(No Model.) 4 Sheets—Sheet 1.

N. C. BASSETT.

ELEVATOR.

No. 570,592. Patented Nov. 3, 1896.

Fig. 1

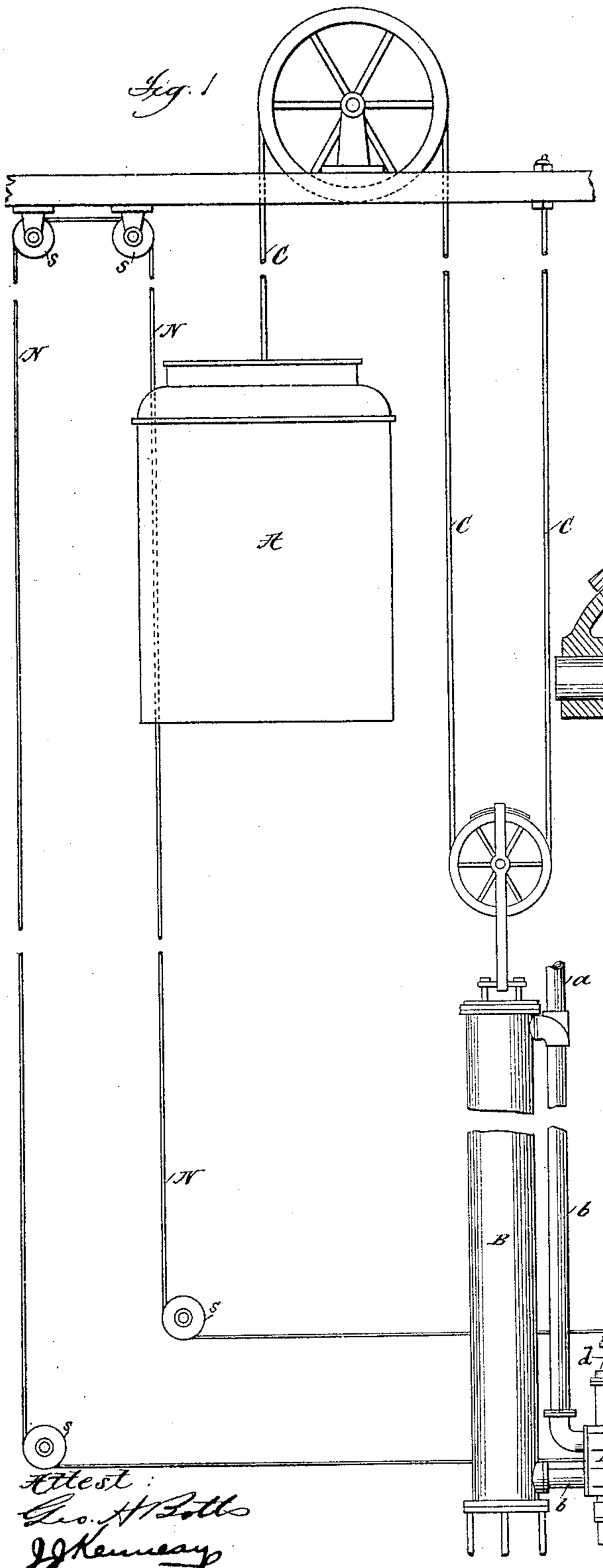
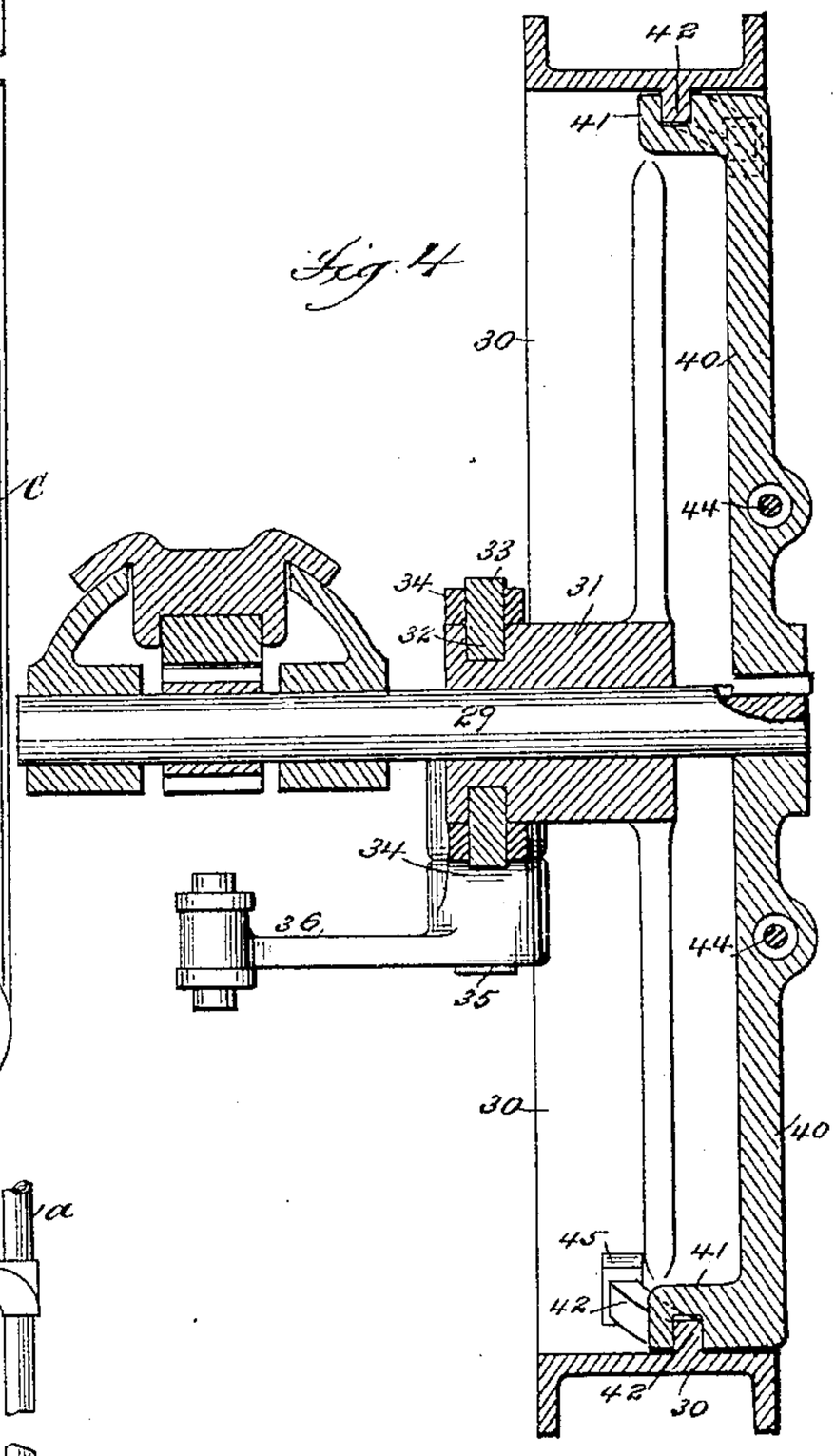


Fig. 4



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J. J. Kennedy

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by
Philip, Philp & Hovey
Attys

(No Model.) 4 Sheets—Sheet 2.

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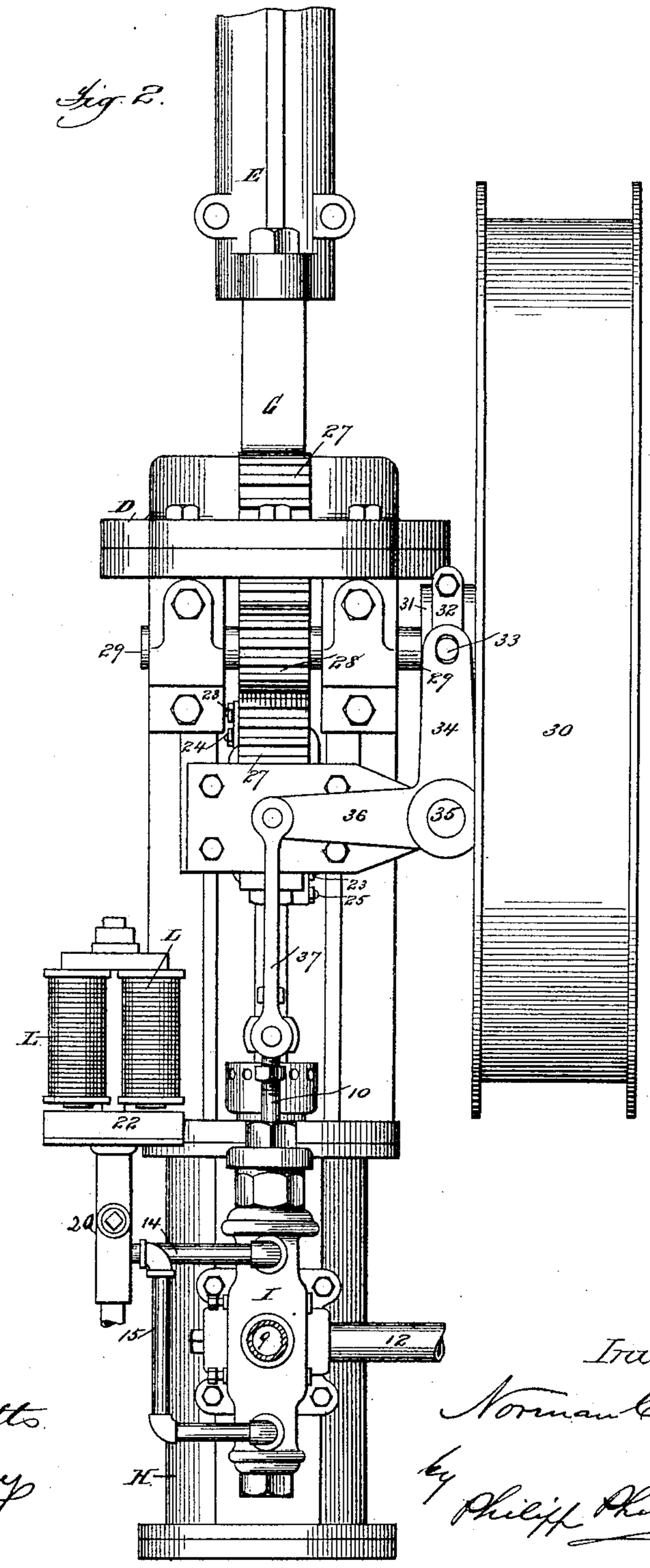
Fig. 2.



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(No Model.)

4 Sheets—Sheet 3.

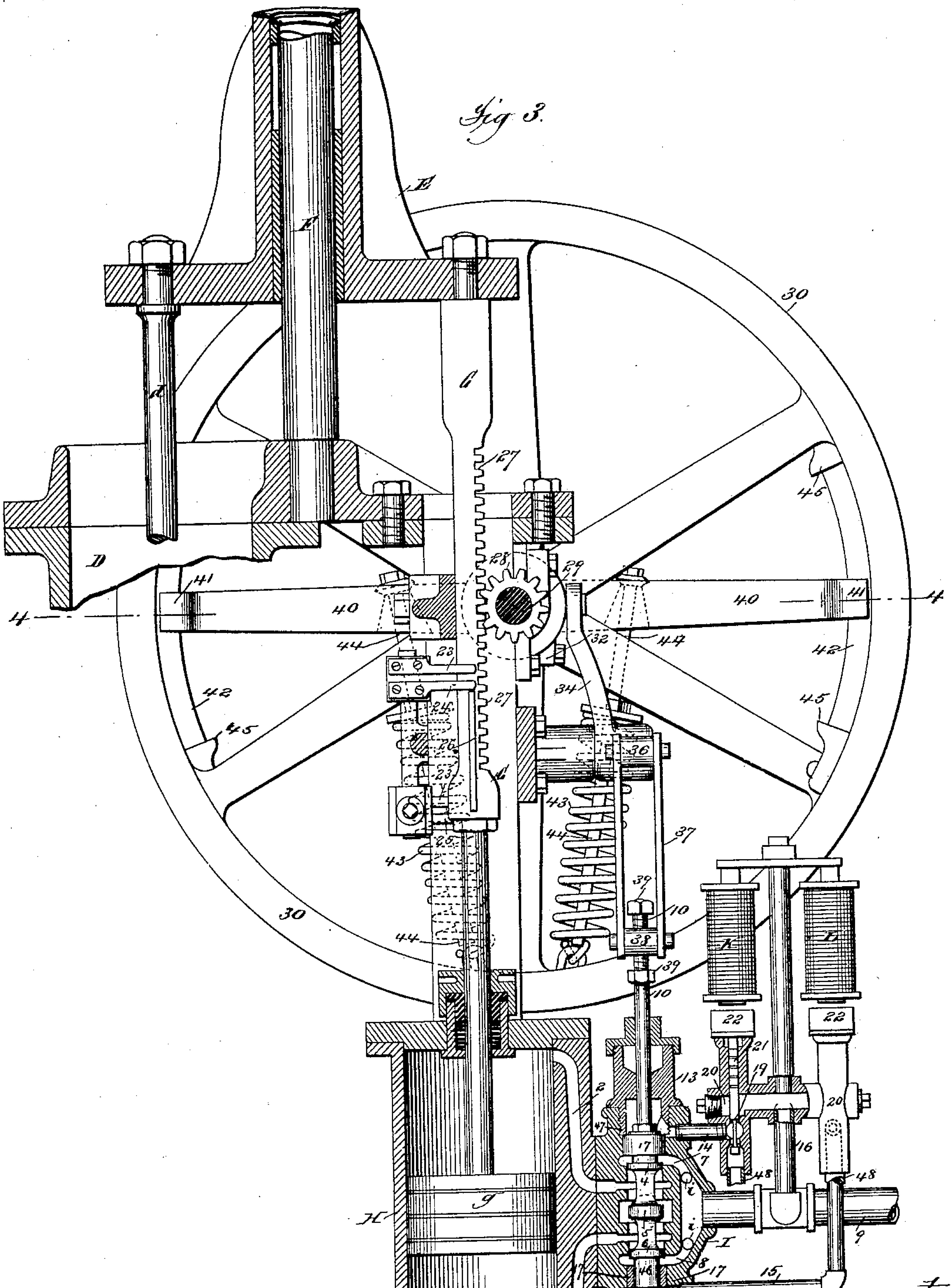
N. C. BASSETT.

ELEVATOR.

No. 570,592.

Patented Nov. 3, 1896.

Fig 3.



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(No Model.) 4 Sheets—Sheet 4.

N. C. BASSETT.

ELEVATOR.

No. 570,592. Patented Nov. 3, 1896.

Fig. 6.

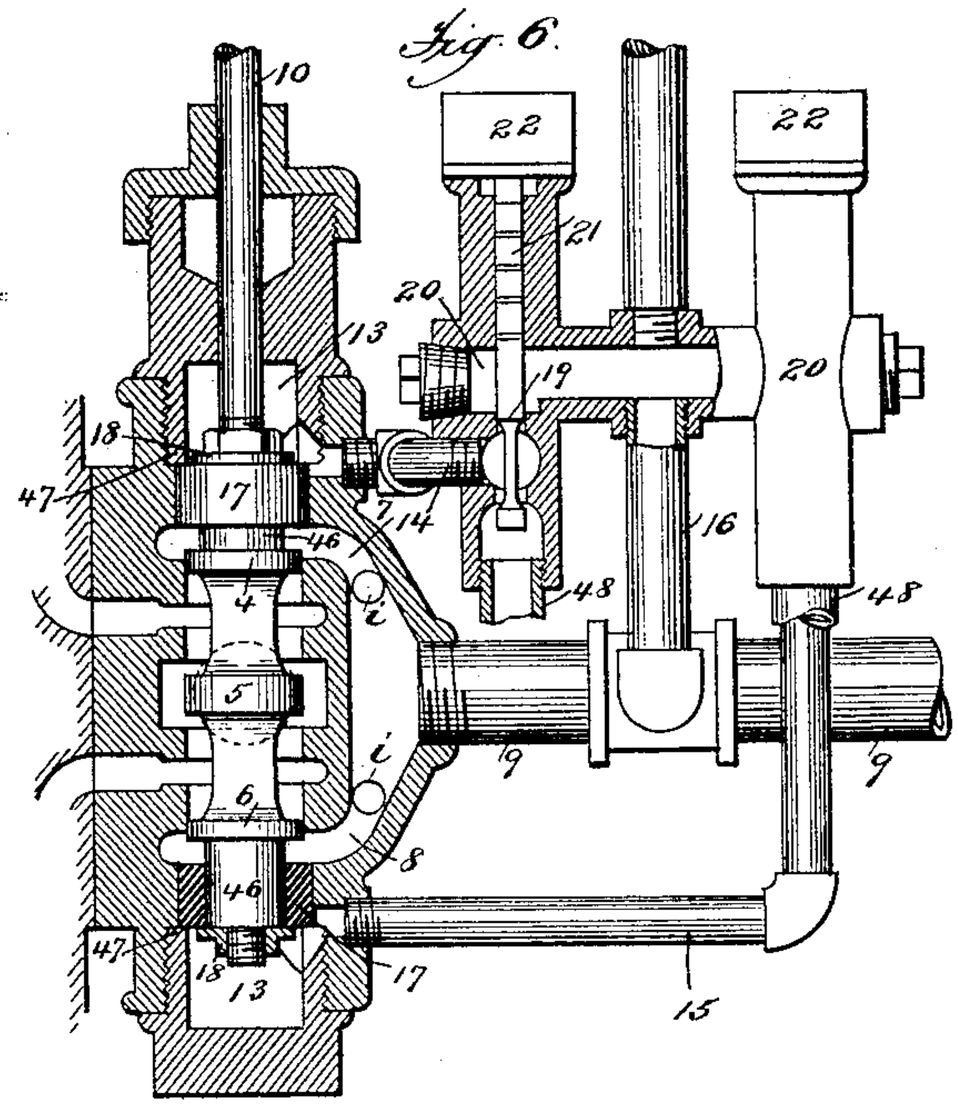

Fig. 5.

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UNITED STATES PATENT OFFICE.

NORMAN C. BASSETT, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE HYDRAULIC ELEVATOR COMPANY, OF ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 570,592, dated November 3, 1896.

Application filed July 6, 1888. Serial No. 279,190. (No model.)

To all whom it may concern:

Be it known that I, NORMAN C. BASSETT, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a valve apparatus for controlling the movements of an elevator-car.

A full understanding of the invention can only be given by an illustration and a detailed description of an organized elevator embodying the same. All preliminary description will therefore be omitted and a full description given, reference being had to the accompanying drawings, in which—

Figure 1 is an elevation of a hydraulic elevator equipped according to the present invention. Fig. 2 is an enlarged elevation of the auxiliary-valve apparatus, looking from the right of Fig. 1. Fig. 3 is a sectional elevation of the same. Fig. 4 is a horizontal section of the same, taken on the line 4 of Fig. 3. Fig. 5 is a diagram showing the electrical connections for operating the valve apparatus from the car. Fig. 6 is an enlarged view of a part of Fig. 3.

Referring to said drawings, it is to be understood that A represents the elevator-car, B a hydraulic cylinder or other motor by which the car is raised, and C the hoisting-cable, all of which parts are organized in the usual and well-known manner. The cylinder B is provided with the usual induction, circulating, and discharge pipes *a b c*.

D represents the mechanism for controlling the movements of the elevator-car, which in the case shown is the main induction and exhaust valve of the cylinder B, which is of any suitable construction to allow the water to circulate to cause the car to descend when the valve is in one position; to allow the water to escape from the cylinder to permit the car to ascend when the valve is reversed, and to prevent both the circulation and exhaust of the water to stop the car when the valve is in an intermediate or mid-position. Such cylinders and valves are in common use and their construction is well known. I have not, therefore, deemed it necessary to illustrate or describe the same in detail. It is to be understood, however, that the cylinder B may, if preferred, be arranged horizontally instead of vertically, or may be a motor arranged in any of the ways common in elevators.

The main induction and exhaust valve D or other controlling mechanism is connected by a rod *d* with a cross-head E, which works upon a vertical guide F and is provided with a rod G, which is connected to a piston *g*, which works in an auxiliary cylinder H, having induction and exhaust ports 2 3, which admit and exhaust the water to and from the opposite sides of the piston *g*, moving it and the connected main valve upward or downward as it is desired to cause the car to ascend or descend. The ports 2 3 are controlled by means of an auxiliary-valve apparatus I, which is operated through two primary valves from electromotors under control of the conductor in the car or of a person at any landing, as will be hereinafter described.

The auxiliary-valve apparatus consists, primarily, of a valve composed of three pistons 4 5 6, located in a valve-chamber into which the ports 2 3 open and into which also open ports 7 8, which communicate with an induction-pipe 9, through which water is admitted from the circulating-pipe *b* or other source under suitable pressure to operate the piston *g*. The pistons 4 5 6, forming the auxiliary valve, are connected to a common rod 10, and are so arranged that when in their normal or mid position they close both the ports 7 8 and prevent the entrance of water from the pipe 9 to the valve-chamber. The ports 2 3 are so arranged that when the auxiliary valve is in its mid-position they open into the chamber between the pistons 4 5 and 5 6, respectively. The chamber in which the auxiliary valve is located is also provided with an exhaust-pipe 12, which opens into the chamber in such position as to be directly opposite the piston 5 when the latter is in its normal or mid position, but this pipe is of such size as not to be closed by the piston 5, so that when this piston is in its mid-position

communication is established between both the ports 2 3 and the exhaust-pipe 12. When, however, the auxiliary valve is moved either up or down from its mid-position, communication is cut off between the port 2 or 3, as the case may be, and the exhaust-pipe, leaving that pipe, however, in communication with the other port. The chamber in which the auxiliary valve is located is extended beyond the ends of the valve, forming two primary cylinders 13, which communicate by pipes 14 15 with a pipe 16, which in turn communicates with the pipe 9 or other source of water supply, and through which water is allowed to enter the cylinders 13, so as to act upon pistons 46, formed by the ends of the valve, to move the valve in opposite directions. The cylinders 13 are made somewhat larger in diameter than the pistons 46, and the pistons are provided with loose rings 17, which are acted on by the pressure of the water upon the induction side of the valve and move freely upon the pistons, but are limited in their outward movement by shoulders 47, formed on cylinders which overlap the rings. The ends of the pistons 46 are provided with flanges 18, which overlap slightly onto the rings and carry the rings away from the shoulders 47 when the valve is moved from its mid-position. The admission and exhaust of the water to and from the cylinders 13 are controlled by means of valves 19, termed, for convenience, "primary" valves, which are located in chambers 20, with which the pipes 14 15 16 communicate, and which also communicate with discharge-pipes 48, through which the water escapes after performing its work in the cylinders 13. The rods 21 of the valves 19 are connected to the armatures 22 of a pair of electromotors K L, which, as herein shown, consist of ordinary electromagnets, and will, therefore, for convenience, be hereinafter termed "magnets;" but it is to be understood that this term includes any form of electromotor which is capable of being energized by the passage through it of an electric current.

The operation of the apparatus as thus far described is as follows: So long as neither of the magnets K L is energized both of the primary valves 19 will remain in position to prevent any water from entering the primary cylinders 13 to act upon the pistons 46 and in position to allow the water in the cylinders to escape through the pipes 14 15 to the exhaust-pipes 48. When the primary valves are in this position, the water entering through the pipe 9 will act upon the rings 17, so as to force and hold both of the rings against the shoulders 47, thereby holding the auxiliary valve in its mid-position and causing the pistons 4 6 to close the induction-ports 7 8 and prevent the entrance of water to the auxiliary cylinder II, and as a consequence the main valve D will not be operated, but will remain in whatever position it may occupy. So long as the auxiliary valve is in its normal or mid-position both of the ports 2 3 of the cylinder II will be in communication with the exhaust-pipe 12, as already explained, so that any water in either end of the cylinder will be permitted to escape freely and thus offer no resistance to the movement of the piston *g* in either direction. As soon as one of the magnets—K, for example—is energised by the closing of the electric circuit through it its armature 22 will be attracted, thus raising the primary valve 19, connected to that armature, so as to close the exhaust 48 and open communication between the pipes 14 16 and thus allow the water to flow through the pipe 14 and enter the cylinder 13, so as to act upon the piston 46. The water thus entering the cylinder 13 and acting upon the piston 46 will overcome the pressure of the water against the opposite side of the ring 17 and move the auxiliary valve downward, so as to bring the ports 3 8 into communication and allow the water from the pipe 9 to enter the cylinder II and move the piston *g* upward. As the auxiliary valve is thus moved downward any water contained in the cylinder 13 below the valve will find its escape through the pipe 15 to the exhaust-pipe 48. At the same time that communication is established between the ports 3 8 by the downward movement of the auxiliary valve communication will also be cut off between the port 3 and the exhaust-pipe 12, as before explained; but communication will remain established between the port 2 and the exhaust-pipe 12, so as to allow the water contained in the upper end of the cylinder II to escape as the water enters the lower end of the cylinder. The upward movement of the piston *g* will, through the connections which have been described, impart a corresponding movement to the main valve, thereby allowing the water to escape from the lower end of the cylinder B and causing the car to ascend. As soon as the circuit through the magnet K is broken the primary valve 19 will resume its normal position, thereby opening communication between the pipes 14 and the exhaust 48; and as soon as this is done the pressure of the water upon the under side of the piston 6 will restore the auxiliary valve to its normal position and stop the movement of the main valve. By closing the circuit through the other magnet the same operation will take place, but in the reverse direction, thereby causing the main valve to move downward, so as to permit the water to circulate from the upper to the lower end of the cylinder B and permit the car to descend, or if it is desired to simply stop the car the circuit will be broken through the magnet as soon as the main valve D arrives at its mid-position. The car will then remain at rest.

The ports 7 8 are provided with adjustable plug-valves *i*, by which the areas of the two ports can be adjusted independently to regulate the supply of water passing to the upper and lower ends of the cylinder H. This is an

important feature, as it is frequently desirable to cause the pressure exerted upon the upper and lower sides of the piston *g* to vary to compensate for the weight of the piston and connected parts which acts to aid the piston upon its downward movement and to resist it upon its upward movement.

The system of electrical connections which will preferably be employed for energizing the magnets to operate the primary valve 19, as just described, will now be explained. In this explanation it will be assumed that the magnet K controls the ascent of the car and the magnet L its descent. In the organization as herein shown the two magnets are energized by separate batteries M, and this is preferable, but is not in all cases necessary, as in some cases a single battery may be employed for both magnets. One pole of each magnet is connected to a wire *f*, which leads to the elevator-car, where it is connected to two wires *h k*, which return to the other poles of the magnets and include the batteries M. The courses of these circuits and also of the other circuits to be hereinafter referred to can readily be traced by reference to Fig. 5 of the drawings. The wires *f h k* are connected to the traveling car by being formed into a suitable cable which hangs in the shaft with sufficient slack to allow for the travel of the car. The circuits *f h* and *f k* thus formed, each of which includes one of the magnets, are provided with push-buttons or other circuit-closers *l m*, located upon the car.

The term "push-button" is herein used for convenience and it is to be understood as including any means for making and breaking the circuits.

From the description of the auxiliary-valve apparatus which has already been given it will readily be seen that by operating the button *l* to close the circuit *f h* and thus energize the magnet K the car will be caused to ascend, and that by releasing said button, so as to break the circuit *f h* and deënergize the magnet, and then operating the button *m* to close the circuit *f k* and energize the magnet L, the car will be stopped or caused to descend according to the length of time the circuit *f k* is kept closed, and vice versa. The car can be controlled from the landings in the same manner by providing the circuits *f h* and *f k* with branch circuits which include push-buttons located at the landings.

From what has been said it will be seen that the circuits *f h* and *f k* are sufficient to enable the conductor to cause the car to ascend or descend and to come to rest at any desired point. In order, however, to stop the car in exactly the proper position at any landing, it is necessary to close the circuit, which is to reverse the main valve and hold it closed until the car has been brought to rest and then to immediately break the circuit, so as to arrest the main valve in its mid-position, as, if the circuit is maintained closed after the car has stopped, the main valve will not be arrested in its mid-position, but will move onward past that position and thus reverse the movement of the car. It is therefore desirable to provide means by which, when it is desired to stop the car at any landing, the circuit will be automatically broken as soon as the car is stopped. For this purpose the wire *f* is provided with a branch *n*, which includes a push-button *o*, located upon the car, and also a pair of contact-plates 23, located adjacent to the rod G of the auxiliary piston *g*, and the wires *h k* are provided with branches *p q*, which are connected to contact-plates 24 25, also located adjacent to the rod G and to the plates 23. The rod G is provided with two contact-plates 26, which are so positioned upon the rod that when the piston *g* is in its mid-position, which corresponds to the mid-position of the main valve, the connection will be broken between both the contact-plates 23 24 and 23 25, but that when the piston *g* has been moved up or down from its mid-position the plates 26 will operate to form an electrical connection between the plates 23 24 or 23 25, as the case may be, and the connection thus formed will remain until the main valve and the piston *g* have been moved back to their mid-position. Assuming, now, that the main valve has been moved upward from its mid-position, so as to cause the car to ascend and at the same time close the circuit through the plates 23 24, it is only necessary in order to stop and retain the car at any point to press the button *o*. The circuit will then be completed through the wires *n q k f*, thereby energizing the magnet L, so as to reverse the main valve and cause it to descend until it arrives at its mid-position, when the circuit will be automatically broken, thereby deënergizing the magnet and preventing the main valve from being moved past its mid-position and thus stop and retain the car. The operation of stopping the car when it is descending will be the same, except that in that case the circuit will be closed through the wires *n p h f* and the magnet K.

In addition to means for operating the controlling mechanism electrically in the ordinary working movements of the elevator it is desirable that means should be provided by which in case of an accident or in case the electrical appliances or the primary or auxiliary valves should for any reason become ineffective the conductor can have positive control of the main valve by means of mechanical connections. For this purpose the rod G of the auxiliary piston *g* is provided with a rack 27, which is engaged by a pinion 28, fixed upon a shaft 29, which carries a pulley 30, around which passes an ordinary hand-rope N, which passes around suitable pulleys *s* and extends through or adjacent to the car in the usual manner. The pulley 30 is mounted to turn freely upon the shaft 29 and to be capable of a limited movement longitudinally upon said shaft. The hub 31 of the pulley 30

is provided with a circumferential groove, in which is seated a loose ring 32, having trunnions 33, which are connected to a pair of rock-arms 34, which extend from a shaft 35, having an arm 36, which is connected by links 37 with a head 38, which moves freely between stops 39, formed upon the rod 10 of the auxiliary valve. The shaft 29 is provided with a pair of arms 40, which are keyed rigidly to the shaft and are provided at their outer ends with forks 41, which embrace oblique ribs 42, formed upon the inner periphery of the rim of the pulley 30 in such manner that whenever the pulley is moved about its shaft the ribs 42, moving in the forks of the arms 40, will act to move the pulley longitudinally on or along the shaft 29, and thereby impart a rocking movement to the arms 34 36. The movement of the forks 41 upon the ribs 42 is limited by means of stops 45, arranged upon the opposite sides of the forks. The arms 40 are connected to the pulley 30 by means of a yielding connection formed of springs 43, which are connected to the rim of the pulley and to rods 44, which pass freely through openings in the arms and are provided with heads upon the opposite sides of the arms. These springs are so adjusted as to normally hold the pulley in such position that the forks of the arms will be midway between the stops 45. The operation of this part of the apparatus is as follows: As the auxiliary piston *g* is moved up and down in the cylinder H by the admission and exhaust of water to and from the cylinder the rack 27, engaging with the pinion 28, will revolve the shaft 29 and impart a corresponding movement to the arms 40. The tension of the springs 43 is, however, so adjusted that as the arms 40 are thus moved the springs will overcome the resistance caused by the friction of the hand-rope in passing around its pulleys *s* and cause the pulley 30 to move with the shaft 29, so that the forks 41 will not move upon the ribs 42, and as a consequence the pulley 30 will not be caused to move longitudinally upon the shaft 29 and no rocking movement will be imparted to the arms 34 36. The stops 39 upon the rod 10 are so positioned with relation to the head 38 that so long as that head remains in its normal position the movement of the valve-rod 10, occasioned by the movement of the auxiliary valve, will not bring either of the stops 39 into engagement with the head 38. If, however, the pressure upon the rings 17 should at any time fail, owing to the binding of the rings or for any other reason, to restore the auxiliary valve to its normal or mid position after it had been moved in either direction, or if, owing to defective operation of either of the primary valves or for any other reason, the auxiliary valve should fail to operate properly to admit water to either end of the cylinder II, the conductor can by operating the hand-rope overcome the tension of the springs 43 and turn the pulley 30 upon its shaft 29. This will, through the ribs 42 and arms 40, cause the pulley to move longitudinally upon the shaft in one direction or the other, according to the direction in which the hand-rope is moved, and thereby rock the arms 34 36 and bring the head 38 into engagement with one or the other of the stops 39 and thus force the auxiliary valve to its normal position, so as to bring the ports 2 3 of the auxiliary cylinder into communication with the exhaust-pipe 12, and then operate the auxiliary valve so as to bring the ports 2 7 or 3 8 into communication to admit water to the upper or lower end of the cylinder II. As soon as the auxiliary valve has been brought to this position the stops 45 will engage with the ends of the arms 40 and thus lock the pulley 30 to its shaft 29, and the continued movement of the pulley by the hand-rope will then, through the shaft 29, pinion 28, and rack 27, operate the auxiliary piston *g* and the main valve directly. It will thus be seen that if for any reason the electrical apparatus becomes ineffective or the primary or auxiliary valves become inoperative, or any of the water-passages leading to the primary cylinders 13 or the auxiliary cylinder H become clogged, so as to prevent the proper operation of the auxiliary-valve apparatus, the conductor can have positive mechanical control of the auxiliary valve, and if this is not sufficient he can by the continued movement of the hand-rope have positive mechanical control of the main valve, the same as in the ordinary constructions in common use, and it will further be seen that by reason of the organization which has been described it is not possible for the main valve to become locked by the failure of the auxiliary valve to respond to the water-pressure, so as to maintain an open exhaust from the auxiliary cylinder.

I do not claim the combination, with the mechanism for controlling the movements of the elevator, of the auxiliary cylinder and piston for operating said mechanism, the auxiliary valve for controlling said piston, which valve is normally maintained in position to allow the water to flow out of the cylinder, a piston for operating said auxiliary valve, and a primary valve for controlling said last piston. Neither do I claim the foregoing in combination with a rope connected to operate said controlling mechanism from the elevator. Neither do I claim the electrical connections herein shown for operating the primary valves and for automatically arresting the main valve in its mid-position to stop the car, as these combinations and features are the invention of another.

What I claim is—

1. The combination with the mechanism for controlling the movements of the elevator-car and the auxiliary cylinder and piston II *g* for operating the same, of the auxiliary valve, the primary cylinders and pistons 13 46 for operating the valve, the loose rings 17 acted on by the water upon the induction side

of the valve and abutting against shoulders in the primary cylinders and flanges upon the primary pistons to hold the valve in its mid-position, substantially as described.

2. The combination with the mechanism for controlling the movements of the elevator-car and the auxiliary cylinder and piston II *g* for operating the same, of the auxiliary valve, the loose rings 17 acted on by the water upon the induction side of the valve and abutting against shoulders in the primary cylinders and flanges upon the primary pistons to hold the valve in its mid-position, and the primary valves 19 controlling the admission and exhaust of the water to and from the primary cylinders and normally maintaining an open exhaust, substantially as described.

3. The combination with the elevator-car, the mechanism for controlling its movements, the auxiliary piston connected to and operating said mechanism, the auxiliary valve for controlling said piston the primary valves 19 for controlling the auxiliary valve and the electromagnets for operating the primary valves, of mechanical connections for operating both the controlling mechanism and the auxiliary valve from the car, substantially as described.

4. The combination with the elevator-car, the mechanism for controlling its movement, the auxiliary piston connected to and operating said mechanism, the auxiliary valve for controlling said piston, the primary valves 19 for controlling the auxiliary valve, and means for operating the primary valves from the car, of mechanical connections for operating both the controlling mechanism and the auxiliary valve from the car, substantially as described.

5. The combination with the elevator-controlling mechanism and the shaft 29, of the pulley 30 having a limited lateral and rotary movement upon the shaft, the auxiliary valve, connections between the pulley and auxiliary valve for imparting the lateral movement of the pulley to said valve, means for clutching the pulley to the shaft to rotate the shaft, connections between said shaft and the controlling mechanism for operating the latter, and the hand-rope N for operating the pulley from the car, substantially as described.

6. The combination with the elevator-controlling mechanism and the shaft 29, of the pulley 30 having a limited lateral and rotary movement upon the shaft, the auxiliary valve, the arms 34, 36 connecting the hub of the pulley to the auxiliary valve with a limited lost motion between the two, means for clutching the pulley to the shaft to rotate the shaft, connections between said shaft and the controlling mechanism for operating the latter, and the hand-rope N for operating the pulley from the car, substantially as described.

7. The combination with the shaft 29 connected to operate the elevator-controlling mechanism, of the pulley 30, yieldingly connected to and free to move laterally upon the shaft, the arms 40 and ribs 42 for moving the pulley laterally, the auxiliary valve and connections for imparting the lateral movement of the pulley to the valve, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

NORMAN C. BASSETT.

Witnesses:
F. E. HERDMAN,
E. M. SPIRING.