(No Model.) 2 Sheets—Sheet 1.

H. B. GALE.

CONTROLLING DEVICE FOR ELEVATORS, &c.

No. 598,416. Patented Feb. 1, 1898.

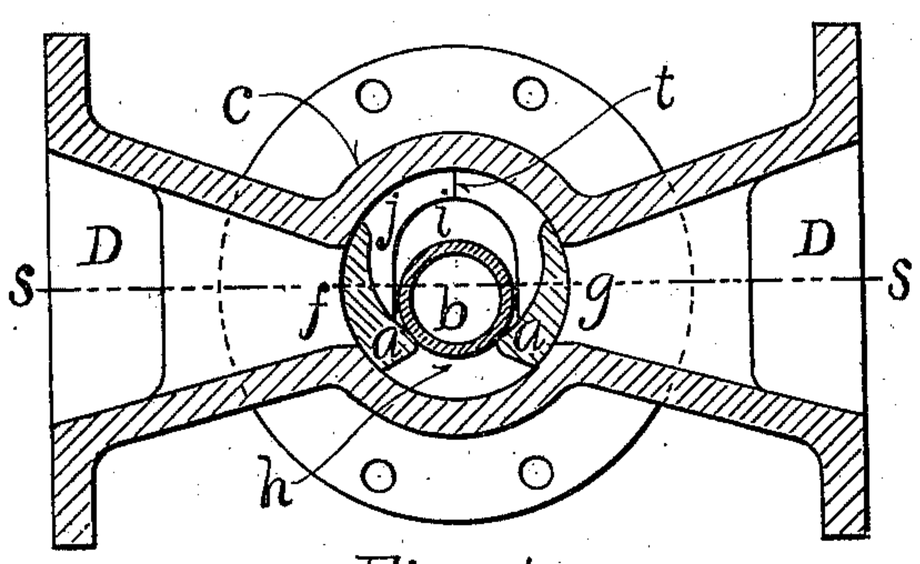

Fig. 1.

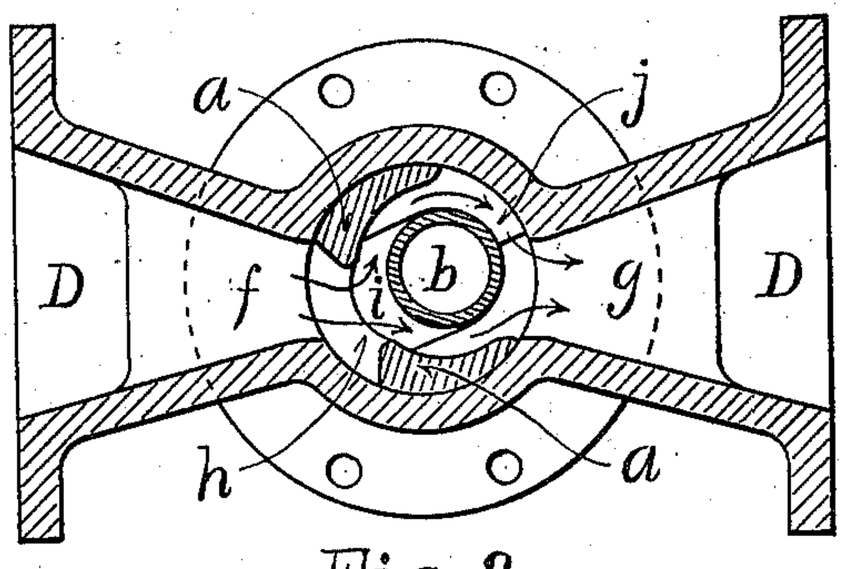

Fig. 2.

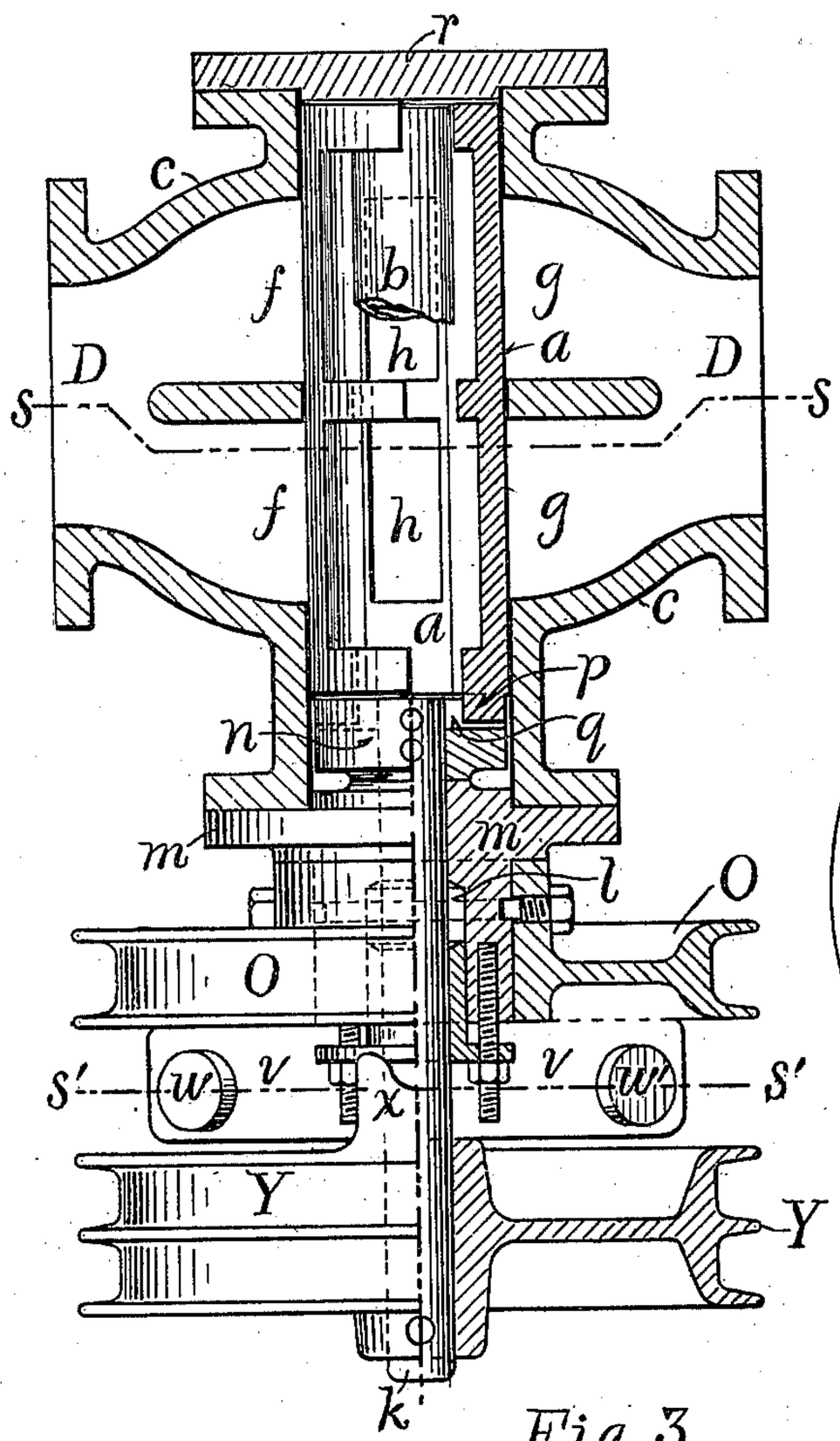

Fig. 3.

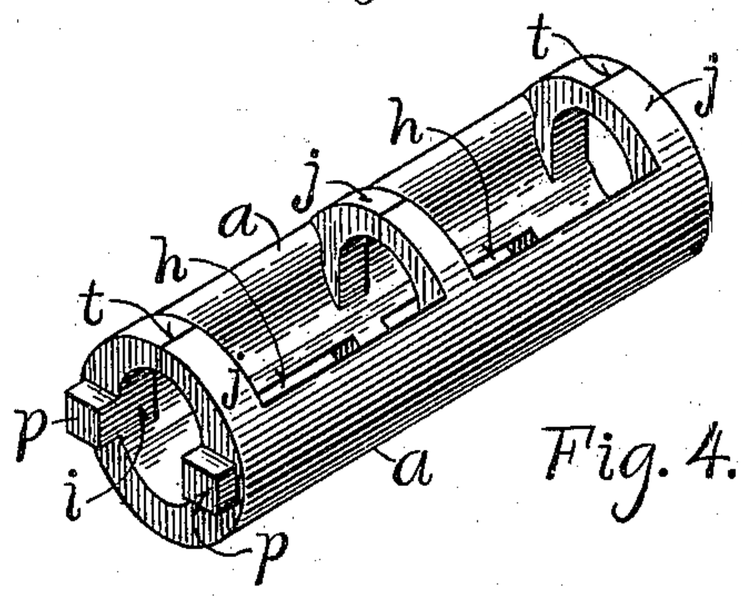

Fig. 4.

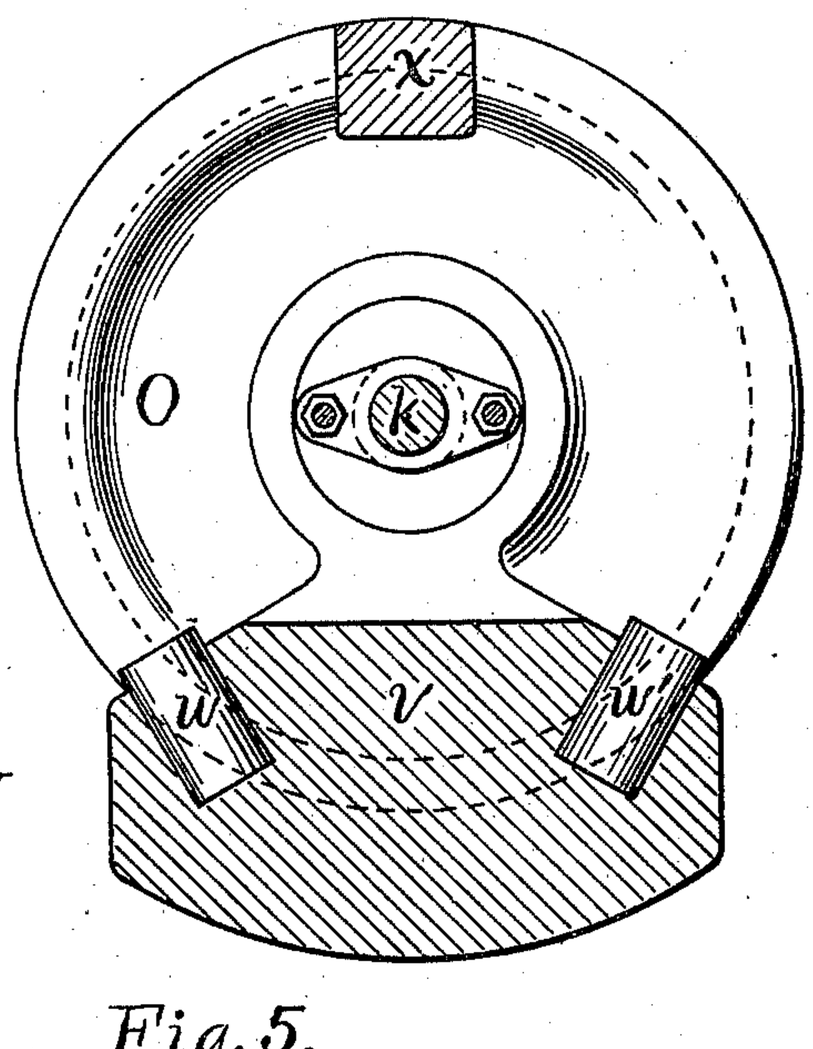

Fig. 5.

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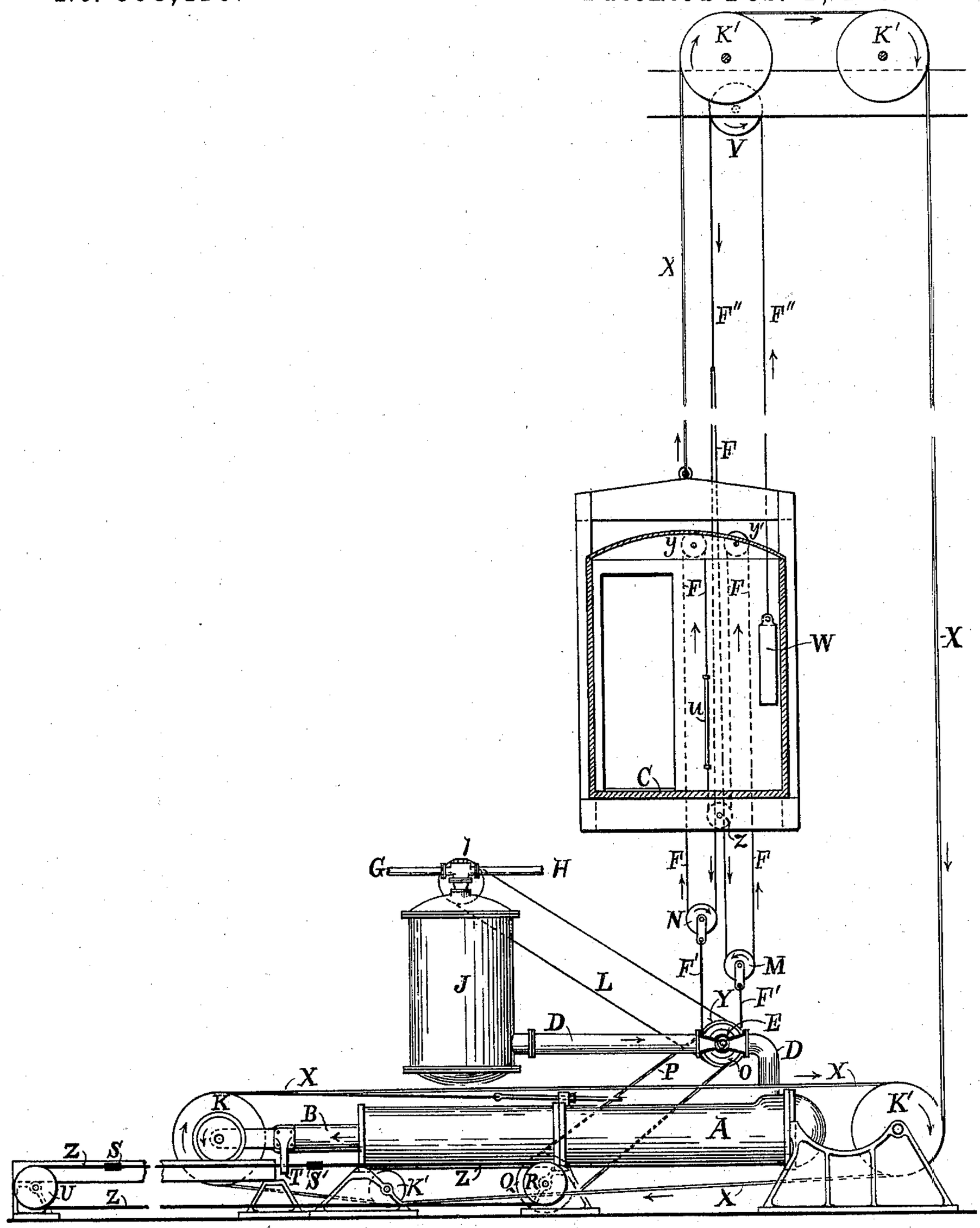

Fig. 6.

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CONTROLLING DEVICE FOR ELEVATORS, &c.

SPECIFICATION forming part of Letters Patent No. 598,416, dated February 1, 1898.

Application filed February 8, 1896. Serial No. 578,591. (No model.)

To all whom it may concern:

Be it known that I, HORACE B. GALE, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Controlling Devices for Elevators and Hoisting Apparatus; and I do hereby declare the following to be 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 devices for controlling the operation of those types of hoisting apparatus in which the movements of the load are produced by or dependent upon corresponding continuous relative movements of a cylinder and a piston or plunger subjected to the pressure of a liquid, including hydraulic elevators, cranes, and the like; and the improvements claimed are designed more especially for use in that class of hydraulic elevators in which the main working piston or plunger is propelled by the combined action of a liquid, as water, and an elastic fluid, such as steam or air. Such elevators, which have been distinguished, respectively, as "hydro-steam" and "hydropneumatic" elevators, are included herein under the title "hydraulic elevators," which is used in this specification as a general designation for the class of elevators to which the improvements described are applicable.

The main object of my invention is to provide a new and simple form of controlling-valve designed to be operated with comparatively little resistance, which shall remain tight without packing and which shall act also as a check-valve to prevent accidental reverse movements of the elevator.

In the accompanying drawings, which constitute a part of this specification, Figures 1 and 2 each show a vertical section, and Fig. 3 a horizontal section, of a main controlling-valve, the section planes being indicated by the lines *s s*. Fig. 4 is a view of the main valve removed from the case. Fig. 5 is a section on the line *s' s'* of Fig. 3, and Fig. 6 is a general diagram showing the essential mechanism of an elevator for high service and illustrating the connection of the controlling devices therewith.

Similar characters indicate similar parts in all the views.

Referring to Fig. 6, A indicates the working cylinder, and B the plunger or piston-rod, which carries the sheaves K, around which and the fixed sheaves K' are passed the ropes X, which support the car or platform C.

D indicates the main pipe or passage by which the water or other liquid enters and leaves the cylinder, E the controlling-valve in that passage, and F a hand-rope by which the valve is operated from the elevator-car.

G indicates a supply-pipe for the working fluid, H a discharge-pipe, and I an admission and exhaust valve by which the working fluid is admitted to and discharged from the outer portion of the passage D.

The valve I and the details of the mechanism for operating the valves from the elevator-car are not essential parts of the present invention, and they may be of any suitable types known and used in this art for similar purposes.

Fig. 6 represents an elevator in which an elastic fluid, such as compressed air or steam, is supplied through the pipe G and valve I to press upon the surface of the water in the passage D, which is enlarged for this purpose at J, so as to form a receiver of somewhat greater capacity than the working cylinder. This type of elevators is chosen for illustration because they are ordinarily more liable than other forms of hydraulic elevators to accidental reverse movements. To prevent such movements, various combinations of check-valves have been devised and used heretofore, all of which require at least two independent check-valves acting in opposite ways. Such a device, for example, is covered by United States Patent No. 510,638, granted to me December 12, 1893.

The controlling-valve E, which is to be described, accomplishes the same result as the earlier combinations referred to and is believed to possess certain advantages in uniting simplicity and cheapness of construction and ease of operation over any combination of valves heretofore employed for this purpose.

It may be explained here that simple stop-valves, which when opened permit the water to flow in either direction, either into or out of the operating-cylinder, do not work well

on elevators of the class illustrated, which use an elastic fluid to propel the water, for when the loaded car or platform C has been raised the receiver J remains filled with compressed air or steam, which will not instantly escape on the opening of the exhaust-valve I for the purpose of lowering the platform. Therefore unless a check-valve were provided in the passage D to prevent a flow of water in the wrong direction the platform in such a case would at first move upward for a short distance until the pressure in the outer end of the passage D was sufficiently reduced and would then begin to descend.

The construction of the controlling-valve is illustrated in Figs. 1, 2, 3, and 4. The stop-valve portion of it consists, essentially, of a plug *a*, inclosed in the chamber or case *c* and capable of closing the ports *f* and *g*, which connect the chamber *c* with the main water-passage D on each side. In the lower side of the plug *a* is a port *h*, which in Fig. 1 is closed by the auxiliary check-valve *b*. The latter is a plain cylinder resting loosely on the edges of the port *h*, which are bored to fit it, and is capable of a slight free movement away from its seat, limited by the oval slots *i* in the rings *j*, which form part of the main valve *a*.

The plug *a* can be turned toward the right or left from the position shown in Fig. 1 by means of the spindle *k*, which passes through a stuffing-box *l* in the cylindrical head *m* and has a disk *n* attached to its inner end. The plug *a* is provided with two projecting studs *p*, which fit loosely in the slot *q* in the face of the disk *n*. The stop-valve *a* and the check *b* can be slipped out of the casing on removing the head *r*. A fine saw-cut *t* is made through the top of the rings *j* after the plug *a* has been turned to fit the casing *c*, which gives the plug sufficient spring to allow it to enter easily.

The spindle *k* may be oscillated by an operator in the elevator-car by means of a wheel Y and ropes F and F′, as shown in Fig. 6, or by other means known in the art.

When the controlling-valve is closed, as in Fig. 1, the pressure of the water in the passage D, being transmitted to the inside of the chamber *c*, forces one or the other face of the valve *a* outward against its seat on the low-pressure side of the chamber, thus preventing leakage. When the valve *a* is turned through an angle of about sixty degrees toward the right, as shown in Figs. 2 and 6, the water can flow freely in the direction indicated by the arrows in those figures, the cylindrical check-valve *b* being pushed away from its seat to the extent permitted by the slots *i*; but any tendency of the water to return will cause the check-valve *b* to roll down against its seat and close the passage. This allows the platform C to go up if the pressure in the outer portion of the passage D is sufficient to raise it, but will not permit it to run down should the pressure be too low. If the valve is turned through an equal angle to the left from the position of Fig. 1, the check-valve *b* is set to open in the reverse direction, and the water can flow through the passage D only from right to left or away from the working cylinder in Fig. 6.

In Figs. 3, 5, and 6 are illustrated automatic means for closing the controlling-valve E, so as to stop the car at the upper and lower limits of its travel. O indicates a wheel free to turn on an extension of the head *m* and provided with a projecting lug *v*, capable of engaging the lug *x* on the wheel Y. The lug *v* carries wooden plugs *w* and *w′*, which serve to cushion its contact with the lug *x*. The wheel O is connected by a cord P with the wheel Q on the same shaft with the wheel R, between which and the wheel U is stretched a cord Z, carrying the lugs S and S′.

When the car C approaches, for example, the upper limit of its motion, the tappet T, carried by the piston-rod B, strikes the lug S, turning the wheel O by means of the cords Z and P until the lug *v* engages the lug *x* and turns also the wheel Y, thus closing the valve E and stopping the motion of the elevator. When the car has reached the limit thus set for its upward movement, the controlling-valve cannot be opened by the hand-rope F in the direction required for going up, as the lug *v* prevents any movement of the wheel Y in that direction; but it can be turned freely in the opposite direction, so that the starting of the car downward is not at all interfered with by the limit-stop. When the car approaches the lower limit of its travel, the tappet T strikes the lug S′, turning the wheel O in the opposite direction and closing the valve E in a similar manner. In this position the valve cannot be opened for a further descent, but may be moved freely in the direction required for going up. The limits of travel for the car can be set at any desired points by adjusting the lugs S and S′ on the cord Z. The lug *v* is extended beyond the rim of the wheel O, forming a weight, which serves to return the wheel O to its mid-position as soon as the tappet T releases the lug S or S′.

The hand-rope F, as shown in Fig. 6, is looped around the movable sheaves N and M, whose axes are attached by the rope F′ to the wheel Y. The latter is provided with a second groove which carries the cord L for actuating the admission and exhaust valve I. The hand-rope is also led around the sheaves *y*, *y′*, and *z*, whose axes are carried by the car C, and its two ends are carried up and united to a single rope F″, which passes over the stationary sheave V and supports a weight W, by which the ropes F and F′ are kept taut. A handle *u* may be attached to the rope F at a convenient point in the car, or, if preferred, the rope may be shifted by turning the wheel *z*.

The diagram shows the relative positions of the parts when the elevator is going up, the arrows indicating the direction of motion of all the moving parts of the apparatus. It will be observed that the parts of the hand-

rope carried by the sheaves y, y', and z normally travel with the car, as does also the tension-weight W. The latter therefore may be guided by the car and does not require guides running the length of the shaft.

The arrangement of the hand-rope shown is the one which I prefer for use with the system of valves which has been described, especially in high-speed elevators, for the following reasons: First, because the manipulation of the hand-rope is not interfered with by any relative motions between it and the car; second, because the use of the sheaves N and M gives a double purchase on the rope F', making the movement of the valve easier; third, because neither the stretching of the ropes nor the movement of the car has any tendency to displace the valve E, and, fourth, because the hand-rope F cannot be manipulated so as to interfere with the automatic closing of the valve at the extreme limits of the car's travel. The latter point may be explained as follows: The connections between the stops S and S' and the valve E are positive and unyielding whenever the lug v has been brought in contact with the lug x; but the handle u on the hand-rope F controls only one-half of each of the loops supporting the sheaves N and M, the inner part of each loop being supported by the rope F'' and the weight W. Consequently if the sheave N, for example, is drawn down by the action of the limit-stop in closing the valve, while the handle u is held, the effect is to slightly raise the weight W. As soon as the restraining force is removed the weight W will draw the handle u back to its middle position. This arrangement of the hand-ropes, in combination with the design of the automatic stop-motion, thus permits the limit-stop to be applied to the main controlling-valve E with the same degree of safety and independence in operation as is attained in other constructions by the use of a separate valve for that purpose.

Although the use of the special controlling-valve E or an equivalent combination of check-valves for preventing accidental reverse movements of the car is more especially required in elevators and other hoisting apparatus employing an elastic working fluid in the manner described, the use of this valve is not restricted to such cases and frequently it may be employed with advantage in hydraulic elevators worked entirely by water from tanks, service-pipes, or the like, especially in freight-elevators, which are liable to troublesome reverse movements when the attempt is made to start them upward under an excessive load or with insufficient working pressure. The arrangement and operation of all the valves shown in Fig. 6 may remain the same whatever working fluid is supplied through the pipe G; but when water alone is used the enlarged receiver J is omitted.

It is evident that the plug a instead of being made perfectly cylindrical may, if preferred, be made slightly conical or tapering and fitted to a correspondingly-tapered bore in the casing c. When the plug a is tapered, the lengthwise saw-cut t is omitted.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a controlling device for a hydraulic elevator, the combination of a cylindrical-faced check-valve in a passage by which the liquid enters and leaves one end of the working cylinder, a movable valve-seat fitting the cylindrical face of the valve, and means controllable by hand from the elevator-car for shifting the position of the said valve-seat whereby the valve may be set at will to open in either direction relative to the said passage, so as to permit a movement of the car in either direction desired by the operator and to prevent any movement in a contrary direction, substantially as described.

2. In a hydraulic elevator or hoisting apparatus, the combination with the working cylinder of a controlling device in a passage by which the liquid enters and leaves the same, comprising an oscillating stop-valve, capable of closing the passage, and an auxiliary rolling, cylindrical check-valve, fitting a port in the said stop-valve, and adapted to permit a flow either into or out of the working cylinder as determined by the adjustment of the said stop-valve, substantially as set forth.

3. A controlling device for a hydraulic elevator or hoisting apparatus, comprising a rotatable plug, capable of positively closing a passage communicating with the working cylinder, and an auxiliary rolling, cylindrical check-valve, adapted to close a port in the said plug, and opening to permit the passage of liquid in either direction through the passage, as determined by the position of the said plug.

4. In a controlling device for a hydraulic elevator or hoisting apparatus, the combination of an oscillating stop-valve in a passage by which liquid enters and leaves the working cylinder, and a rolling cylindrical check-valve adapted to close a port in the said stop-valve, and reversible in operation by the movement of the latter, substantially as set forth.

5. In a hydraulic elevator or hoisting apparatus, operated by the combined action of a liquid and an elastic fluid, the combination of a main hydraulic working cylinder, an oscillating stop-valve in a passage by which the liquid enters and leaves the same, an auxiliary rolling cylindrical check-valve fitting a port in the said stop-valve, and reversible in operation by the movement of the latter, a separate valve mechanism controlling the admission and exhaust of the elastic fluid, and an operating device controlling both the said separate valve mechanism and the said oscillating stop-valve, substantially as set forth.

6. A combined hand and automatic controlling device for a hydraulic elevator, com-

prising a reversible stop and check valve in a passage by which the liquid enters and leaves one end of the working cylinder, a traveling rope looped around sheaves operatively connected to the said valve, one part of each loop being connected to the hand controlling device in the elevator-car, and the other parts to a tension-limiting device, and a positively-acting mechanism operated independently by the movement of the elevator to close the said valve at determinate points in the travel of the car, whereby the operating-valve is positively closed against any further passage of the liquid in the same direction, independently of any movement of the hand-rope, without interfering with the free opening of the said valve by the hand-rope to permit a flow of liquid in the reversed direction, all substantially as and for the purposes set forth.

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

HORACE B. GALE.

Witnesses:

F. R. HUTTON,

FRANCIS W. HOADLEY.