(No Model.) 5 Sheets—Sheet 1.

K. BRYAN.

MAIN OPERATING VALVE FOR HYDRAULIC ELEVATORS, &c.

No. 561,089. Patented June 2, 1896.

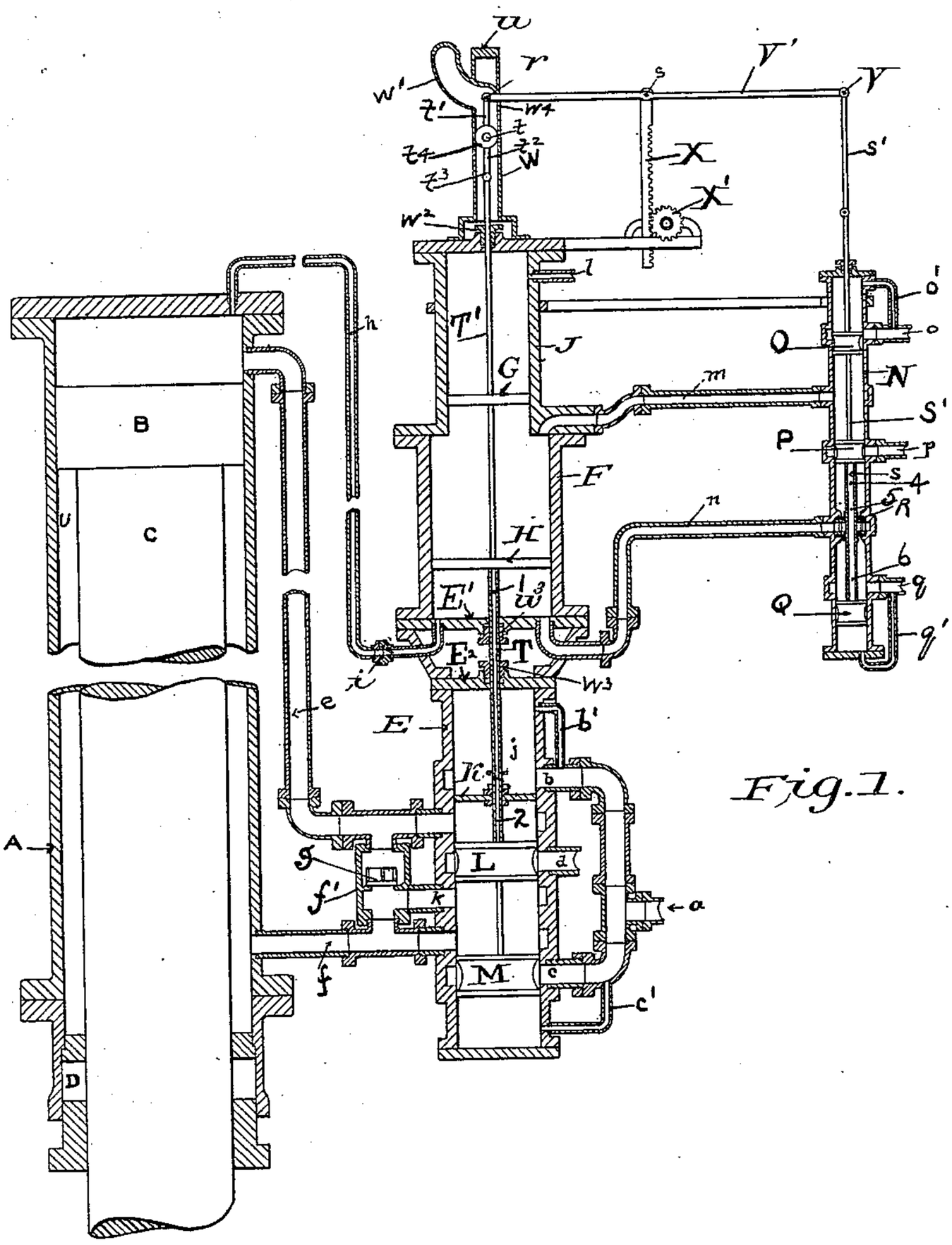

Fig. 1.

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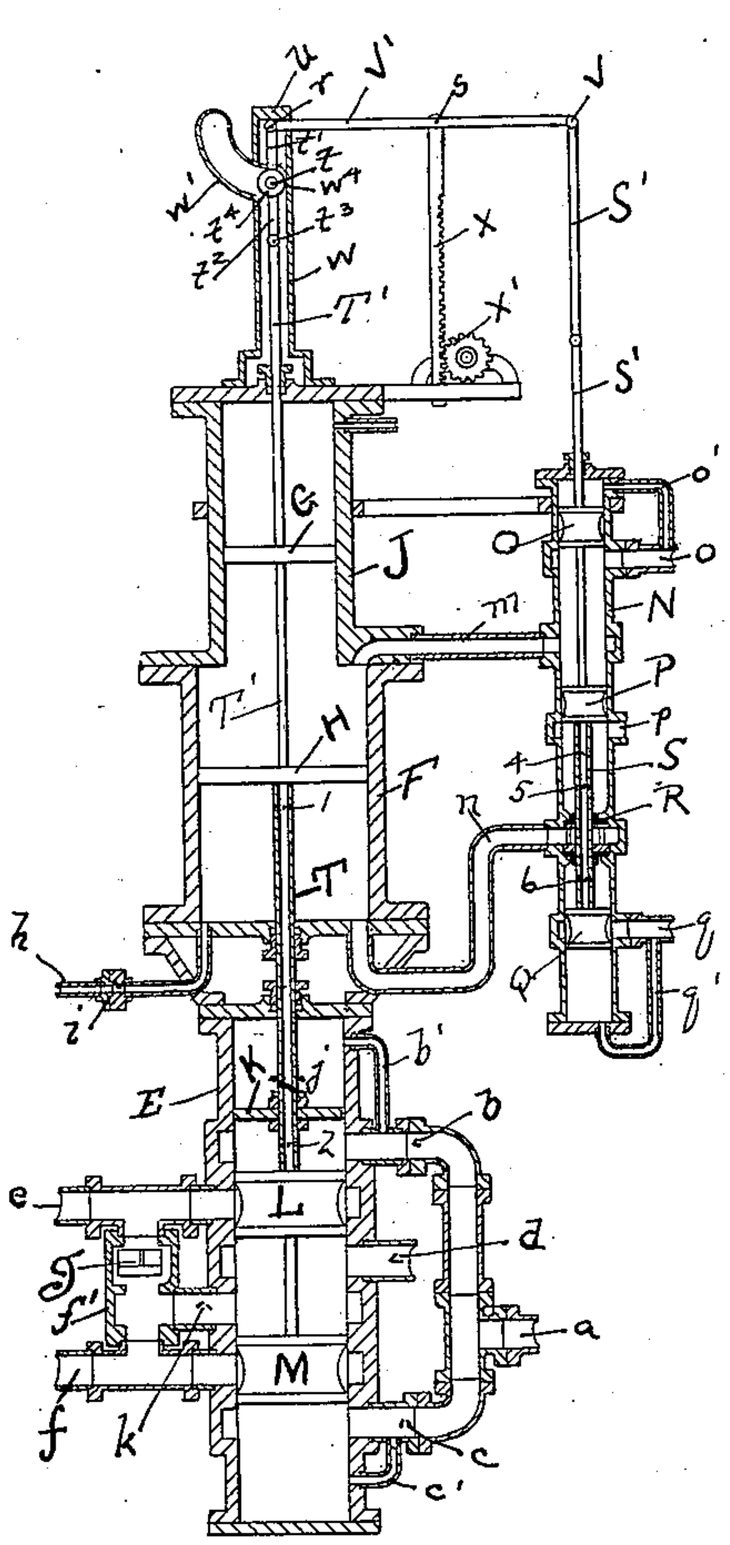

Fig. 2.

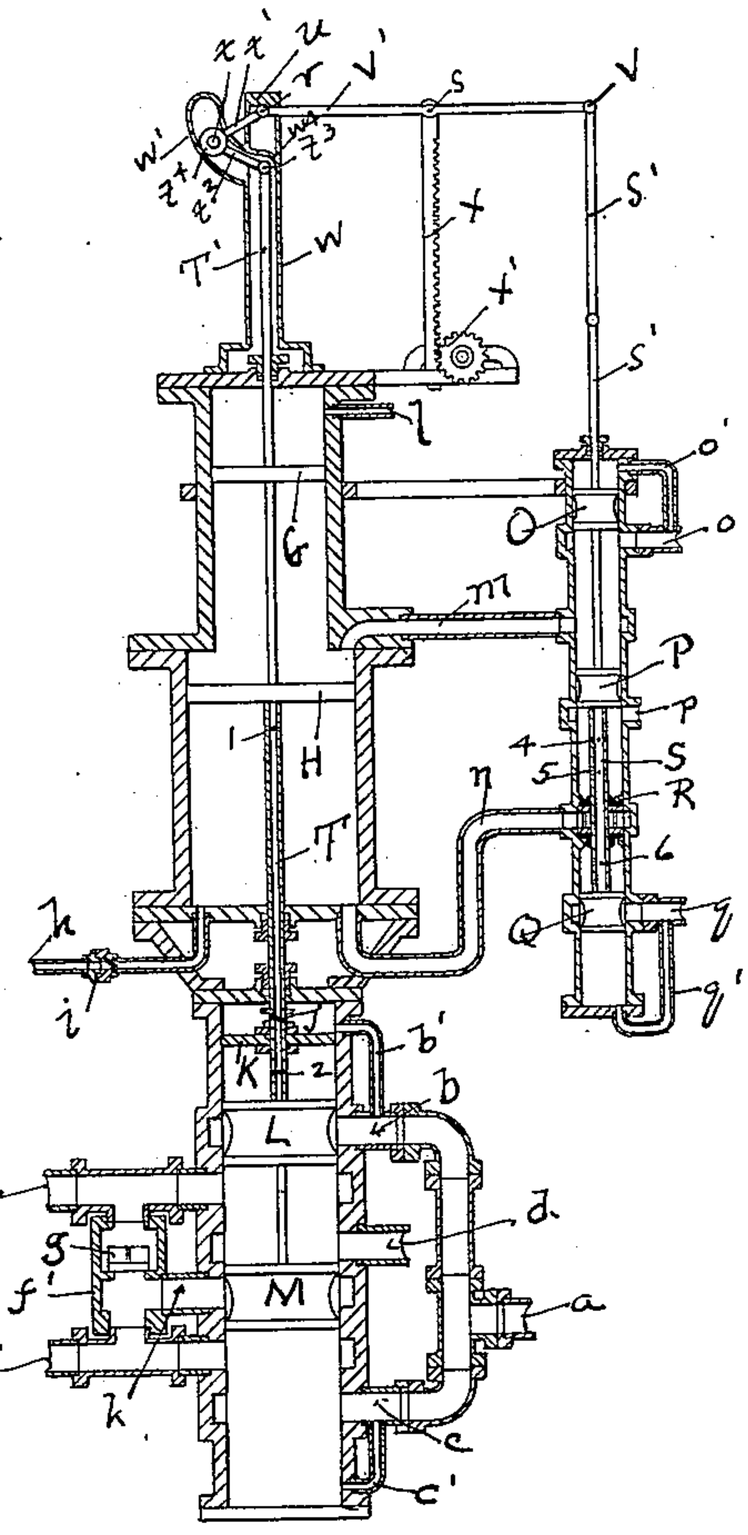

Fig. 3.

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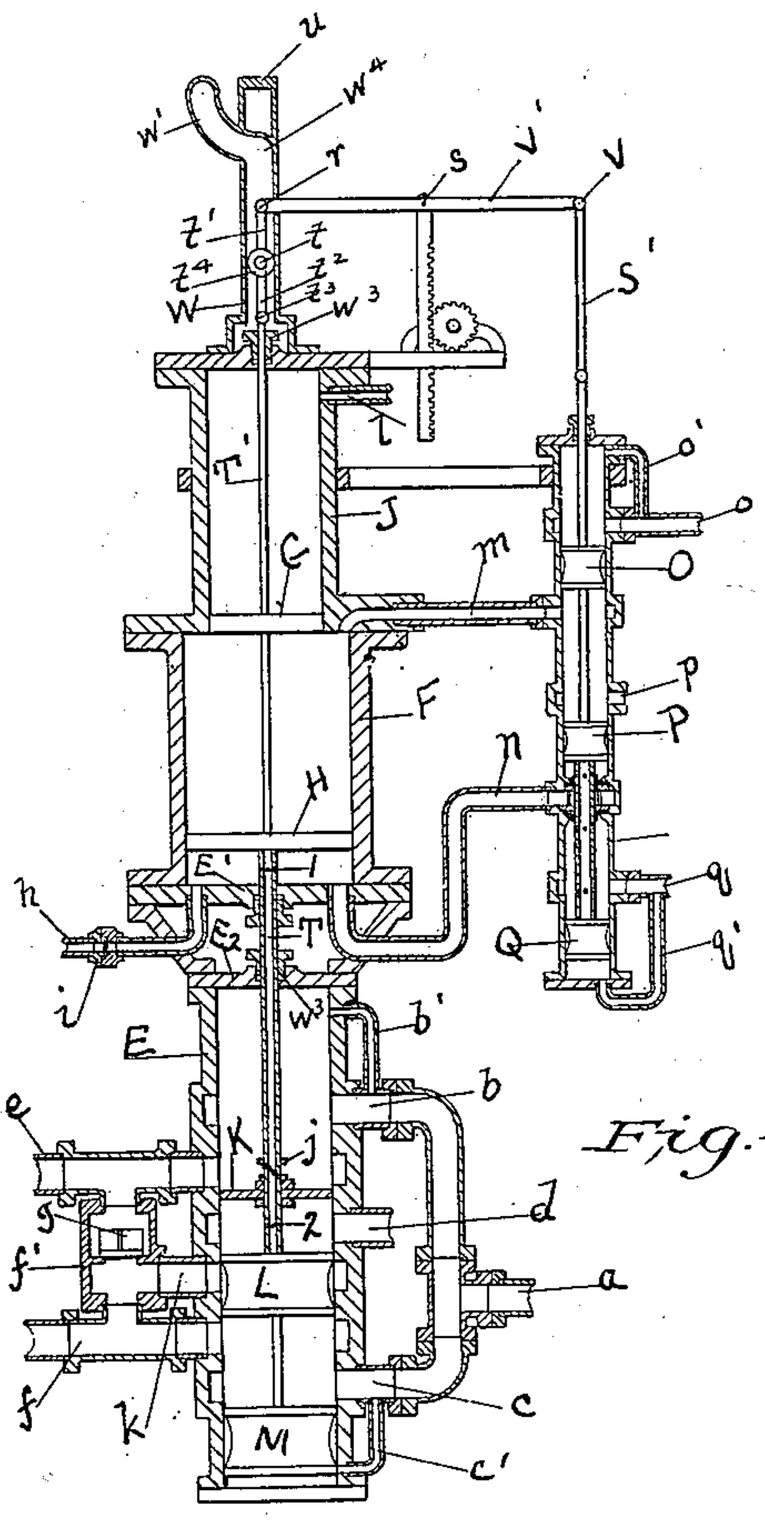

Fig. 4.

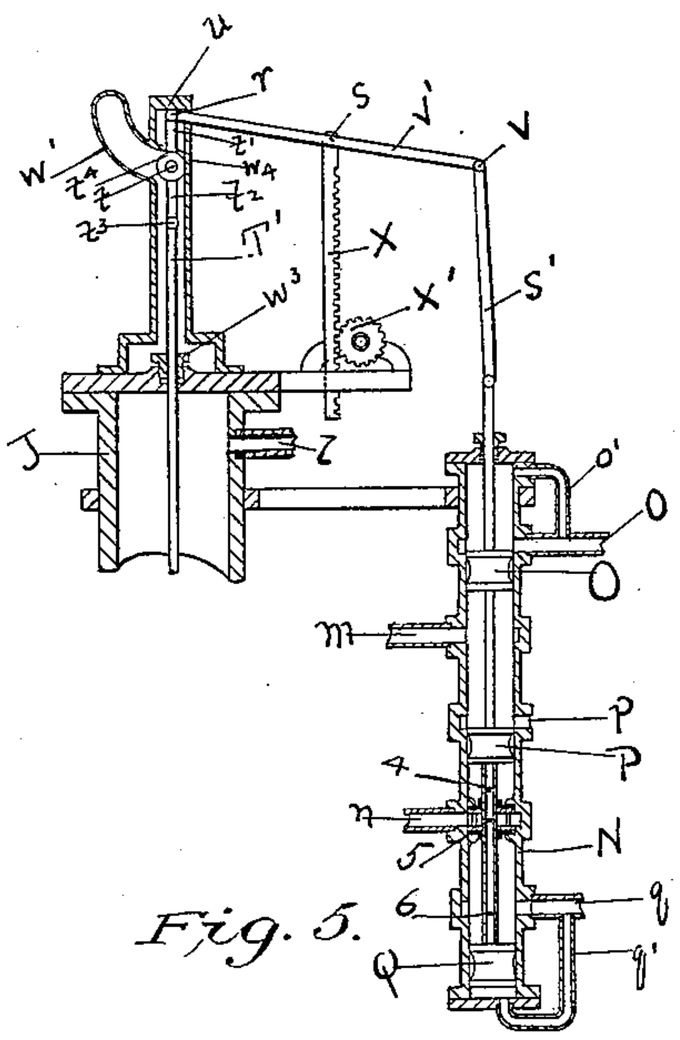

Fig. 5.

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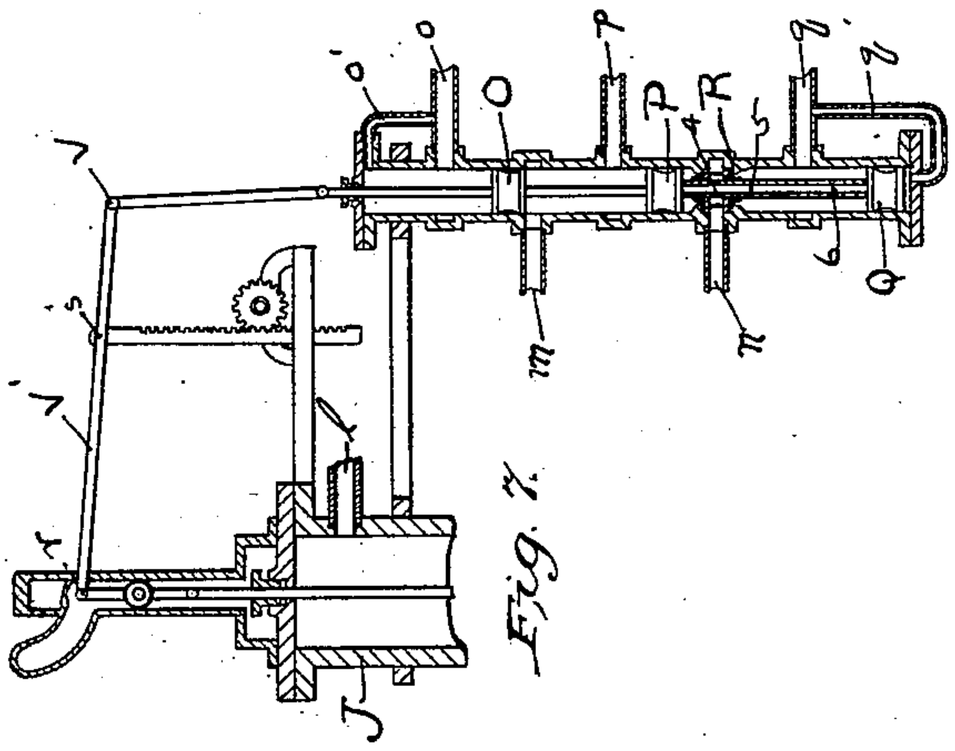

Fig. 7.

Fig. 6.

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MAIN OPERATING VALVE FOR HYDRAULIC ELEVATORS, &c.

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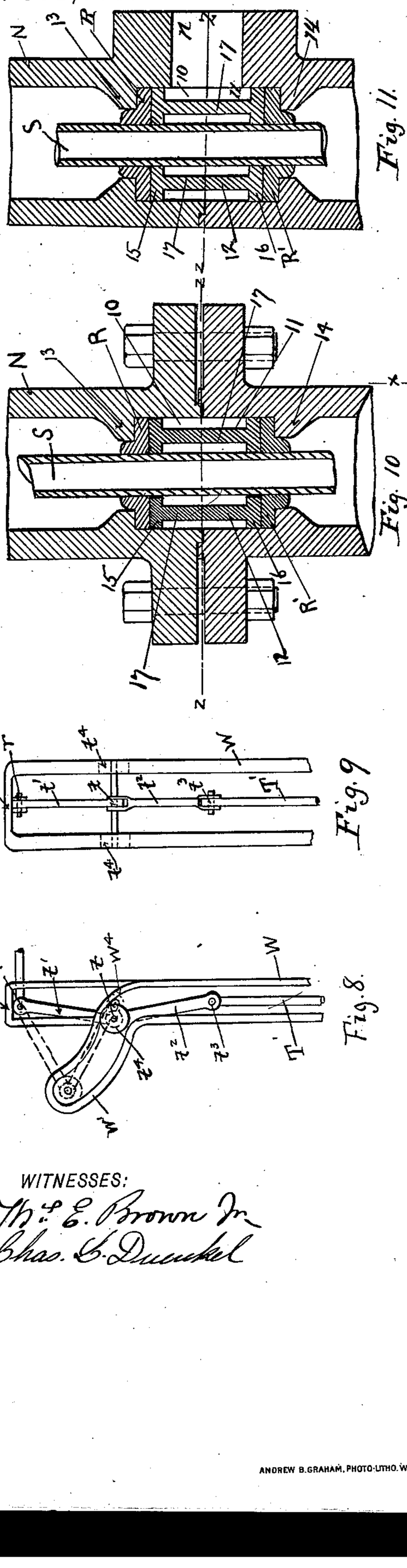

Fig. 11.

Fig. 12.

Fig. 10

Fig. 9

Fig. 8.

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UNITED STATES PATENT OFFICE.

KENNERLEY BRYAN, OF NEW YORK, N. Y.

MAIN OPERATING-VALVE FOR HYDRAULIC ELEVATORS, &c.

SPECIFICATION forming part of Letters Patent No. 561,089, dated June 2, 1896.

Application filed July 28, 1894. Serial No. 518,819. (No model.)

To all whom it may concern:

Be it known that I, KENNERLEY BRYAN, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented certain new and useful Improvements in Main Operating-Valves for Hydraulic Elevators and Hoisting Apparatus, of which the following is a specification.

My invention relates to improvements in the main operating-valves of hydraulic elevators.

The first object of the invention is to provide, in combination with the motor-cylinder, an operating-valve arranged and equipped to automatically control the power (which is to say, the volume of water) consumed by the motor-cylinder. In this respect my invention provides that when the motor is running under half its load or less only one-half the required volume of water shall be taken from the pressure-main, but that when the motor is running under its maximum load the whole volume of water required shall be taken from the pressure-main and that this increase or decrease of the volume of water taken from the main shall be effected automatically by the operating-valve under the influence of the load. I may also apply the same principle so that the minimum consumption of power shall take place when the elevator is operating under a load which is some other proportion of the maximum load than one-half, the proportion of the power consumed to the maximum power having been varied accordingly.

The second object of the invention is to connect the operating-valve in the preferred manner with a pilot-valve so equipped and arranged as to aid in automatically controlling the operating-valve.

The third object of the invention is to provide such parts and combination of parts in the apparatus as shall efficiently secure the results aimed at.

Referring to the drawings which accompany the specification to aid the description, Figure 1 is a vertical section of a motor-cylinder operating and pilot valves. The parts are shown in the position of rest. Fig. 2 is a vertical section of the operating and pilot valves in the positions assumed for lifting the elevator-car with half-load or less, and Fig. 3 a vertical section of the same valves in the position assumed for lifting the elevator-car with load in excess of one-half the maximum load. Fig. 4 is a vertical section of the operating and pilot valves in the position assumed for allowing the elevator-car to descend. Fig. 5 is a vertical section of the pilot-valve and parts of the operating-valve, showing the position to which the operator throws the pilot-valve to stop the car on the up motion. Fig. 6 is a vertical section of the same parts as in Fig. 5, but the pilot-valve is in the position for starting the car on the up motion. Fig. 7 is a vertical section of the same parts as Fig. 5, but the pilot-valve is in the position for starting the car on the down motion. Fig. 8 is a detail, on an enlarged scale, of the guide-yoke and links at the upper end of the operating-valve piston-rod. The solid lines show the parts in the position of Fig. 2 and the dotted lines show the parts in the position of Fig. 3. Fig. 9 is a view of the same parts, but on a plane perpendicular to that of Fig. 8, the parts being in the position of Fig. 2. Fig. 10 is a broken vertical section, on the line $x\,x$ of Fig. 12, of a part of the pilot-valve and casing on an enlarged scale, and showing a joint in said casing, a broken portion of the hollow rod S, the fixed packings R R′, through which the rod S works, and the bridge 17, which aids in holding the packings in place. Fig. 11 is a view of the same parts on the line $y\,y$ of Fig. 12 perpendicular to that of Fig. 10 and showing the joint through the port. Fig. 12 is a plan on the line $z\,z$ of Figs. 10 and 11.

A is the motor-cylinder; B, the piston; C, the plunger, (or piston-rod,) of one-half the area of piston B and working through the stuffing-box D; U, an annular space, filled, of course, with water, between plunger C and cylinder A.

E F J is the casing of the main operating-valve, the area of the part J being one-half that of part F. Said operating-valve consists of differential pistons G H, the area of piston H being double that of piston G, combined as a component part with any suitable device for controlling the connections of the cylinder A. In the drawings said device consists of pistons K L M working in the casing E and connected with the differential pistons G H, so as to form one coöperating and comoving

device therewith by the hollow rod T. In place of said pistons K L M, I may use any other suitable device, my invention in this respect consisting in an operating-valve as a whole which contains differential pistons as a component part. In the drawings, casings E and F are separated by the heads E′ E².

e f are channels respectively connecting the working and piston-rod ends of cylinder A with the operating-valve; *g*, a check-valve on the branch pipe *f′* and opening upward; *h*, a pipe connecting the working end of cylinder A with the operating-valve below piston H; *i*, a check-valve in pipe *h*, opening toward the operating-valve; *j*, a check-valve in hollow rod T, opening upward; *k*, a pipe from the branch *f′* to the operating-valve. 1 and 2 are holes opening into hollow rod T.

a is the exhaust-pipe, having branches to the ports *b c*, *b′ c′* being by-passes.

d is the port connecting with the pressure-main. (Not shown.)

W is a guide-yoke on top of casing J and closed by the stop-block *u*; W′, a curved extension connecting with W and shaped on an arc of a circle struck from the point *r*, Fig. 2, as a center.

*w*⁴ is a guide-surface to direct the roller *t*⁴ into *w′*; W² W³, stuffing-boxes through which the valve-rod works.

t′ t² are links jointed at *t*, where there is an antifriction-roll *t*⁴, as shown, rod T′ being jointed to link *t²* at *t*³.

l is a pipe always open from above piston G to the pressure-main.

N is a pilot-valve casing; O, P, and Q, pistons therein, O and P being connected by the solid rod S′, and P and Q by the hollow rod S, 4, 5, and 6 being holes in said hollow rod S.

m n are pipes connecting the pilot-valve with the operating-valve, respectively above and below piston H.

R is a fixed packing in the pilot-valve casing N, making a water-tight joint with the hollow rod S.

o q are exhaust connections, respectively near the top and bottom of the pilot-valve, *o′ q′* being by-passes.

p is a connection from the pressure-main to the pilot-valve.

s′ is a link connecting rod S′ with lever V′ at V, said lever V′ being fulcrumed at *s* to the rack X, which is moved by the pinion X′, said pinion being operated from the elevator-car in any usual manner. Said lever V′ is connected at *r* with the link *t′*.

The operation is as follows:

First, to raise the car when containing half the maximum load or less: Suppose the apparatus in the position of rest, Fig. 1, in which position the pistons K L M have cut off the channels *e f* from communication with the main pressure-port *d* and exhaust-ports *b c* and the pilot-valve has cut off the pipes *m n* from communication with the pressure connection *p* and exhaust connections *o q*. Now the operator raises the pistons O P Q of the pilot-valve to the position of Fig. 6, opening communication from the pipe *p* by way of holes 4 5 6 in the rod S through pipe *n* to the operating-valve below piston H, and opening communication from above the piston H by way of pipe *m* with the exhaust connection O, thus relieving the pressure on the top of piston H. Said piston H, being double the area of piston G, lifts the operating-valve as a whole, including all the pistons G H K L M, until further movement is arrested by the stop-block *u*. The pistons G H K L M are now in the position of Fig. 2, but the lever V′ being fulcrumed at *s*, which remained fixed during the motion of the pistons G H K L M, has simultaneously depressed the pistons O P Q of the pilot-valve to the position of Fig. 2. Consequently when the parts have reached the position of this figure the main pressure is shut off by the pilot-valve from the under side of piston H, but the upper side of said piston is still in communication by pipe *m* with the exhaust *o*. Now the main pressure passes by the branch *k*, check-valve *g*, and channel *e* into the working end of cylinder A, the main pressure being able to lift the said check-valve *g*, because the elevator is by hypothesis working under only one-half the maximum load or less, and there is one-half or less the maximum main pressure on the top of said check-valve. The pressure on the piston B forces it down, raising the elevator-car, while the water in the annular space U is forced out by the channel *f* up through check-valve *g* and channel *e* into the working end of the cylinder A. Thus the motor draws only one half the volume of water above the piston B from the main, the other half being drawn from the annular space U. It will be seen that with different relative areas of piston B and plunger C the consumption of water may be varied in the proportion of such other relative areas, with the same valve mechanism correspondingly proportionally arranged.

Second, to raise the car with a load exceeding one-half the maximum: Suppose the various pistons of the main operating and pilot valves to be brought to the position of Fig. 2, in the manner hereinbefore described. Now as soon as the pistons G H K L M reach that position the pressure created in the working end of cylinder A by the load in the car (and which is more than one-half the maximum pressure from the main) is transmitted through pipe *h* and check-valve *i* to the under side of piston H, the upper side thereof being in communication with the exhaust connection *o*. Now the piston H, being double the area of piston G, will lift itself and the other pistons G K L M to the position of Fig. 3, the rod T′ breaking at the joints *t³ t*, as shown, Fig. 8, and the roll *t*⁴ running up the guide *w′* by reason of the guides *w*⁴. During said upward movement of the piston H the fulcrum, and consequently the pilot-valve

pistons O P Q, remain stationary, because the point *r* is arrested by the block U. (Compare Figs. 2 and 3.) Now the main pressure goes directly from pipe *d* by way of channel *e* to the working end of cylinder A, the water in the annular space U beneath the piston B going directly and with no resistance except its friction to the exhaust *c*. The pressure existing on the under side of piston H cannot be transmitted through holes 1 and 2 and rod T to the upper side of piston L and under side of piston K, because of the check-valve *j'*, which opens toward piston H. Thus the maximum main pressure is now effectively applied to raise the car. The valve-rod T' may be broken inside the casing J; but I prefer to break it above said casing in the manner shown in the drawings.

Third, to stop the car on the up motion: The pilot-pistons O P Q are thrown by the operator from the position of Fig. 2 or Fig. 3 to that of Fig. 5, thus admitting main pressure from pipe *p* through pipe *m* above the piston H, and relieving the pressure below said piston H by connecting the pipe *n* through the holes 5 and 6 of the hollow rod S with the exhaust connection *q*. Therefore all the pistons G H K L M of the operating-valve descend, while simultaneously, the point *s* being fixed during such descent, the pilot-valve pistons O P Q are raised until the operating-valve and the pilot-valve shut off simultaneously, bringing the apparatus to rest in the position of Fig. 1.

Fourth, to allow the car to descend: The operator moves the pilot-valve pistons O P Q from the position of Fig. 1 to that of Fig. 7, in which the main pressure is introduced by the connection *p* and pipe *m* above the piston H, while the under side of said piston is opened to the exhaust *q* by the pipe *n* and holes 4, 5, and 6 in the rod S. Now all the pistons G H K L M descend to the position of Fig. 4, while simultaneously the pivot-valve pistons O P Q are shifted to the position of the same figure. Now the working and the piston-rod ends of cylinder A are connected by the channels *e f* with, respectively, the exhaust-ports *b c* and the car descends, lifting the piston B, the water above the said piston going to the exhaust, and the space U beneath said piston being filled by suction from the exhaust.

Fifth, to stop the car on the down motion: The operator shifts the pilot-valve pistons O P Q from the position of Fig. 4 to that of Figs. 2 and 3, but the lever V' inclining downwardly toward the rod T' because the pistons G H K L M are in the position of Fig. 4. In this position of the pilot-valve the upper side of piston H is connected with the exhaust *o* by pipe *m*. Now, the pistons G H K L M having been momentarily in the previous position of Fig. 4, the main pressure from pipe *d* went by the holes 2 and 1 and check-valve J in the hollow rod T to the under side of piston H. Thus all the pistons G H K L M rise, simultaneously depressing the pilot-valve pistons O P Q until both the operating and pilot valves shut off, bringing the apparatus to rest in the position of Fig. 1.

Referring to Figs. 10, 11, and 12, the packings R R', of any suitable material and having a central perforation to permit the working of the rod S, are arranged, respectively, in chambers 10 and 11 in the casing N, which casing is joined on the line *z z* about midway between the packings R R' and through the port *n*. Said packings are held in place by the bridge 12 and the lugs 13 and 14 on the casing N. Said bridge 12 is constructed with top and bottom flanges 15 16, perforated to permit the passage of the rod S, and with separators 17 17. The joint in the casing N through the port *n* is kept tight in any ordinary manner.

Now, having described my improvements, I claim as my invention—

1. The combination with the motor of hydraulic hoisting apparatus, of a main operating-valve for controlling the supply and exhaust channels of the motor, and differential pistons operatively connected and moving with said main operating-valve, and also operatively connected with the main pressure and the motor and adapted to actuate said main operating-valve according to the load on the motor, substantially as described.

2. In the motor of a hydraulic hoisting apparatus, the combination of a main operating-valve for controlling the supply and exhaust channels of the motor, differential pistons operatively connected and moving with the main operating-valve, and adapted to actuate said main operating-valve according to the load on the motor, a connection continually open from the main pressure to one side of the smaller differential piston, a connection from the motor to the opposite side of the larger differential piston, independent discharge and supply connections from said larger differential piston, and a pilot-valve controlling said independent supply and discharge connections, substantially as described.

3. The combination with the motor of hydraulic hoisting apparatus, of a main operating-valve for controlling the supply and exhaust channels of the motor, differential pistons operatively connected and moving with the main operating-valve, and also operatively connected with the main pressure and the motor and adapted to actuate said main operating-valve according to the load on the motor, channels from the working and piston-rod ends of the motor to the main operating-valve, a connection between said channels, and a check-valve in said connection adapted to open toward the working end of the motor, substantially as described.

4. The combination with the motor of a hydraulic elevator, the channels from the working and piston-rod ends thereof, and main supply and exhaust pipes, of a main operating-valve adapted to control the communica-

tion between said channels and pipes, a pilot-valve operatively connected with said main operating-valve, a lever connecting the rods of said main operating and pilot valves, links in the rod of said main operating-valve, and a guide adapted to deflect said links laterally, so as to permit of additional motion of said operating-valve, substantially as described.

5. In a hydraulic elevator, a main operating-valve comprising the following parts, to wit: a casing, differential pistons G, H, pistons K L M connected with said pistons G H by a rod, a hollow rod T containing orifices 1, 2, and a check-valve *j* and extending between said pistons H and L, ports in said casing connecting with pipes from the motor and with main supply and exhaust pipes, a rod T' provided with links t^2 t^3, a guide adapted to deflect said links, a pilot-valve, and a lever connecting the stem thereof with said links, substantially as described.

6. In a hydraulic elevator, and in combination with an operating-valve, a pilot-valve provided with a connection from the main and exhaust ports, connections with the operating-valve, pistons O, P and Q, a hollow rod S connecting the pistons P, Q, and holes 4, 5, 6 in said rod S, substantially as described.

7. In a hydraulic elevator, and in combination with a main operating-valve differential pistons connected and moving with said main operating-valve and adapted to automatically control the power according to the load, a pilot-valve provided with a tubular stem, and orifices therein, a casing for said valve, and packings fixed in said casing and adapted to control communication between the orifices of said tubular stem, substantially as described.

8. In a hydraulic motor, the combination of a motor-cylinder, a main operating-valve controlling said motor and adapted to differentiate the power according to the load, a channel from the working end of the cylinder to the main operating-valve, a channel from the piston-rod end of said cylinder to said operating-valve, a check-valve controlling the direct communication between said channels, and a passage *k* located between said channels and leading from one side of the check-valve to the main operating-valve, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 26th day of July, 1894.

KENNERLEY BRYAN.

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