S. C. GREER.

VALVE FOR ELEVATORS.

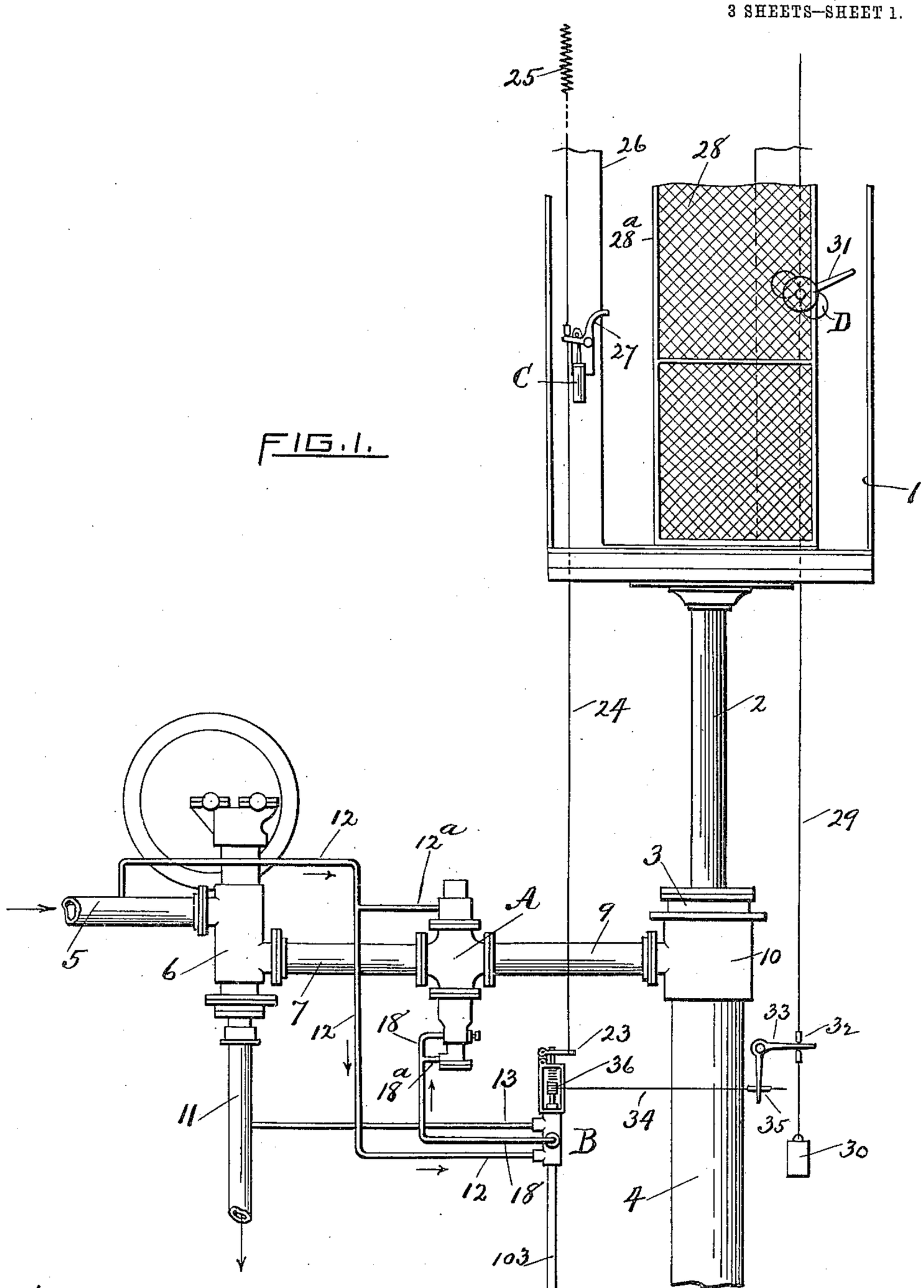
APPLICATION FILED JULY 10, 1913.

1,136,899.

Patented Apr. 20, 1915.

3 SHEETS—SHEET 1.

FIG. 1.



WITNESSES:

Peter L. Cannon

Geo. Parker

INVENTOR:

Samuel C. Greer.

By C. J. Hannigan

Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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3 SHEETS—SHEET 2.

FIG. 2.

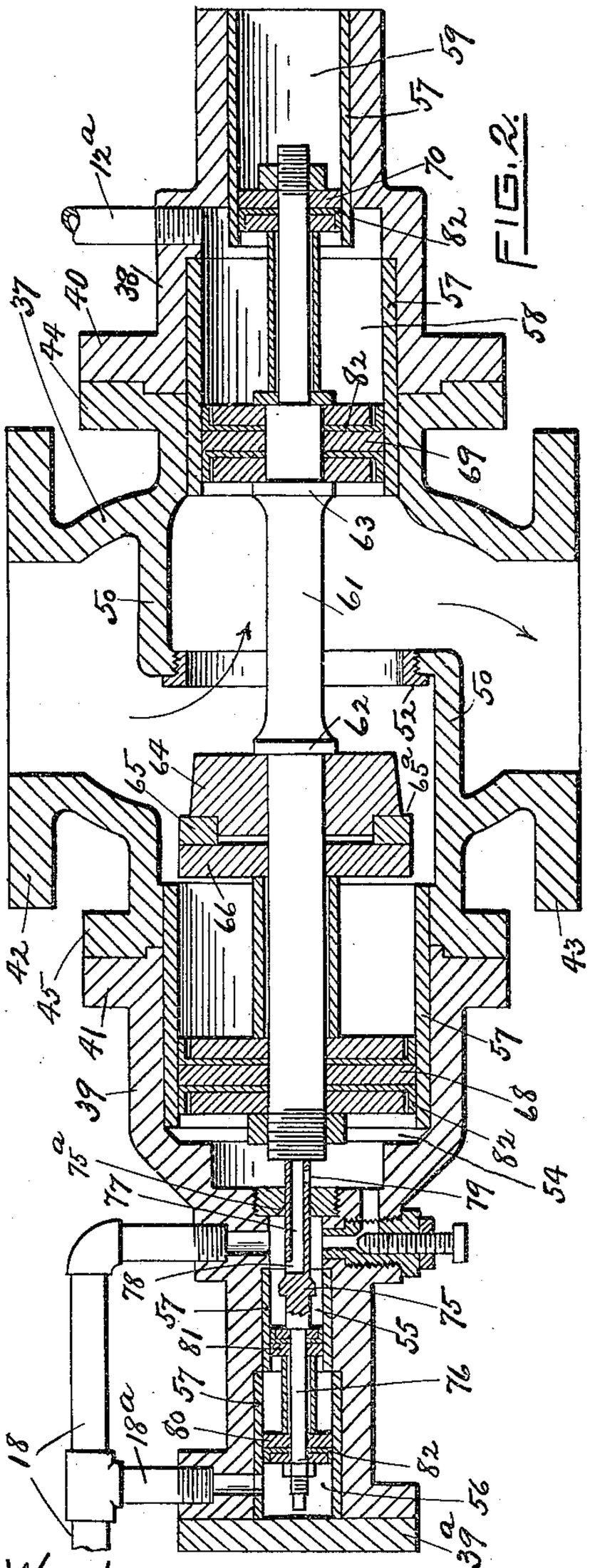
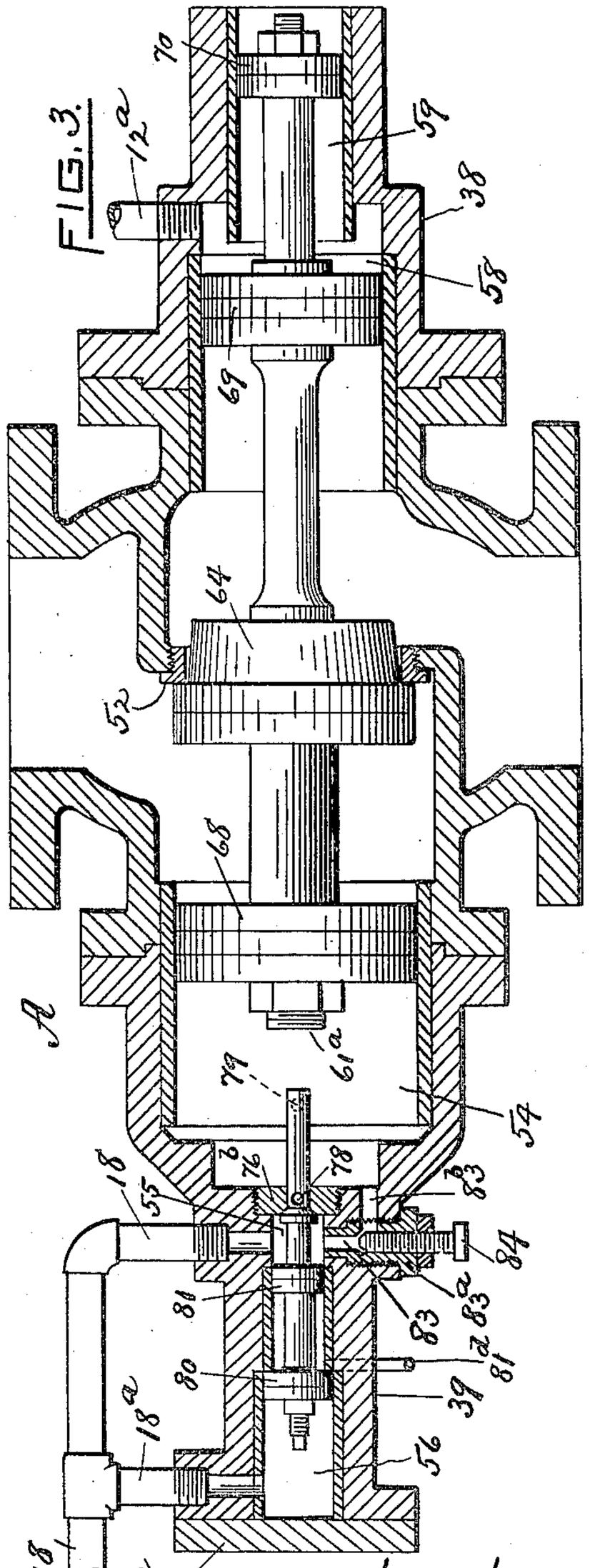


FIG. 3.



WITNESSES:

Peter B. Cannon

Geo. Parker

INVENTOR:

Samuel C. Greer.

By C. L. Hannigan

Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

S. C. GREER.

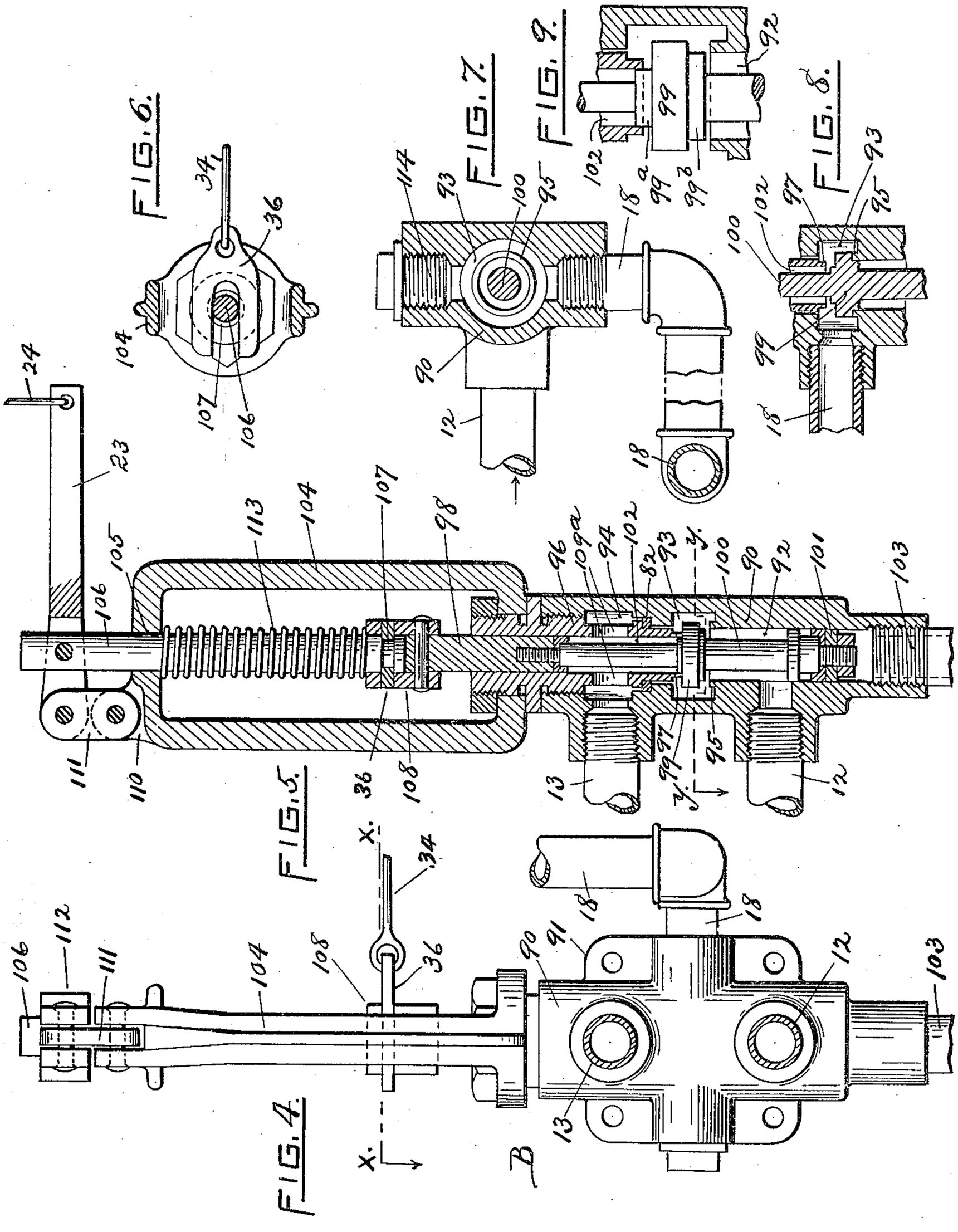
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INVENTOR

Samuel C. Greer.

By C. T. Hannigan

Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

SAMUEL C. GREER, OF WARWICK, RHODE ISLAND, ASSIGNOR TO SAFETY ENGINEERING COMPANY, OF PROVIDENCE, RHODE ISLAND.

VALVE FOR ELEVATORS.

1,136,899. Specification of Letters Patent. **Patented Apr. 20, 1915.**

Application filed July 10, 1913. Serial No. 778,265.

To all whom it may concern:

Be it known that I, SAMUEL C. GREER, a citizen of the United States, residing at Warwick, in the county of Kent and State of Rhode Island, have invented certain new and useful Improvements in Valves for Elevators, of which the following is a specification.

My invention relates to an improved valve mechanism adapted to be actuated by the tripping devices of the shaft doors of a hydraulic elevator; and the object in view is to provide a pilot-valve device and a cut-off-valve device operating automatically in conjunction with each other, to control the elevator when, on any floor of a building, a door opening therefrom to the elevator well is not closed or fastened, to prevent movement of the elevator, either up or down, whenever and when any such door remains open, and thereby to protect against accidents.

In the accompanying drawings like reference letters and numerals indicate like parts.

Figure 1 is a view in elevation showing the elevator car with its plunger and cylinder, in combination with my improved cut-off valve device and pilot-valve device, the shaft-door tripping device to actuate said pilot device, and the supply and discharge pipes for said cut-off device and said pilot device. Figs. 2 and 3 illustrate the construction of my improved cut-off valve device; Fig. 2 being a central longitudinal section of the device, showing the main cut-off valve in its open position, as when all doors of the elevator shaft are closed, and, Fig. 3, a similar view, showing the cut-off valve in its closed position, when one or more of the shaft doors are open. Figs. 4 to 9 inclusive, illustrate my improved pilot-valve device for actuating the closing and opening of the cut-off valve device; Fig. 4 being a side view of said pilot-valve device; Fig. 5, a central vertical section of said device, showing the position its double acting valve assumes when one or more of the elevator shaft doors are open; Fig. 6, a plan section as seen on line *x.—x.* of Fig. 4; Fig. 7, a plan section on line *y.—y.* of Fig. 5; Fig. 8, a partial central vertical section, showing the pilot-valve as seated against constant supply to one end of the cut-off valve device, as when all of the shaft doors are closed, and, Fig. 9, an enlarged detail view of the pilot-valve, showing its manner of construction to close one chamber before unseating to open its opposite chamber.

Referring first to Fig. 1 for a complete combination of the several parts of my invention in their mutual relations and positions, illustrating the whole in one comprehensive view, it is seen that the elevator car 1 has the usual plunger 2, which passing through the stuffing-box 3, moves up and down in the cylinder 4 in the usual and well-known manner. The elevator is equipped with the various appliances for the operation and control thereof, but these equipments are not shown in the drawings, as they do not constitute any part of my invention hereinafter described. A supply pipe 5, from a street main or other source of hydraulic power, admits water to the usual motor or elevator operating valve 6. A pipe 7 conducts water from the motor valve 6 into my improved cut-off valve device, designated by letter A as a whole, and the cut-off valve of said device is open while the elevator is properly working and the doors from the various floors in the building to the elevator well or shaft are all shut, but said valve acts to cut off the main pressure to and from the elevator cylinder 4 when any such doors are open, and the mechanism of said cut-off device operates as hereinafter explained.

A pipe 9 discharges from the cut-off device A into the head 10 of the plunger-cylinder 4. A pipe 11 is the usual discharge from the motor valve 6 to the sewer or other suitable drain. A small pipe connection 12 leads from the main supply pipe 5, at a point just before said supply pipe enters the motor valve 6, to a lower chamber 92 formed in the pilot-valve device, which is designated by reference letter B as a whole, and said pipe 12 has a branch connection 12ª to an upper bonnet of the cut-off device A, to give a constant pressure to a chamber 58 formed in said bonnet. A small discharge pipe 13 leads from an upper chamber 94, formed in the pilot-valve device B, to the main discharge pipe 11. A small pipe connection 18 leads from a chamber 55 formed in a lower bonnet, of the cut-off device A, to a chamber 93 formed in and intermediate the aforesaid chambers 92, 94 of the pilot-valve de-

vice B, and said pipe 18 has a branch connection 18ª which leads to a chamber 56 formed in said lower bonnet in which the pipe 18 enters. These pipes 18 and 18ª serve as a supply and also a discharge between the devices A and B.

The pilot-valve device B has a pivotally mounted swinging arm 23 to which the end of a cable 24 is attached, and this cable extends vertically up through the elevator shaft or well and attached to the lower end of a coil spring 25, whose upper end is fastened to the roof of the elevator well or other proper support there.

On the side of the elevator shaft or well, and near the jamb 26 of the door opening or entrance into the latter, is a spring-controlled bell-crank lever 27 which engages loosely with the cable 24, and said lever forms a working part of a tripping device for the shaft-door.

The elevator well door 28 is on the floor of the building, and this door and all other doors to the well or shaft should always be closed, except, of course when it must be opened for the entrance or exit of passengers, to or from the floor of the elevator car.

For entrance or exit purposes the door 28 is moved by the hand of the operator along its own run-way. But at all times the operator should see that the door 28 is slid so that its upright edge 28ª is closed against the jamb 26 and at the same time in forcible contact with the spring-pressed lever 27. Another cable 29 is suspended vertically from the roof of the elevator well and is held taut by a weight 30. An emergency operating lever 31, in combination with take-up rollers, is engageable at will with the cable 29. The lower end of the cable 29 is connected at 32 to an arm of a bell-crank lever 33, and a short horizontal cable 34 has one end connected at 35 to the other arm of said lever and its opposite end fastened to a slidable key 36.

The construction of the cut-off valve device A, as shown in Figs. 2 and 3, is as follows: The valve case 37 has top and bottom flanges 44, 45, and also side flanges 42, 43, and said case is divided by inner integral partitions 50, 50 so as to leave a central screw-threaded opening therebetween, to receive an annular member to form a valve seat, as 52, which has threaded engagement in the said opening of the partitions and overlies the ends of the same.

The main supply pipe 7 has a flange secured to the side flange 42, of the case 37, and the main pipe 9 has also a flange secured to the opposite flange 43 of said case.

Open ended tubular bonnets 38 and 39 have each a flange 40 and 41 respectively secured to the top and bottom flanges 44 and 45 of the valve case 37.

The upper bonnet 38 is provided with two bored chambers 58 and 59, and the lower bonnet 39 is provided with three bored chambers 54, 55 and 56, and in each chamber of said bonnets is secured a stationary tubular bushing 57 coaxial with one another.

A piston rod 61 has two annular enlargements 62, 63 formed thereon, and said rod carries a cut-off valve which is made in three parts, comprising a conical member 64 adapted to bear against the enlargement 62 and having its smaller end of a size to freely enter and pass through the opening of the fixed seat member 52; a disk 66, and a ring 65 intermediate the latter and fast on a reduced portion of said conical member 64.

The ring 65 forms the cut-off valve and is larger in diameter than the larger end of the conical member 64, in order to provide a shoulder, as at 65ª, to rest against the seat 52 in closing off the main supply from the pipe 7 to the pipe 9.

The rod 61 also carries three pistons; two pistons 69 and 70 slidable in the chambers 58 and 59 of the top bonnet 38, and one piston 68 at the lower part of said rod and slidable in the chamber 54 of the bottom bonnet 39.

The pair of pistons 69, 70 are held in separated fixed relation on the rod 61, and the single piston 68 is also held fixed to said rod and separated from the parts 64, 65, 66 comprising the cut-off valve.

The lower bonnet 39 contains an auxiliary or follower-valve 75, which is formed on a stem that has one portion solid, as at 76, and its other portion of tubular form, as at 77. Normally the upper end of the tubular portion of the valve-stem 76 abuts the lower end of the valve-rod 61.

The tubular portion of the valve stem 76 is provided with two spaced openings formed through its wall, to serve as inlets or as outlets, as at points 78, 79.

Pistons 80, 81 are held in separated fixed relation on the solid portion of the valve stem 76, and said pistons are slidable in the chambers 56, 55 of the bonnet 39. Each of the aforesaid pistons of the bonnets 38, 39 is provided with leather packing rings, as at 82, to prevent leakage.

A flat annular member 76ᵇ is secured in the lower bonnet 39 and is provided with a central opening to receive the tubular portion 77 of the valve stem 76 therethrough, and this member 76ᵇ divides the chamber 54 from the chamber 55 and has a beveled valve seat, as at 75ª, for a beveled part of the valve 75 to rest upon.

The lower bonnet 39 is provided with a by-pass for regulating the pressure from the small pipe 18 to the large piston 68, and this by-pass consists of a cylindrical plug 83ª which has a central longitudinal screw-threaded opening, to receive a screw 84 whose inner end is conical to rest upon a

beveled seat formed at the end of a duct 83, which communicates with the chamber 55, and outwardly of the seat the plug is provided with a side duct to register with a passage 83[b] communicating with the chamber 54.

A cover 39[a] is fast upon and closes the outer end of the bonnet 39.

A drip pipe 81[d] leads from the chamber 55, of the bonnet 39, at a point between the pistons 80, 81, to prevent any possible accumulation of water pressure between the pistons 80 81.

In Figs. 2 and 3, it will be seen that the small constant pressure pipe 12[a] is always in communication with the chamber 58 of the upper bonnet, and that the small pipes 18, 18[a] (which serve as discharge and supply) are always in communication with the chambers 55, 56 of the lower bonnet, at points outside of the separated pistons 80, 81.

The chamber 54 is made larger in diameter than the diameter of the chamber 58, in order that when pressure is applied to the large piston 68 it will overcome the power exerted by the pressure in said chamber 58, and thereby force the cut-off valve 65 from its opened position shown in Fig. 2 to its closed position shown in Fig. 3.

In Figs. 4 to 9 inclusive, the construction of the pilot-valve device B is illustrated.

A vertical tubular casing 90 has an integral base 91 by which the device is secured to the side of the elevator well, and said casing is bored throughout its length so as to provide three concentric chambers 92, 93, 94, and the intermediate chamber 93 formed with an annular valve seat 95.

A tubular sleeve 96 is mounted within the casing 90 and fixedly secured at the upper part thereof, and said sleeve extends to the intermediate chamber 93 and has an annular valve seat 97 projecting into the same.

The sleeve 96 is bored throughout its length to receive a rod 98, and a valve 99 is formed on a stem 100 which has one end secured to said rod 98 and its other end having a piston 101 fixed thereto and movable in the lower chamber 92.

The valve 99 is concentrically reduced at each side in order to have a sliding fit on the bore of the chamber 92 of the casing 90, and also on the bore of the chamber 102 of the sleeve 96, the chamber 102 being left by the upper portion of the valve stem 100.

The sleeve 96 is also provided with openings 109[a] formed through its wall and communicating with the chamber 94.

Referring to Fig. 9, the reduced portions 99[a], 99[b], of the valve 99, are of a length sufficient to allow said valve to travel upward and close off the chamber 102 before it uncovers the chamber 92, and vice versa, on the downward travel of said valve. Thus the valve 99 forms a double acting valve to operate within the middle chamber 93 in closing upon either seat 95 and 97.

The lower end of the casing 90 is provided with a drip pipe 103 to lead to a drain.

An open bracket 104 is secured to an outer projecting part of the stationary sleeve 96, and said bracket extends vertical and is provided with a bearing at its top part, as at a point 105, to receive a slide rod 106, whose lower end abuts the upper end of the rod 98, and these rods 98, 106 are coupled together by a fork key 36, which passes through a slotted collar 108 fixed to the rod 98, in the manner as shown in Figs. 5 and 6.

The bracket 104 has a bifurcated portion 110 formed at its top part to receive a link 111, which is connected to a horizontal arm 23 that is pivoted on the slide rod 106.

The cable 24 is connected to the free end of the arm 23.

An expanding coil spring 113 surrounds the rod 106 and has its ends bearing against the top of the bracket 104 and the coupling or collar 108.

Having now described my improvements I will explain their mode of operation. In the regular and proper working of the elevator, the doors to the elevator well on all the floors being shut, the water is let on in the well-known manner, and flows, under the regular pressure, through the supply pipe 5, motor valve 6, pipe 7, cut-off valve device A and pipe 9 to the cylinder 4, wherein the plunger operates as heretofore. In this usual and proper operation of the elevator the flow of water is through the annular valve seat 52, of the valve device A, the cut-off valve proper 65, the meanwhile being in the open position shown in Fig. 2, and all the pistons in said device in the positions shown in said figure. During this time of the usual and proper operation of the elevator, the flow of water from the main supply pipe 5 is cut off between the chambers 92 and 93 of the pilot device B, and the water so applied keeps the pilot-valve 99 at its lower position and upon the seat 95 (see Fig. 8) and passes from the chamber 94 and discharged through the small pipe 13 into the main discharge pipe 11. And during the time the pilot-valve 99 is seated, as in Fig. 8, the small pipe 12 maintains pressure in the lower chamber 92 of the pilot device B, and the small branch pipe connection 12[a] gives constant pressure to the chamber 58 of the top bonnet of the cut-off device A. During said previous proper working the elevator well door 28 is closed, and the door bears against and holds the bell-crank lever 27 back against the action of its spring. The constant pressure maintained back of the piston 69 of the chamber 58 (Fig. 2) tends to keep the cut-off valve 65 in its open position, as shown in said figure, when all of the doors to the elevator

well or shaft are closed. But whenever and as soon as any door is open on any floor, the bell-crank lever 27 moves into the position shown in Fig. 1, and as the lever tilts to this position its horizontal portion causes a button, fast on the cable 24, to rise and thereby pull the latter upwardly. The upward pull of the cable tilts up the arm 23 of the pilot device B, and lifts the rod connections 106, 98 and valve stem 100 therein, and thus the pilot-valve becomes seated against the annular seat 97, and so prevents further discharge of water out through the small pipe 13 into the main discharge pipe 11, as in the position of parts shown in Fig. 5. The action of the water in the cut-off device A, during the abnormal conditions just described, is to close the cut-off valve 65 to its seat 52, so that no more water can flow to or from the cylinder 4 while said conditions continue. As soon as any door becomes open and the pilot-valve 99 closes off communication between the chambers 93 and 94 of the pilot device (Fig. 5), such condition then causes the water to pass from the small pipe 12, through the chambers 92 and 93, of said device, and discharge through the small pipes 18 and 18[a] into the lower bonnet of the cut-off device A.

Referring to Figs. 2 and 3, as the water pressure passes from the pipe 18 it discharges from the chamber 55 into the inlet 78 of the tubular portion 77, of the auxiliary or follower-valve 75, and from the outlet 79 of said tubular portion, and into the chamber 54 and presses against the large piston 68, and in addition to this, there is a small volume of water pressure passing through the by-pass duct 83 and pressing against the said piston.

During the time the aforesaid water pressure is passing from the pipe 18 there is also a water pressure passing from the pipe 18[a] and discharging back of the small piston 80 of the follower-valve 75. Thus the cut-off movement in the device A is accomplished by the action of the aforesaid combined pressures upon the piston 68 and 80, and these conjoint actions cause the cut-off valve 65 to close upon its seat 52. As the cut-off valve travels to its seat the conically-disposed member 64, of said valve, serves to close off gradually the main supply, and the purpose of the follower-valve 75 is to provide a more rapid movement during the first part of the travel of the cut-off valve, thereby cutting off or rapidly reducing the volume of water passing to the cylinder 4 of the elevator, and thus slowing down the speed of the car. The by-pass 83 provides a means of controlling the final closure of the cut-off valve 65 to its seat, and is therefore always adjusted to a slightly opened position, as shown. When the cut-off valve 65 and the follower-valve 75 and their associated parts, as described, are in the normal positions shown in Fig. 2, all of the elevator well doors are closed. When one or more doors are open, the valves 65 and 75 move from their normal positions shown in Fig. 2, to their abnormal positions shown in Fig. 3, and so all further supply of water to and from the elevator cylinder 4 is stopped. In this manner the car 1 is prevented, by wholly independent means, from moving while any one (or more) of the doors of the elevator well are open, and this action is automatic, and not subject to the will or discretion of the operator. The car is stopped in a very short distance of travel, and without jar or shock, and without creeping. When the edge 28[a], of the elevator shaft door, is in contact with the jamb 26 of the door opening, the bell-crank lever 27 is tilted back against the tension of its spring, and it is therefore safe to start the car. As soon as the operator closes the door the water is discharged by the small constant pressure pipes 12, 12[a], and presses against the piston 69 (and its associated parts) and the cut-off valve 65 forced to its open position shown in Fig. 2.

When the bottom end of the cut-off valve rod 61, as at 61[a], comes into abutment with the end of the tubular portion 77 of the follower-valve 75, the pistons 80 and 81 of the latter are moved downwardly by the advance of the said rod in that distance.

During normal condition the tripping lever 27 is held back against the tension of its spring, by the jamb 28[a] of the door, and the arm 23 (of the pilot device B) and the parts movable thereby are in the position shown in Fig. 8.

The water which is displaced by the downward movement of the large piston 68 (and its associated parts) is forced out through the by-pass 83 and also through the tubular portion 77 of the follower-valve and thence through the pipe 18, and the water which is displaced by the downward movement of the piston 80 (and its associated parts) is forced out through the pipe 18[a]. These united volumes of water are by said pistons 68 and 80 forced into the center chamber 93 of the pilot device, through the chamber 94 of the latter, and out through the pipe 13 to the discharge pipe 11.

The cut-off device operates entirely independent of the main supply. The constant pressure admitted to the upper chamber 58 holds the valve 65 to a wide open position when all of the shaft doors are closed, and the extra pressure discharged against the large piston 68 of the chamber 54 overcomes the constant pressure exerted against the piston 69, by virtue of the difference in areas of said chambers, so that the valve 65, accelerated by action of the follower-valve, is hastened to its seat the instant any door or

doors open, and thus the car is brought to a stand-still in a very quick time.

What I claim is:—

1. A pilot-valve device, including a vertical tubular casing having three chambers, the lower chamber receiving a constant water pressure, the upper chamber serving as an exhaust, and the intermediate chamber serving as a supply and as a discharge; a tubular sleeve fixedly secured within the casing and extending to the intermediate chamber, and said sleeve having openings communicating with the upper chamber; a stem carrying a piston movable in the lower chamber, said stem having a valve formed thereon and reduced at each side in order to have a sliding fit on the bore of the chamber left by the upper part of said stem and bore of said sleeve, and to allow said valve to close off the latter chamber before it uncovers the lower chamber of said casing, and means to actuate the stem to permit its valve to close off the constant water pressure.

2. A pilot-valve device, including a vertical tubular casing having three chambers, the lower chamber receiving a constant water pressure, the upper chamber serving as an exhaust, and the intermediate chamber serving as a supply and as a discharge; a tubular sleeve fixedly secured within the casing and having openings communicating with the upper chamber; a double acting valve operable in the intermediate chamber and constructed to close off the water pressure from the upper chamber before uncovering the pressure in the lower chamber, and a spring-controlled means to hold said valve closed against the said constant water pressure, during normal condition; and means to actuate the valve to close off the discharge from the upper chamber, during abnormal condition.

3. A pilot-valve device, including a tubular casing having a chamber to receive a constant water pressure, a chamber to serve as an exhaust, and an intermediate chamber to serve as a supply and as a discharge, respectively; a stem having a double acting valve formed thereon, and said valve constructed to close off the discharge to the second mentioned chamber before it uncovers the chamber which receives the constant pressure; a bracket; a tilting arm mounted above said bracket; a slide-rod movable through the latter and connected to said arm; a rod having its lower end secured to the valve-stem; means to couple together the inner ends of both said rods; an expanding coil spring interposed between the coupling point of said rods and upper part of said bracket, and means to uncouple said rods to enable the valve, through action of said spring, to close off the pressure to the intermediate chamber.

4. A cut-off valve device, including a vertical valve-case having a partition provided with a valve-seat surrounding an opening to receive a main supply of water pressure therethrough; a bonnet secured at the top of said case and provided with two chambers of different diameters; a bonnet secured at the bottom of said case and provided with three chambers, one of which is of large diameter and the other two of relatively smaller size; a valve-rod carrying pistons held in separated fixed relation on said rod and movable in the chambers of the top bonnet, and the other piston secured at the opposite end of said rod and movable in the large chamber of the bottom bonnet; a cut-off valve carried by said rod and having a conical member designed to close off gradually the main supply as said valve moves toward the seat of said case; a pipe to deliver a constant water pressure back of the inner piston, of the separated pair on said rod, and thereby keep the valve to its open position, during normal condition, and a follower-valve device operable by water pressure in the small chambers of the bottom bonnet, to provide a more rapid movement during the first part of travel of said valve in closing upon its seat, during abnormal condition.

5. A cut-off valve device, including a valve-case having a partition provided with a valve-seat surrounding an opening to receive a main supply of water pressure therethrough; a valve-rod carrying different size pistons; a cut-off valve secured on said rod, at a point intermediate its pistons, said valve comprising a conical member to freely enter and pass through the opening in the seat of said case and to close off gradually the main supply, a disk, and a ring, which forms the valve proper, intermediate said disk and of larger diameter than the latter in order to provide a shoulder to rest against the seat in closing off the main supply, respectively; a constant water pressure back of the small piston of said rod, to keep the valve at its open position, during normal condition, and means back of the large piston of said rod and operable by water pressure, to accelerate the valve in the first part of its travel toward the seat of said case.

6. A cut-off valve device having a vertically movable rod carrying pistons of different diameters and also a cut-off valve, to control a main supply of water pressure through said device, and a constant water pressure back of the smaller piston of said rod, to keep the valve normally at its open position, in combination therewith, of a follower-valve device, including a bonnet having small chambers; a valve-seat member secured in said bonnet and said seat surrounding an opening; a follower-valve-stem carrying separated pistons movable in said

chambers, said stem having a valve formed thereon to rest against said seat member, and said stem movable through the opening of the latter and which portion is of tubular form and normally in abutment with the bottom end of said rod, said tubular portion having an inlet open to the inner chamber of said bonnet and also an outlet communicating with the chamber of the larger size piston of said rod; pipe connections to deliver a supply of water pressure back of the outer piston of said stem, and also within the inner chamber of said bonnet and passing through the inlet, through the tubular portion, through the outlet and back of the larger piston of said rod, whereby the aforesaid combined pressures in said bonnet overcome the said constant pressure and accelerate the cut-off valve in the first part of its travel to close off the main supply.

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

SAMUEL C. GREER.

Witnesses:

PETER C. CANNON,

C. T. HANNIGAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."