No. 717,243. Patented Dec. 30, 1902.

E. Y. MOORE.

HOIST.

(Application filed May 15, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

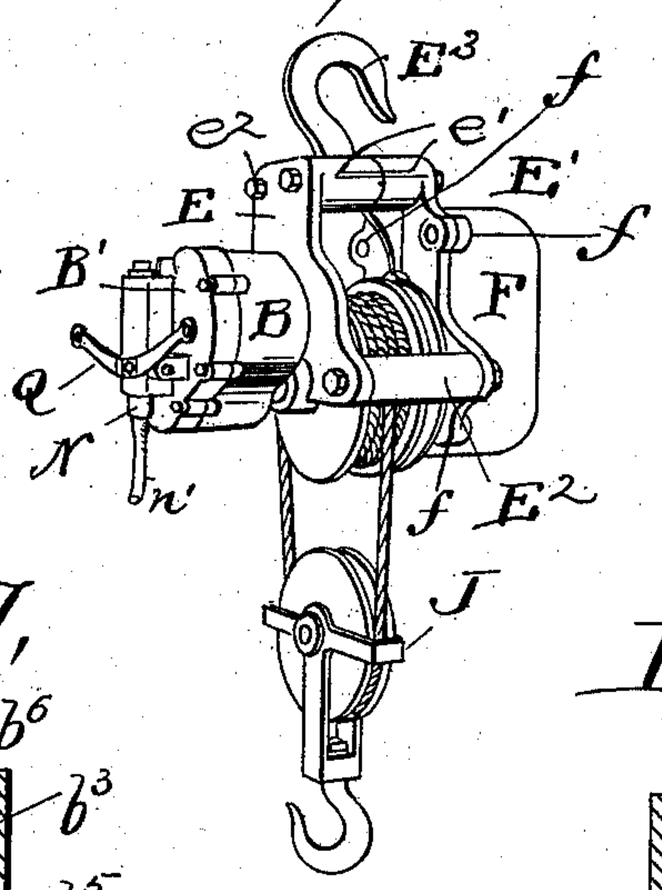


Fig. 7.

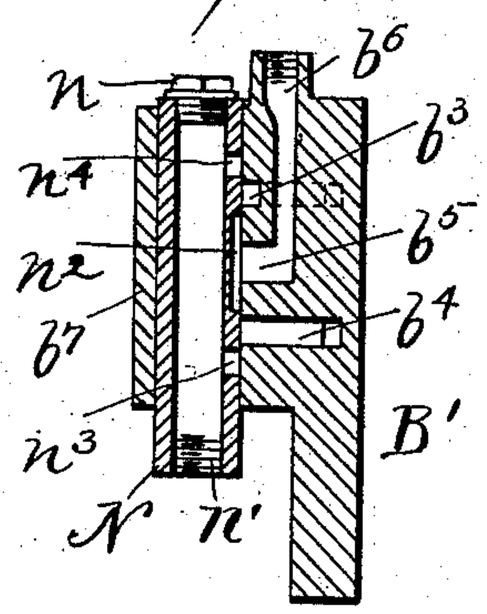


Fig. 8.

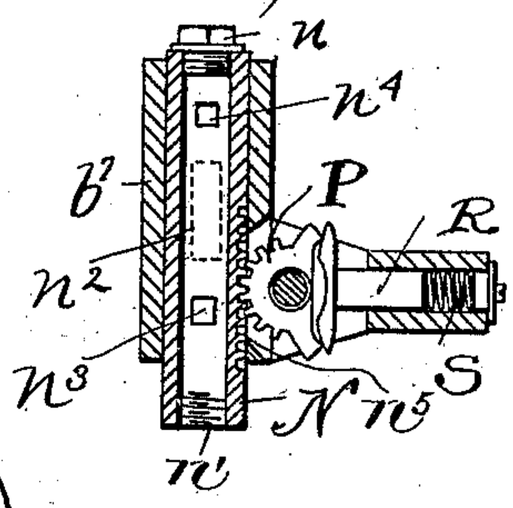
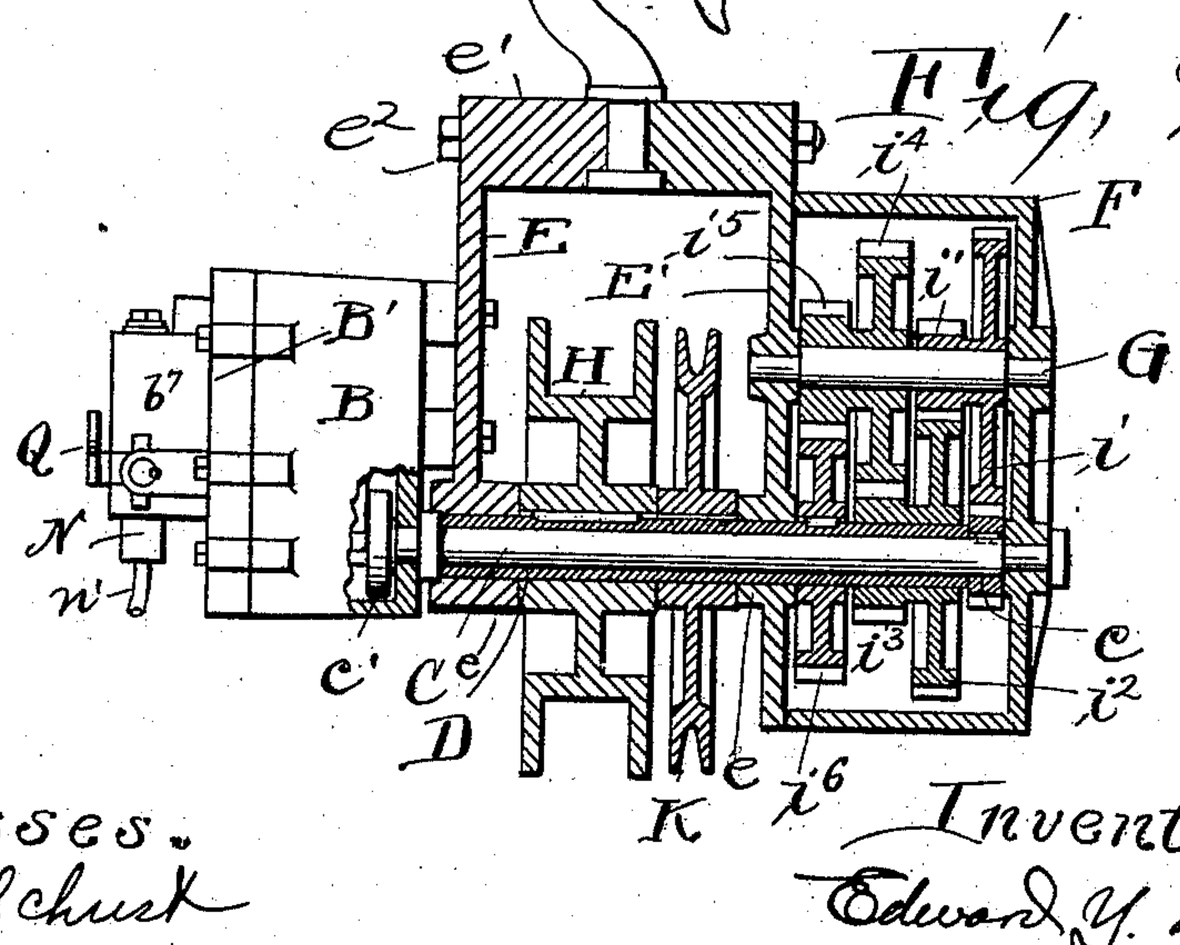


Fig. 2.



Witnesses.
E. B. Gilchrist
H. M. Wise.

Inventor,
Edward Y. Moore,
By his Attorneys,
Thurston & Bates.

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HOIST.

(Application filed May 15, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 3,

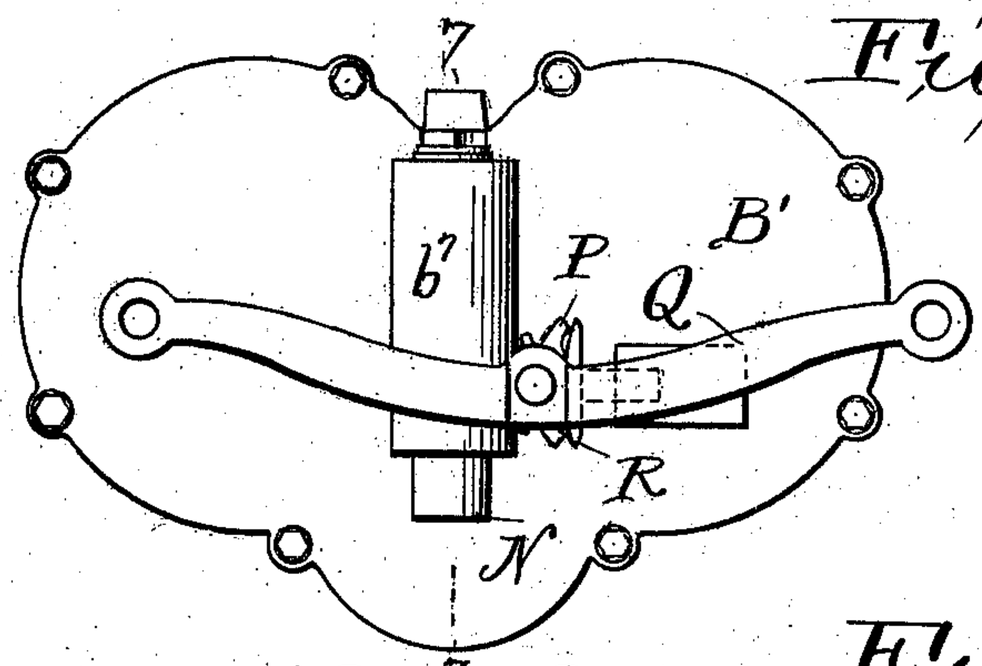


Fig. 4,

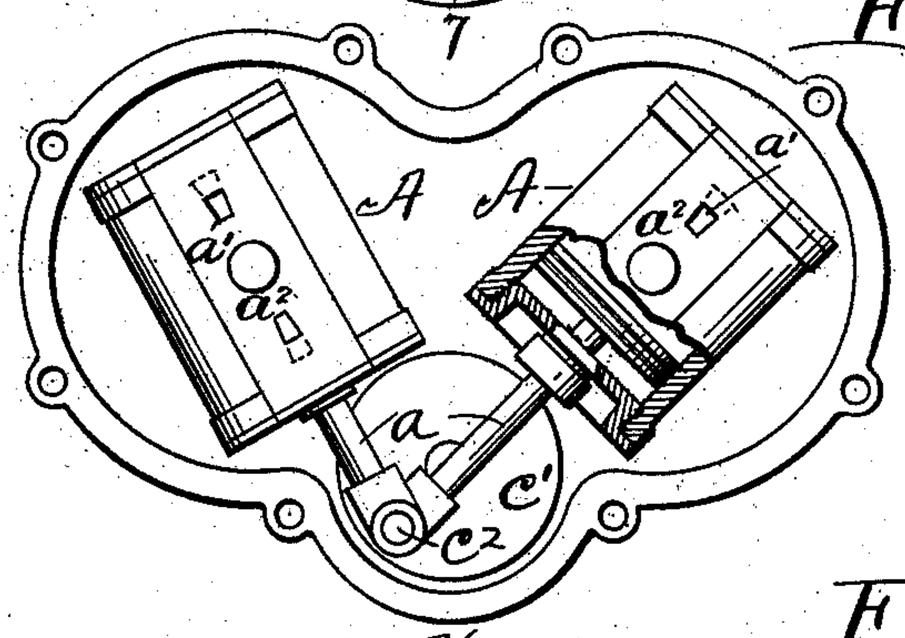


Fig. 5,

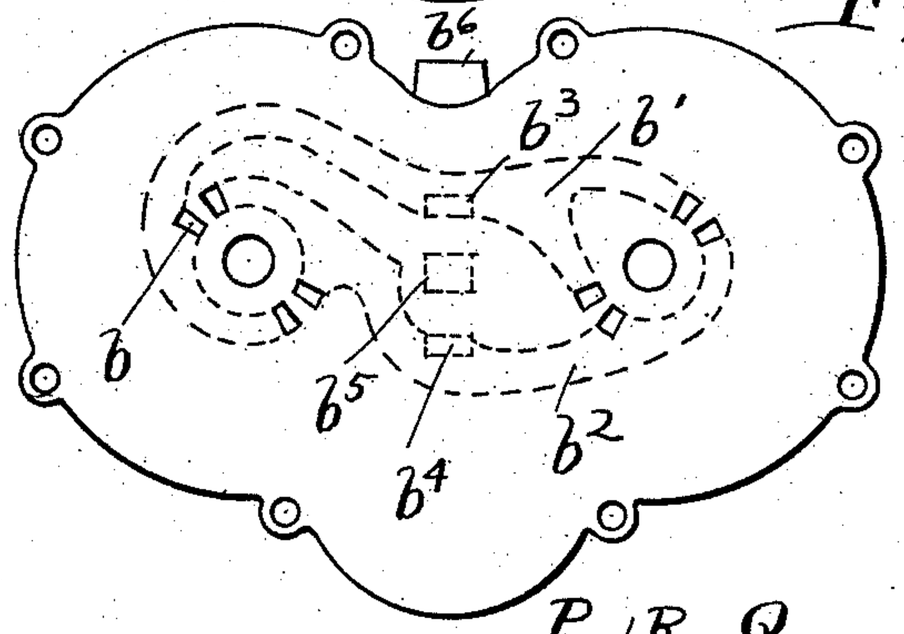
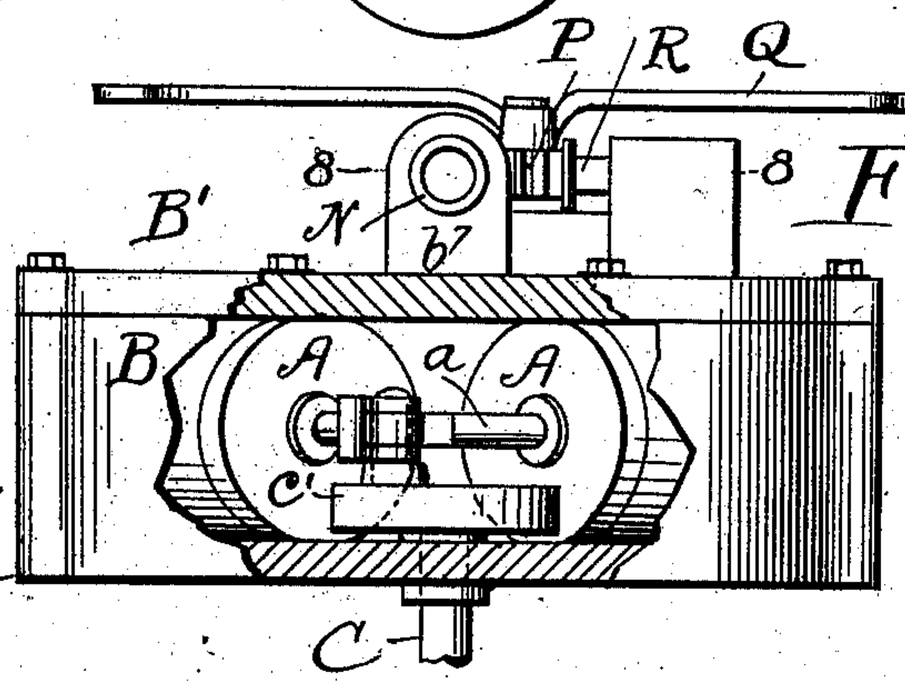


Fig. 6,



Witnesses.
E. B. Gilchrist
H. M. Wise.

Inventor:
Edward Y. Moore,
By his Attorneys,
Thurston & Bates

UNITED STATES PATENT OFFICE.

EDWARD Y. MOORE, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CHICAGO PNEUMATIC TOOL COMPANY, A CORPORATION OF NEW JERSEY.

HOIST.

SPECIFICATION forming part of Letters Patent No. 717,243, dated December 30, 1902.

Application filed May 15, 1901. Serial No. 60,322. (No model.)

To all whom it may concern:

Be it known that I, EDWARD Y. MOORE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Hoists, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of this invention is to provide a cheap power-hoist adapted to sustain its load at any point and be of high operative efficiency.

Heretofore it has been customary to make hoists self-locking by providing internal friction from differential gearing, worms, &c.; but such construction necessarily reduces the efficiency to less than fifty per cent., for the work of elevating would have to include the useless work of overcoming the friction, which must be greater than the work of raising the load. To obviate this decrease in efficiency, ratchets and friction-clutches have been applied; but these complicate the construction by requiring special means to throw them out of action for lowering. I obviate the difficulty by providing an efficient straight-line gearing for driving a direct drum from a suitable shaft, and I rotate this shaft by a pneumatic engine having a reciprocating plunger and crank-shaft and a valve so arranged that the air-pressure is confined within the cylinder when the raising operation has stopped, whereby the backward rotation of the shaft is prevented and the load is held at any desired point. The invention includes such an arrangement of engine and elevating mechanism broadly.

The invention also includes the particular form of gearing which I employ and the arrangement thereof with reference to the engine and shaft and also the particular form of hoist-frame, all of which contribute to the cheapness and efficiency of the hoist.

In the drawings, Figure 1 is a perspective view of a complete hoist embodying my invention. Fig. 2 is a vertical central section thereof. Fig. 3 is a face view of the engine or motor. Fig. 4 is a view of the interior thereof with the cover-plate removed. Fig. 5 is an elevation of the inner side of the cover-plate. Fig. 6 is a bottom view of the motor, partly broken away. Figs. 7 and 8 are vertical sections at right angles to each other through the valve preferably employed, being on the lines 7 7 of Fig. 3 and 8 8 of Fig. 6, respectively.

My hoist in its preferred form comprehends a bifurcated frame adapted to be supported by a hook or eye, a drum between the sides of the frame on a sleeve journaled therein, a driving-shaft within said sleeve, a pneumatic motor having a crank and reciprocating pistons and contained within a casing on one side of the frame and connected with said driving-shaft and having a suitable valve and reduction-gearing on the other side of the frame contained within a suitable casing and connecting the shaft and sleeve. Such a hoist will now be specifically described.

The pneumatic motor is closed within a suitable casing B, having a cover-plate B′. It operates, as hereinafter described, to rotate the shaft C, projecting through the back of the casing, which shaft intermediately drives the drum, which may be a winding-drum, sprocket, or other direct-acting member which is not self-locking. This shaft is journaled in the sleeve D, which is in turn journaled in bosses *e e*, carried by the plates E E′. These plates carry at their upper ends the integral inward bosses *e′* and are secured together by bolts e^2 passing through such bosses and bolts passing through the distance-blocks E^2. A strong and light frame for the hoist is thus provided. This frame is swivelly carried by the supporting hook or eye E^3.

The motor-casing is secured to the outer side of the plate E, and a box F, covering the reduction-gearing, is secured to the outer side of the plate E′. The reducing-gearing is of the "straight-line" type—that is, it consists of intermeshing spur-gears and pinions without such self-locking mechanisms, as ordinary worms or differential gears. As shown, this reduction-gearing consists of a series of gear-wheels and rigid pinions journaled on an idler shaft or stud G and conveying movement from the shaft C to the sleeve D. As shown this train of gearing leads from the

pinion *c* on the shaft C to the meshing gear *i*, from the pinion *i'*, rigid therewith, to the gear i^2, loose on the sleeve D, from the pinion i^3, rigid with this gear, to the gear i^4, loose on the stud G, and from its rigid pinion i^5 to the gear i^6, which is rigid on the sleeve D.

Between the plates E and E' is the winding-drum H, which is rigid with the sleeve D, wherefore this drum is rotated by the pneumatic motor through the reduction-gearing and may operate to elevate the tackle-block J as desired. A sheave K is shown as mounted loosely on the sleeve D by the side of the drum H, whereby provision is made for the use of a double tackle-block, if desired. The necessity for differential drums is obviated by the reduction-gearing, which is much more efficient.

It will be noticed that the casing F for the reduction-gearing supports the outer ends of the driving-shaft C and the idler-shaft G, this casing being bolted to the outer side of the frame-plate E', as shown at *f*. This makes a very cheap and simple construction. By placing the motor on one side of the hoist-frame and the reduction-gearing on the other side and running the shaft through within the sleeve on which the drum is mounted not only is a very compact hoist obtained, but the hoist balances itself, and the supporting-hook E^3 can be placed centrally of the frame and still be over the drum H.

The particular form of pneumatic motor which I prefer to employ and have shown herein is not of itself a portion of this invention, being covered by my prior patent, No. 669,587, issued March 12, 1901. Any pneumatic motor having a reciprocating piston and crank-shaft may be substituted therefor, provided it has such an arrangement of reversing-valve that it will retain the compressed air against the force of the load which tends to drive out that air.

The motor consists, as shown, of a pair of oscillating cylinders A, contained within a casing consisting of the box B with the cover-plate B', the pistons *a* of the cylinders taking onto a single crank-pin c^2 on the crank *c*, which is rigidly secured to the main shaft C. The cylinders have flat faces a^2, through which there are port-openings *a'*, adapted to coöperate with openings *b* in the cover-plate. The openings *b* are connected in two groups by the passage-ways *b' b*^{2}, into which lead the ports b^3 and b^4 from the valve b^7. Intermediate of these ports is the exhaust-port b^5, shown as discharging through the openings b^6 into the atmosphere. As the cylinders oscillate in operation, their openings *a'* aline alternately with openings *b* in the cover-plate, the flat face of the cylinder adjacent to the openings *a'* covering the unalined ports *b*. Thus the flat face a^2, with the ports *b*, constitutes an automatic valve governed by the movement of the engine and in turn governing it to cause continuous operation of the piston within the cylinder.

The valve may be of any approved construction so long as it is positively held to its seat and cannot be forced therefrom by the pressure from the inside due to the back action of the load. The drawings show the preferred form of valve, which is of itself covered by Patent No. 673,573, issued May 7, 1901, to Thomas Barrow. It consists of a tubular body N, which is shown as closed at its upper end by a plug *n* and provided at its lower end with screw-threads *n'*, to which a flexible hose may be coupled. In the outer surface of this valve is a recess n^2 of sufficient size to couple the exhaust-port b^5 with either of the admission-ports b^3 or b^4, while extending through the valve are the admission-openings n^3 and n^4 to allow the compressed air to pass to either side of the cylinders to drive the load up or down. This valve fits with desirable snugness within its seat. It is balanced as far as the live pressure is concerned, and when it shuts off an admission-port such shutting off is positive, and an excess of pressure from the admission-passage cannot force the valve from its seat, as would be the case if air-pressure alone were relied upon to hold the valve to its seat.

The valve is shown as operated by a gear-segment P, which has teeth meshing with teeth n^5, cut in the valve, the segment being oscillated by a lever Q, rigid therewith. The valve is given a normal tendency to come to its intermediate or off position by the plunger R, suitably guided and having a T-head bearing against toes projecting from the segmental gear on opposite sides of its pivot, the plunger being pressed in that direction by a spring S.

In operation to elevate the load the lever Q is moved in the proper direction, shifting the valve to admit compressed air to the cylinders, which, driving the shaft C, rotates the drum, raising the load. When the load reaches the desired point, the hold on the lever Q is removed, and the spring S brings the valve to the off position, and the compressed air which is already in the cylinders to elevate the load is entrapped therein, preventing the load running down, for the air blocks the backward movement of the piston, and the drum or shaft cannot turn without so driving the piston. By having two oscillating cylinders the pistons of which occupy different relative positions the entrapped air acting through the piston-rods and crank-shaft furnishes a sufficiently rigid backing to hold the load steady. Thus the holding of the load is in no way dependent upon the friction of the driving mechanism, and by employing the straight-line reduction-gearing which I do very much less friction results than when differential gears, bevels, worms, &c., are employed, whereby the efficiency of my hoist is greatly increased.

I claim—

1. In a hoist, the combination of a pneumatic motor, a direct-acting elevating-drum,

straight-line reduction-gearing connecting said drum to said motor, and a governing-valve for said motor adapted on one position to positively entrap the air in the engine whereby the air alone blocks the pistons and sustains the load on the straight-line reduction-gearing, substantially as described.

2. In a hoist, the combination of a pneumatic motor, a shaft, a cylinder and reciprocating piston, an automatic valve governing the same to cause continuous consecutive operations thereof, an elevating drum or pulley, a system of external spur-gearing connecting the same with the shaft, and a reversing-valve adapted in the off position to entrap the air in said cylinder whereby the air alone blocks the piston and sustains the load on said spur-gearing, substantially as described.

3. In a hoist, the combination of a frame, a sleeve journaled therein, a shaft within said sleeve, a drum upon said sleeve, a system of straight-line reduction-gearing on the side of the frame connecting the shaft with the sleeve, a pneumatic motor on the other side of the frame adapted to rotate said shaft, said engine including a reversing-valve adapted in its off position to positively entrap compressed air behind the piston whereby the air sustains the load upon said shaft through said straight-line gearing, substantially as described.

4. In a hoist, the combination of a bifurcated frame, a sleeve rotatably mounted across said frame, a shaft within said sleeve, a drum or pulley between the side plates of said frame rigid with said sleeve, straight-line reduction-gearing consisting of intermeshing spur-gears, and pinions on the outer side of the frame connecting said shaft and sleeve, a driving-engine on the opposite side of the frame connected to said shaft and having an automatic valve operated by the movement of the engine and in turn governing it to cause continuous consecutive operations, and a reversing-valve adapted to entrap the air behind the piston whereby the air sustains the load upon the gearing, substantially as described.

5. In a hoist, the combination of a bifurcated frame, a sleeve journaled in the side plates thereof, a shaft within said sleeve, a drum or pulley between the side plates rigid with said sleeve, an idler shaft or stud on the outer side of the frame, a series of gears and connecting-pinions including one rigid with said shaft and another rigid with said sleeve and others carried by said idler, a casing containing said gearing, a case on the opposite side of the frame, a plurality of pneumatic cylinders oscillating within this latter casing, piston-rods for said cylinders which take onto the same crank-pin on a crank within the casing secured to said shaft, individual valves for said engine in a casing having passages leading to the cylinders, and a reversing-valve controlling said passages and in the off position preventing exit therefrom whereby the air in the cylinders blocks the pistons and sustains the load upon the gearing, substantially as described.

6. In a hoist, in combination, a frame having a pair of side plates or arms, a sleeve journaled in said plates and extending beyond the outer side of one of them, a drum or pulley rigid with said sleeve between said side plates, a shaft rotatable within said sleeve and extending beyond the same, an idler-shaft parallel with said sleeve and carried on the outer side of that plate beyond which said sleeve extends, spur-gearing connecting the main shaft and sleeve via the idler-shaft, a casing containing said spur-gearing and secured to the outer side of the frame, the outer ends of said main shafts and idler-shaft being carried in said casing, and a driving-engine contained within a casing secured on the outer side of the other side plate and connected to said main shaft, substantially as described.

7. In a hoist, in combination, a pair of side plates having near their upper ends rigid bosses said bosses being recessed on their opposed faces, bolts passing through said bosses and holding the frame-plates together, a suspension device swiveled in said opposed recesses, a drum rotatably mounted between said side plates, reduction-gearing on the outside of one side plate, a driving-engine on the outer side of the other side plate, and mechanism connecting the engine with the reduction-gearing and the reduction-gearing with the drum, substantially as described.

8. In a hoist, in combination, a bifurcated frame comprising a pair of side plates having bosses projecting inward substantially the same distance and having coöperating recesses in their opposed faces, bolts passing through said bosses holding the frame-plates together, a suspension device swiveled in said coöperating recesses, a distance-tube holding the frame-plates apart at another point, a bolt inclosed within said tube and passing through said side plates, a casing on the outer side of each frame-plate secured thereto, reduction-gearing within one casing, and a driving-engine within the other, a winding-drum between the frame-plates, a driving connection between said drum and said gearing, and a driving connection between said gearing and said engine, all of said parts being so arranged as to balance each other beneath said centrally-placed hook, substantially as described.

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

EDWARD Y. MOORE.

Witnesses:
ALBERT H. BATES,
H. M. WISE.