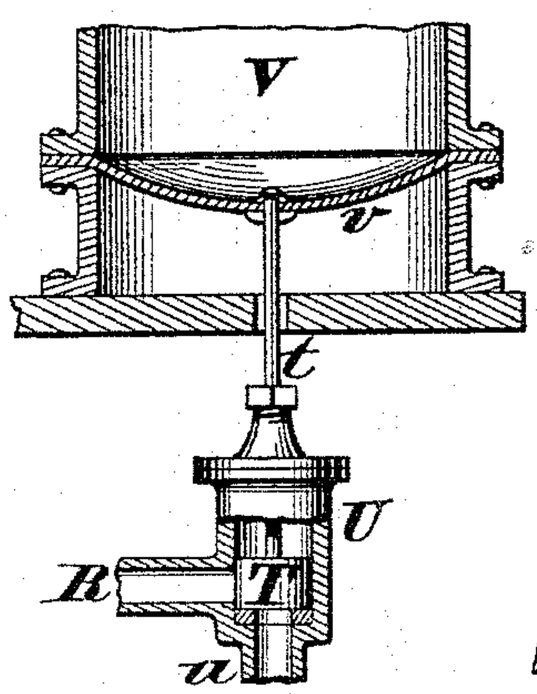


FIG. 5.

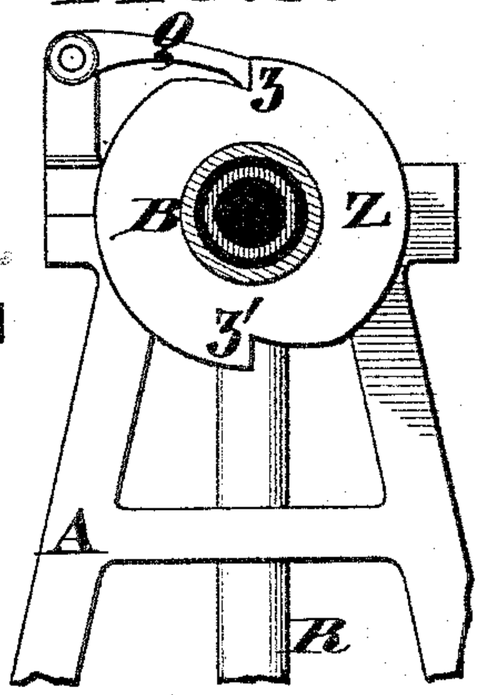
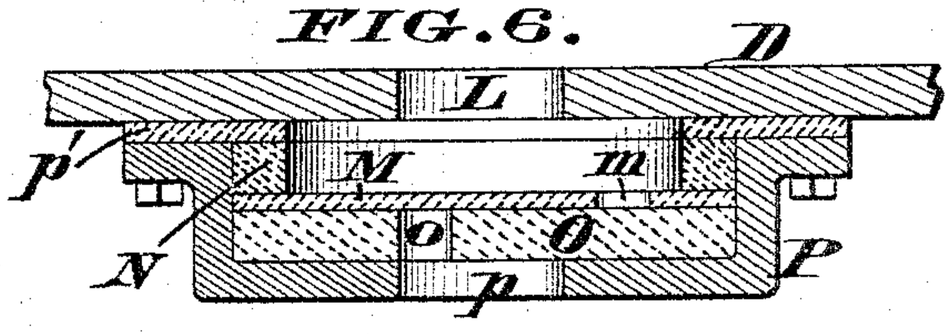


FIG. 6.



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UNITED STATES PATENT OFFICE.

GEORGE H. WALKER, OF CINCINNATI, OHIO.

HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 491,232, dated February 7, 1893.

Application filed April 5, 1892. Serial No. 427,850. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. WALKER, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Hydraulic Air-Compressors; and I do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the annexed drawings, which form part of this specification.

My invention comprises a hydraulic air-compressor which consists, essentially, of a pair of tanks applied to a shaft and having devices that automatically control the admission and discharge of air and water, the apparatus being arranged in such a manner as to revolve intermittently in one direction, as hereinafter more fully described.

In the annexed drawings,—Figure 1 is a vertical section of my air-compressing apparatus, said section being taken longitudinally of the revolving tubular-shaft. Fig. 2 is a similar section, but taken transversely of said shaft. Fig. 3 is an enlarged axial section of the double-acting valve and its accessories. Fig. 4 is an enlarged axial-section of the automatic cut-off appliances. Fig. 5 is an elevation of the ratchet-stop of the apparatus, the tubular shaft thereof being sectioned. Fig. 6 is an enlarged section of one of the air-inlet valves of a water tank.

The main frame of the apparatus consists of a pair of end plates or standards A, A′, that afford journal bearings for a revolving-tubular shaft composed of two parts B, B′, of which, the portion B is the longest and is separated from the other portion B′, by a solid partition C, as represented in Fig. 1. Furthermore, it is preferred to furnish the portion B, with a pair of diametrically-opposite necks *b*, *b′*, screw threaded externally, as seen in Fig. 3, to engage with internally-threaded couplings *d d′*, projecting from the ends of water tanks D D′, said couplings being provided with annular grooves *d″*, to admit india-rubber or other yielding seats E, E′, which latter are pierced at *e*, *e′*. These necks *b b′*, in conjunction with the couplings *d*, *d′*, serve as a guide for a freely-reciprocating piston-valve F, which is cylindrical, but is grooved or fluted longitudinally at *f*, *f′*, to permit a ready passage of water.

The tanks D, D′, are preferably of the same size, shape and capacity, and have near their sides vertical partitions *g*, *g′*, within which are inserted the receiving ends of pipes G, G′, bent in the manner shown, the discharging ends of said pipes being in communication with the portion B′, of the tubular shaft. Again, these tanks have water-inlets H H′, and water outlets *h*, *h′*, the latter being closed, at the proper time, by valves I, applied to the shorter end of levers *i*, suitably pivoted to the heads of said tanks. The longer end of each lever terminates with a rigid stem J, having a pair of fixed collars *j*, *j′*, that limit the stroke of a weight K, adapted to play freely along said stem. In addition to the above-described openings, each tank has an air-inlet L, normally closed by an inwardly-opening valve M, applied to the inner end of said inlet, as seen in Fig. 1. In some cases, however, it is preferred to locate a more complex form of valve on the outside of said inlet, as represented in Fig. 6. Here, this valve M, is composed of a flexible disk, having near one side an opening or slot *m*, and being cemented around its margin to a rubber ring N, and disk O, of similar material, said disk having a perforation *o*, which is not in the same plane as said slot *m*, but communicates with a port *p*, in a cap or box P. This cap is screwed to the exterior of the tank, so as to hold the valve in place, and has a packing ring *p′*, inserted between it and said tank, for the purpose of affording an air-tight joint.

One end of shaft B, has a stuffing-box *r*, within which is fitted a water-supply pipe R, while the end of shaft B′, has a similar box *s*, to admit an air-discharge pipe S. Pipe R, usually communicates with a street-main, although it may be connected to any other source of supply that will afford the desired water pressure, say from five to forty pounds to the square inch, the flow through said pipe being controlled by a suitable device, a cock *r′*, being shown in Fig. 1, and a piston-valve T, being seen in Fig. 4. The latter, however, is preferred, and is adapted to play up and down within a chamber U, having an inlet *u*, at bottom, the pipe R being connected to the side of said chamber. Valve T, has a stem *t*, which after being carried up through a cap on said chamber, is attached to a flexible dia-

phragm *v*, constituting the lower head of an air-receiver V, the upper head thereof having the pipe S connected to it.

W is a pipe for conducting the compressed air to any place where it can be utilized.

x is a small pipe connecting the air receiver V, with a pressure gage X.

Y is a trough to receive the waste water from the apparatus, said trough being provided with a ventage *y*, leading to a sewer or other escape channel.

Z is a disk or wheel, secured upon the shaft B, and having a pair of ratchet-teeth *z*, *z'*, with either one of which a gravitating pawl Q is adapted to engage, as seen in Fig. 5.

Ordinarily, but not exclusively, this apparatus is used for keeping up a pressure of air within kegs or barrels containing liquor on tap, a proper connection being first made between them and the pipe W, which connection can be readily effected with any of the well known appliances attached to beer pumps. Normally, all the operative parts assume the positions seen in Figs. 1 and 2, the gravitating piston-valve F, being now dropped to open communication between the shaft B, and water inlet H of upper tank D, and to close the inlet H', of lower tank D'. Again, in this normal position of the apparatus, the weight K, in the upper tank D, naturally rests upon the collar *j'*, and thereby causes the valve I, to securely close the outlet *h*, and prevent any escape of air at this opening. Consequently, when the water is first turned on, it enters the shaft B, traverses the flutes *f*, of the double acting valve F, and then passes through the inlet H, and gradually fills the tank D. It is evident, however, the tank can be filled only as air escapes from it, and as there is now no outlet to said tank except by the pipe G, the expelled air must be forced through it, and then enter the portion B', of the tubular shaft. From this shaft, the air enters pipe S, and accumulates within the receiver V, the pressure therein being, of course, in exact proportion to the head of water. But as soon as the inflowing water reaches a proper level, say about as high as the top of weight K, as indicated by the broken lines in Fig. 2, the action of the entire apparatus is exactly reversed. Reference to this illustration shows that the tank D is not accurately in line with the center of shaft B, but is set over to one side thereof, in order that said tank may have a natural tendency to swing or turn in the direction of the arrow. Therefore, when said water level is reached, the preponderating load on the right side of the tank overbalances the weight and friction of the other parts of the apparatus, and then the swinging of said tank takes place. As a result of this swinging, the previous upper tank now becomes the lower one, and vice versa, and as said upper tank turns around its weight K, drops down suddenly and rests upon the collar *j*, thus throwing the valve I wide open and allowing the water to escape directly into the waste receptacle Y. Simultaneously with this opening of valve I, the diaphragm M, is distended by atmospherical pressure, and allows air to enter at the apertures *p*, *o*, *m*, L, and thereby insures the complete emptying of the lower tank. When this inversion of the tank takes place, the double-acting valve F, instantly gravitates to another position,—that is to say, it closes the inlet H, of the previous upper tank, and opens the inlet H', of the present upper tank.

Considerable momentum is imparted to the apparatus, when either tank tumbles over, and to prevent any vibration back and forth, the pawl Q and disk Z, are provided; the teeth *z*, *z'*, of the latter being so arranged as to be engaged by said pawl the instant either tank reaches a vertical position. Hence, it is apparent there can be no retrograde turning of shaft B, and its attachments. When either tank tumbles over, the partitions *g* or *g'*, of the same, prevent water entering the receiving ends of the pipes G, G', and thus obtaining access to the portion B', of the tubular shaft, it being understood that said portion is wholly for air, while the other part B, is for water. When a certain pre-determined pressure of air has accumulated within the receiver V, its lower head *v*, springs outwardly, as seen in Fig. 4, and as the stem *t* is operated by said yielding head, the valve *r'*, or T, is closed and the supply of water cut off. But when the air pressure is reduced, said head relaxes, thereby opening the valve, and allowing water to flow into the shaft B. It will thus be seen that all the movements of my air-compressing apparatus are automatic, and, on this account, it requires no personal attention, after once being properly set up and started. Finally, by providing the apparatus with yielding seats E, E', there is no danger of any violent "ram," occurring when the piston valve F, reciprocates, back and forth and strikes either of said seats.

I claim as my invention,—

1. The combination, in a hydraulic air-compressor, of a revolving tubular-shaft communicating with the source of water supply, a pair of tanks attached to said shaft, and having an excess of weight on one side of the latter, a water-inlet to each of said tanks, a reciprocating valve that closes said inlets alternately, automatically-acting air-valves and water-discharge valves applied to each tank, and air-channels leading from said tanks to a common outlet, the arrangement of these parts being such that when the upper tank is sufficiently filled, it swings over, elevates the other tank, and thereby insures an intermittent revolving of the apparatus in one direction, substantially as herein described, and for the purpose stated.

2. The combination, in a hydraulic air-compressor, of a revolving tubular shaft, consisting of two parts B, B', separated by a solid partition C, the part B, communicating with the source of water supply, a pair of

water tanks D, D′, attached to said shaft, and communicating therewith by inlets H H′, a reciprocating valve F, that closes said inlets alternately, automatically acting air-valves M, M, and water discharge valves I I, applied to each tank, and pipes G, G′, leading from them and discharging air into the part B′, of the tubular shaft, substantially as herein described.

3. The combination, in a hydraulic-air compressor, of a revolving tubular shaft having means for admitting water, a set of tanks applied to said shaft, and having an excess of weight on one side of the latter a valve-governed water-inlet, an air-inlet valve and a water-discharge valve for each of said tanks and air-discharge passages leading from them to a common outlet, the arrangement of these parts being such as to cause an intermittent revolving of the apparatus in one direction, substantially as described.

4. A hydraulic air-compressor consisting of a set of tanks applied to a revolving shaft with an excess of weight on one side of the latter and having devices that automatically control the admission and discharge of air and water, the apparatus being arranged in such a manner as to revolve intermittently in one direction, substantially as described.

5. A hydraulic air-compressor consisting of a set of tanks applied to a revolving shaft and having devices that automatically control the admission and discharge of air and water, each tank being arranged to have an excess of weight on one side of said shaft, whereby a preponderance of weight is afforded to revolve the apparatus intermittently in one direction, substantially as described.

6. In a hydraulic air-compressor, arranged and operating as herein described, the revolving tubular shaft B, the tanks D, D′, applied to said shaft and communicating therewith by a reciprocating valve F, having a series of longitudinal flutes or grooves *f*, *f′*, at its opposite ends, for the purpose stated.

7. The combination, in a hydraulic air-compressor, of the two-part revolving tubular shaft B B′, separated by a solid partition C, the lateral necks *b b′*, projecting from said tube, the tanks D D′, attached to said necks and communicating therewith by inlets H H′, the reciprocating valve F *f f′*, adapted to travel back and forth within said necks, air-inlets L, L, to said tanks, water outlets *h h′*, of the same, valves I I, adapted to close these outlets, levers *i*, *i*, carrying said valves, reciprocating weights K K, applied to said levers, pipes G, G′, leading from the upper part of said tanks to the part B′, of said tubular-shaft, a water pipe R, coupled to shaft B, a delivery pipe S, coupled to shaft B′, and a receiver V, with which said pipe S communicates, all as herein described.

8. In a hydraulic air-compressor, arranged and operating, as herein described, the tank D, having a partition *g*, open at top, but closed at bottom, and the air-escape G, communicating with said tank, and extending down almost to the lower end of said partition, for the purpose described.

9. In a hydraulic air-compressor, arranged and operating as herein described, the revolving tubular-shaft B, provided with lateral necks *b*, *b′*, the coupling *d d′*, attached to said neck, the valve seats E *e* E′ *e′*, inserted within said couplings, and the reciprocating valve F *f*, *f′*, traversing said necks and couplings, for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE H. WALKER.

Witnesses:
JAMES H. LAYMAN,
ALFRED M. DAVIES.