W. P. GROOM.

SAFETY DEVICE FOR ELEVATORS.

APPLICATION FILED FEB. 20, 1907.

912,560.

Patented Feb. 16, 1909.

4 SHEETS—SHEET 1.

FIG. 1

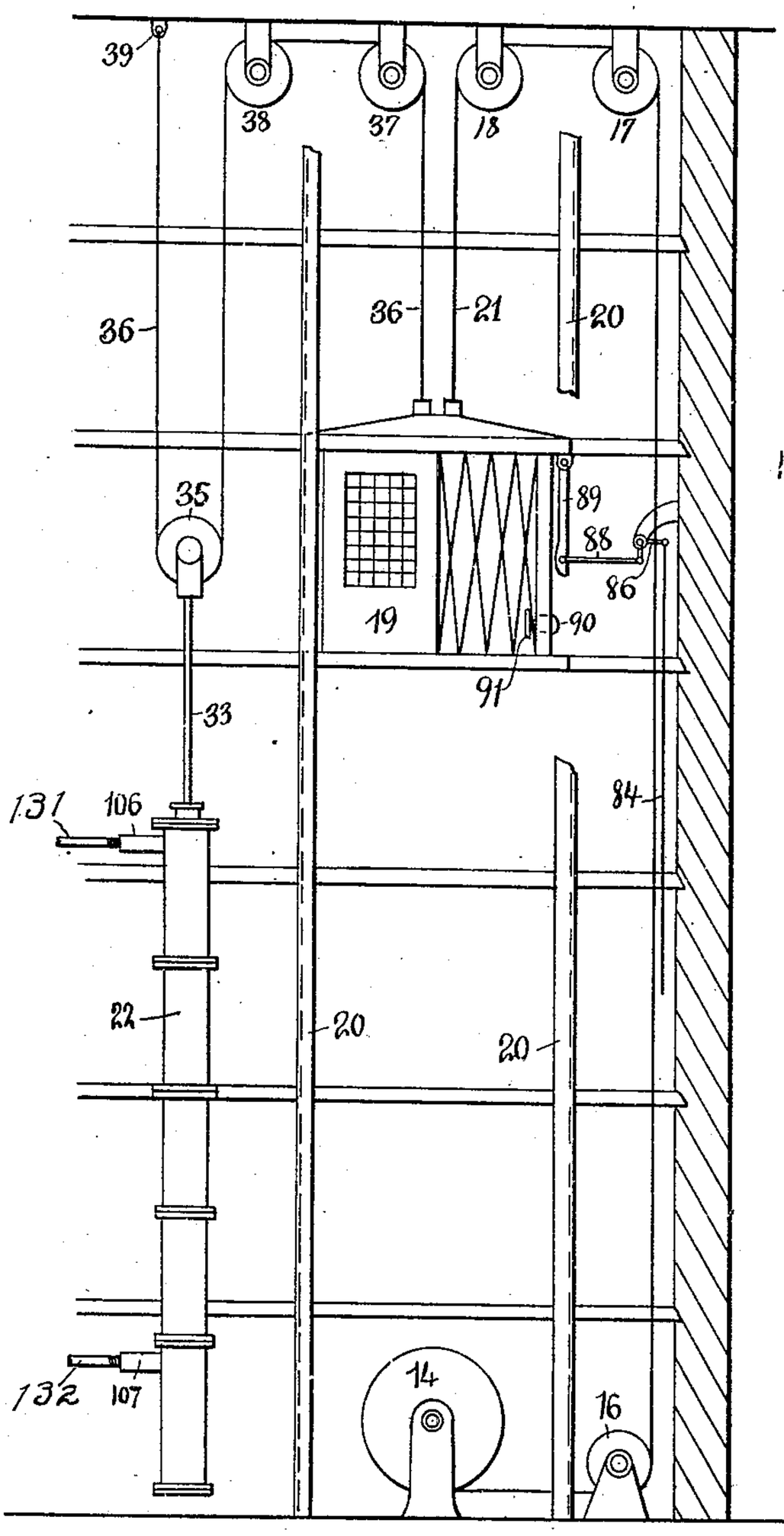
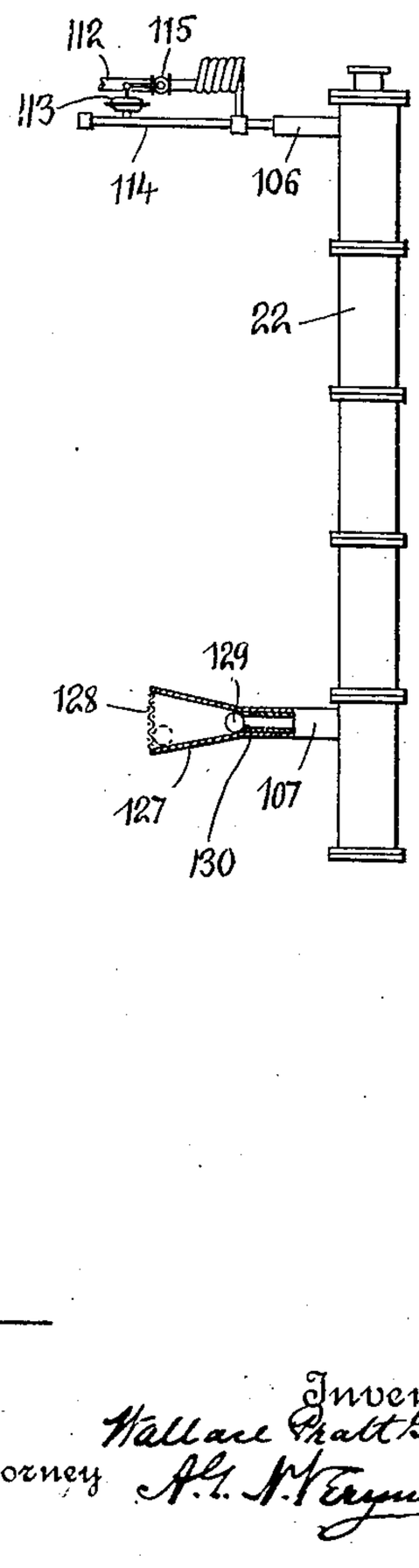


FIG. 2



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4 SHEETS—SHEET 2.

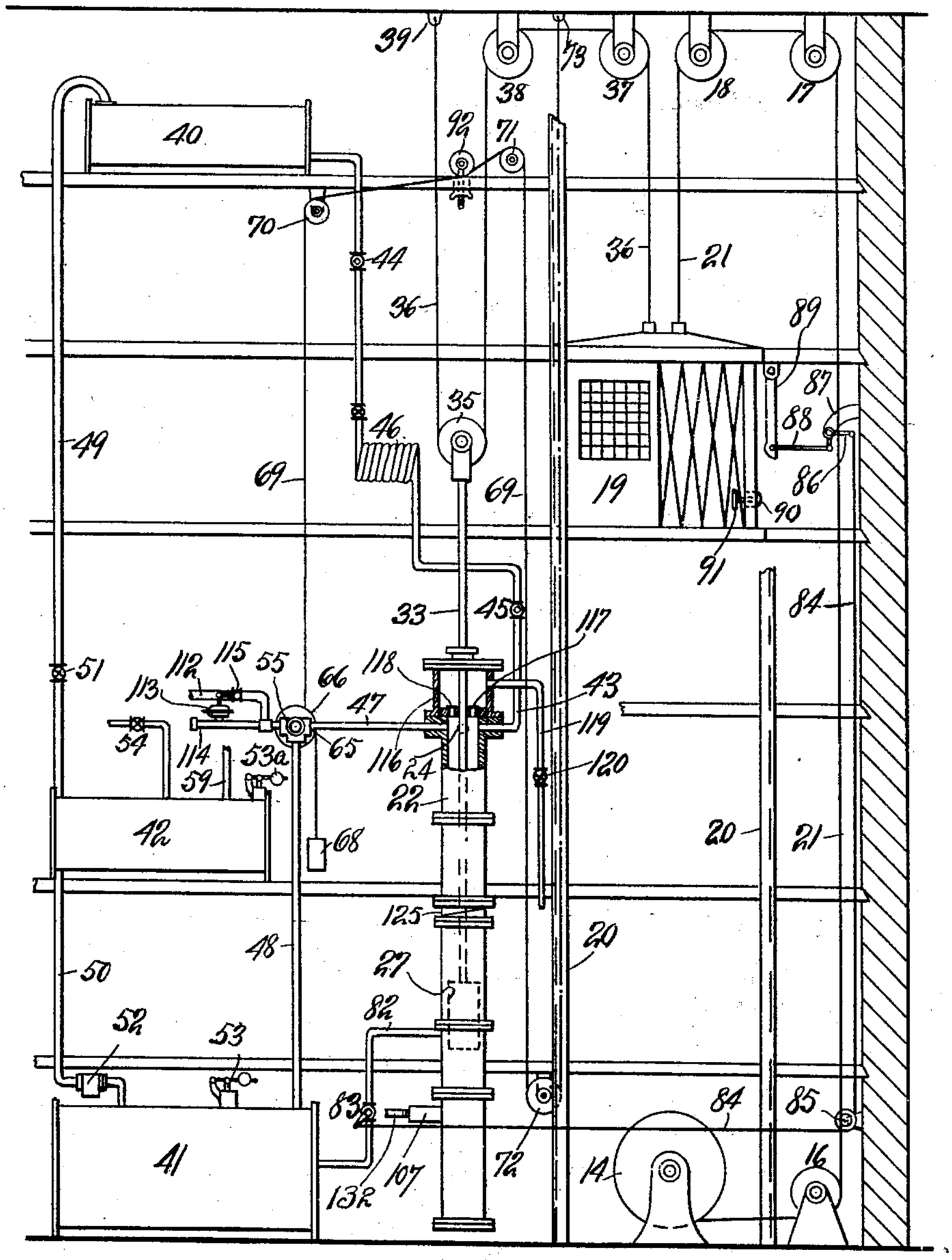

FIG. 3

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4 SHEETS—SHEET 3.

FIG. 4

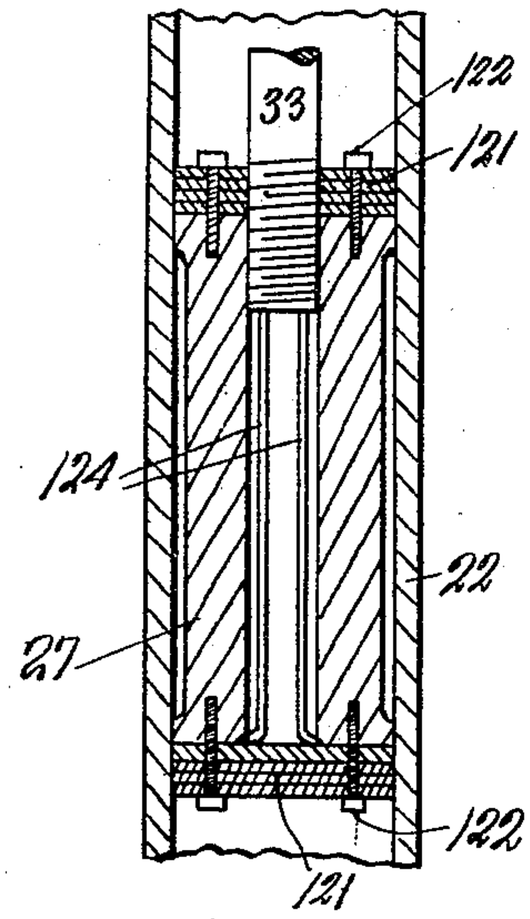

FIG. 5

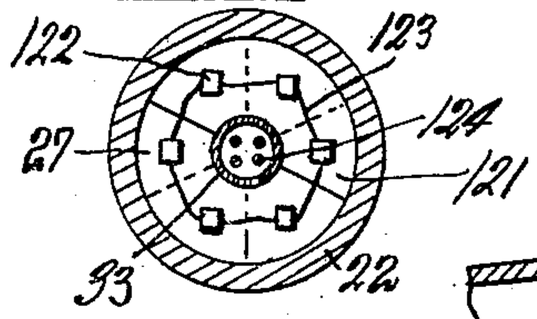

FIG. 6

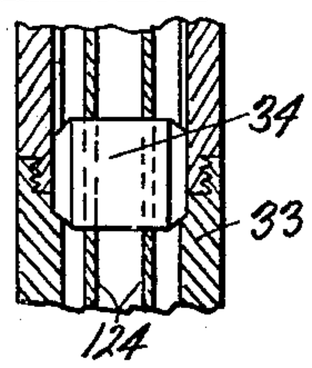

FIG. 7

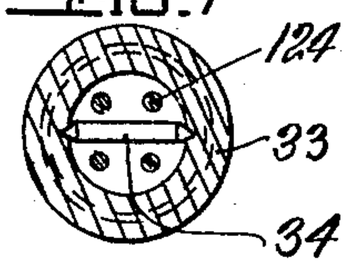

FIG. 8

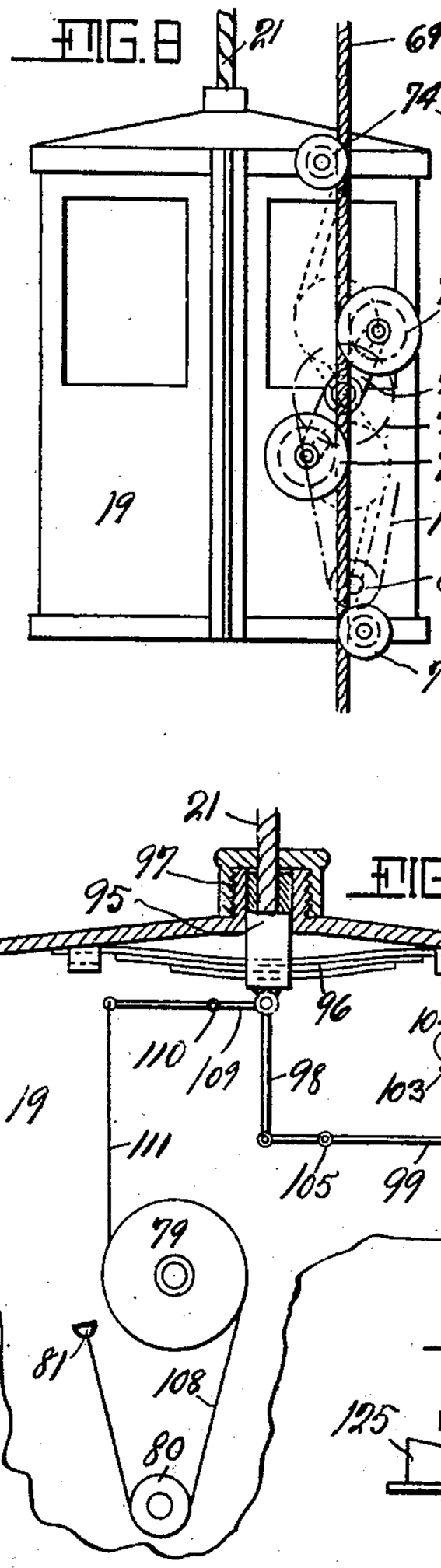

FIG. 9

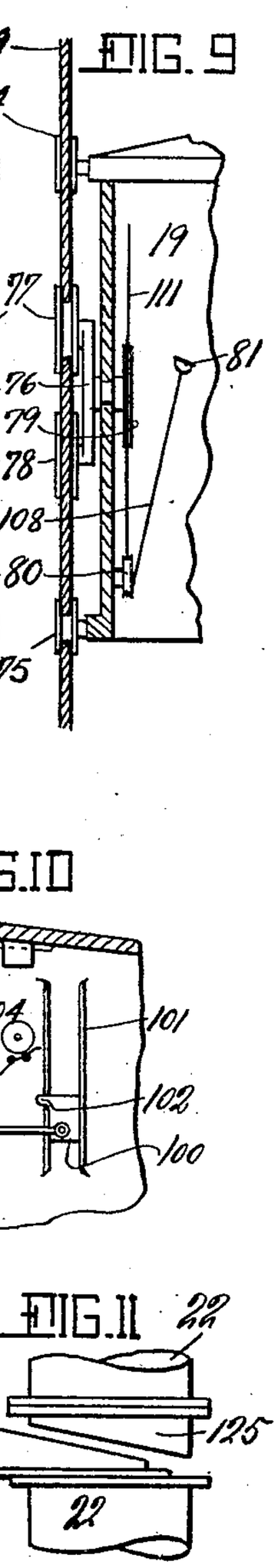

FIG. 10

FIG. 11

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4 SHEETS—SHEET 4.

FIG. 12

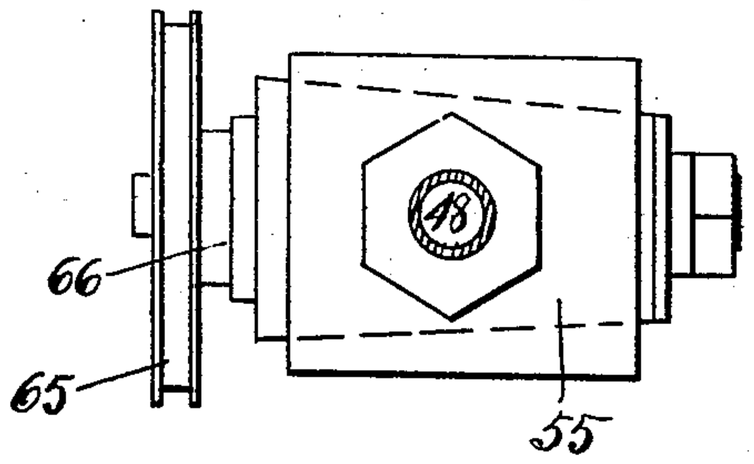


FIG. 13

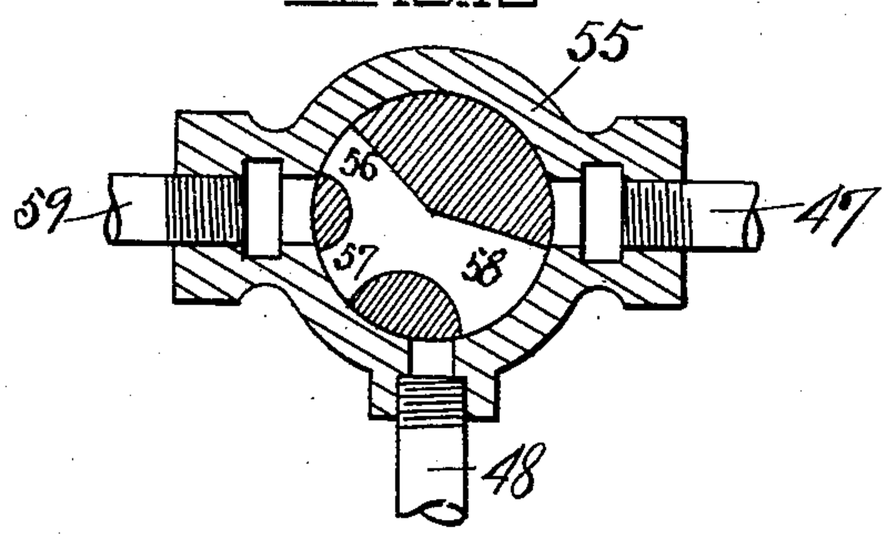


FIG. 14

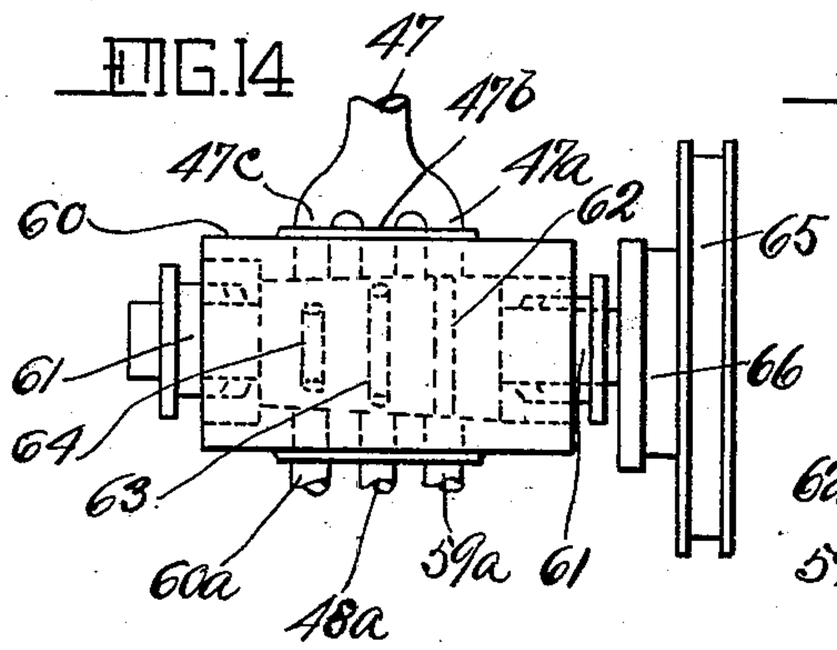
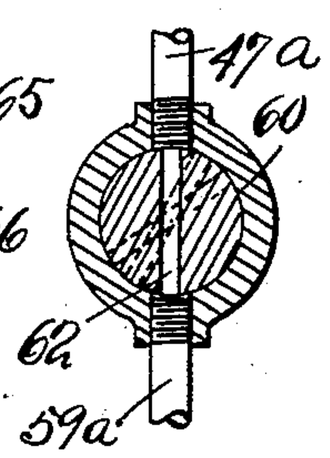


FIG. 15



Witnesses:
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UNITED STATES PATENT OFFICE.

WALLACE P. GROOM, OF BROOKLYN, NEW YORK.

SAFETY DEVICE FOR ELEVATORS.

No. 912,560. Specification of Letters Patent. Patented Feb. 16, 1909.

Application filed February 20, 1907. Serial No. 358,338.

To all whom it may concern:

Be it known that I, WALLACE P. GROOM, a citizen of the United States of America, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Safety Devices for Elevators, of which the following is a specification.

My invention relates primarily to safety devices for elevators and it consists in connecting the piston of a hollow cylinder having a restricted outlet with a cable leading to the elevator car hereinafter simply called the car, and so arranging the combinations as to prevent the car from falling rapidly when the operating cable fails to prevent it from so doing. Also in various details and combinations, more particularly pointed out in the claims.

In the drawings forming part hereof, Figure 1 is a diagrammatic view of an elevator installment equipped with one of the simpler forms of my invention; Fig. 2 is a view of such a device, modified somewhat and provided with a still further check. Fig. 3 is another diagrammatic view representing an addition whereby the power developed in the use of the cylinder and piston may be stored for such use as may be found convenient. Fig. 4 is a vertical sectional view of one form of piston, piston rod and cylinder I sometimes employ. Fig. 5 is a cross-sectional view of said cylinder, showing also the upper face of the piston. Fig. 6 is a vertical sectional view of a part of the piston rod, on a larger scale. Fig. 7 is a cross-sectional view of said piston rod, also on a large scale. Fig. 8 is a side elevation of the elevator car, showing portions of the safety operating devices. Fig. 9 is an end elevation of a part of said car and connected devices. Fig. 10 is a sectional view of the upper part of the car showing in full lines the parts connecting the primary operating cable with the automatically operating lever, which may operate the safety check independently of the human operator's action. Fig. 11 is a detail view of a portion of the cylinder, exaggerated. Figs. 12, 13, 14 and 15 are detail views of forms of multiple way valves which I sometimes employ.

If a piston be moved in a hollow cylinder, it will tend to create a vacuum behind it and compress any air that may be before it, and that compressed air on one side and the tendency to vacuum behind it, is a force which may be readily and economically created and I have therefore selected it as a means for braking the movement of an elevator car and thereby rendering its operation more safe than it otherwise would be.

In providing the means for utilizing the scientific principles involved in my invention, I construct a cylinder with a piston and a piston rod, all so arranged that the end of the piston rod may be readily connected to a cable leading to the elevator car to be controlled. Preferably I set the cylinder vertically in order that I may utilize the piston as a counterweight to the car, and also for the reason that that seems to be the simplest and most economical installation; but I do not limit myself to that arrangement, a horizontal arrangement with rods at each end of the piston and suitable connecting cables would also be effective.

At the upper end of the piston rod I prefer to mount a sheave, 35, and to lead about it a cable, 36, one end of which may be secured to some fixture above the limit of the piston movement and the other end of which is led over sheaves also placed above that limit, and then down to the car, to which it is firmly secured preferably by a fastening entirely independent of the operating cable. Then, by providing outlets, one at (or near) one end and the other at (or near) the other end of the cylinder, my brake, in simple form, is ready for operation. The air outlets from the cylinder may be pipes of rather small diameter.

When the car starts downward, it of course raises the piston in the cylinder. The speed of that piston is controlled by the relation existing between the dimensions of the inlet and outlet pipes and that of the cylinder, and, in turn, through its connected cable, controls the speed of the car. If those relations are properly adjusted, the car may run freely at normal speed but it will be checked or even stopped through abnormal acceleration, caused by very heavy and sudden loading of the safety cable.

If it be found that the car is made to move too slowly, the outlet and inlet pipes may be removed and larger ones substituted; if the pipes used permit the car to move too rapidly, they may be replaced by pipes of smaller diameter. A very simple way of effecting the desired change is to use pipes large enough in cross area to satisfy the greatest demand, such for instance as pipe

106 of Figs. 1 and 2 or 107 of Figs. 1, and 3, thread their outer ends and then screw on an open pipe or coil of such varied diameter and length as may be preferred, such as pipe 131 of Fig. 1 or 132 of Figs. 1, and 3, which restricting pipes may be as long as desired. Changes may thus be made with economy and despatch and the brake may thus be very easily set to regulate the speed of the car independently of the operator. To further provide for cases of accident, the device of Fig. 2 may be used. In it, I provide a valve whose stem is, in this case, connected with a diaphragm regulator or governor. The diaphragm is operated by air led to it by a branch pipe opening from the outlet pipe. When the pressure rises to a given point, which it would do if the piston movement were accelerated by a runaway car, the diaphragm will be so moved as to close the valve, the escape of air will be prevented, and the car will soon be brought to a full stop. If a coil is used, I generally arrange my diaphragm-controlled valve at the further side of the coil, and the union of the branch pipe, with the outlet pipe, at a point nearer the cylinder than the first turn of the coil. If desired, a regulator may be connected with a branch of pipe 107 and a valve therein, all so arranged that a sudden lessening of the pressure in the lower part of the cylinder (such as a quick upward movement of the piston would produce) would actuate the governor to close the lower inlet and prevent the entrance of air. This would result in a vacuum tendency which would assist in arresting the piston and consequently the car as well.

In the drawings, the elevator car 19 is represented as equipped with a primary cable 21 which is led over or about sheaves 18, 17, 16 and 14, the latter representing a part of any form of prime mover which may be selected.

20 are the guideways, 22 is a cylinder, shown as composed of sections which may be bored out, flanged and bolted together. Its aggregate length, in such an installation as here shown, exceeds one-half of the travel of the car. It is capped or closed at each end, has an inlet pipe 106 (which in the simple form is also an outlet) and an outlet pipe 107 (which is also an inlet). In said cylinder there is a piston 27 provided with a piston rod 33, and at the upper end of the piston rod I prefer to mount a sheave 35. About sheave 35 I pass a safety cable 36, one end of which is secured to a fixture 39. The other end is firmly attached to the car preferably by an attachment wholly independent of that of cable 21, the intermediate bight being placed over sheaves 38 and 37, to ensure proper leads.

From the upper end of cylinder 22 (in the more elaborate arrangement of Fig. 3), an outlet pipe 43, provided with a coil 46 and valves 44 and 45, leads to an air reservoir 40. A check valve 24, may also be provided to admit air at this end of cylinder 22. From the reservoir 40 a pipe 49 extends to an intermediate reservoir 42 and thence pipe 50 leads to reservoir 41, a pressure regulator 52 being preferably placed in the connection. Reservoir 42 has an outlet 54 and both reservoirs 41 and 42 are provided with safety valves 53 and 53[a] and pipe connections 48 and 59, the latter shown as broken, but both leading actually to a multiple way valve 55 which is connected with the cylinder 22 by pipe 47.

The plug of the multiple way valve 55 is provided with two drums 65 and 66. About 65 I wind a cable, its inner end secured to the drum and its outer end to a weight, 68, and about drum 66 I similarly wind a control cable 69. This cable 69 passes upward, over and around sheaves 70 and 71, downward and about a sheave 72, upward parallel with the track of the car and in close proximity thereto and is secured to a fixture 73, being preferably provided with an idler 92 suitably mounted or arranged to tighten or slacken the control cable 69.

Upon the side of the car I mount deeply grooved guide sheaves 74 and 75, in whose grooves runs the control cable 69. On the same side of the car I mount a swinging bar 76, provided with grooved pulley sheaves 77 and 78, which lie on opposite sides of the cable 69 and near or against it, at points some distance apart. The shaft of the swinging bar has a crank or wheel (here a wheel) 79, rigidly attached to it, and from this wheel I pass a cable 108 to and about a wheel 80 and thence to a hand piece 81. Cable 21 is preferably secured to a strong yoke 95 between which and the car I interpose a powerful spring 96. To the yoke 95 I attach a lever 109, pivoted at 110 and secured to a cable 111, which passes to and about wheel 79. Then if the operating cable 21 should break, or even slacken, the strain upon yoke 95 will be relieved or lessened and under the stress of spring 96 it will move downward, thereby causing a pull upon cable 111, which through wheel 79 will swing bar 76 toward a vertical position and cause sheaves 77 and 78 to deflect cable 69 from a vertical line and thus turn the plug of the multiple way valve 55. Normally that valve (say that of Fig. 13) is at a blank position, that is, its ports are closed. The first ports opened by the turning of the plug are 58, leading from pipe 47 and 56, then opening to pipe 59, which is connected to the high pressure reservoir 42 and at once the high pressure compressed air is permitted to flow between the compressor cylinder and the high pressure reservoir. As the yoke moves further down, it deflects the cable still more and continues

the turning of the plug of valve 55 until it closes the port to pipe 59 and opens 57, leading to pipe 48, which connects with the lower pressure reservoir 41 and thus lessens the pressure from that of the compressed air in reservoir 42 to that of reservoir 41.

If, instead of the valve shown in Figs. 12 and 13, I use that shown in Figs. 14 and 15, the first movement will bring the respective ends of passage 62, into registry with passage 47ª, (leading to pipe 47,) and 59ª, leading to 59, with a result already noted. A further movement of the yoke brings the valve to a position where the respective ends of passage 63, will register with passage 47ᵇ, leading to pipe 47, and passage 48ª, leading to pipe 48, and still further movement causes the respective ends of passage 64, to register with passage 47ᶜ, leading to pipe 47, and passage 60ª, which is to be connected to pipe 112 leading to the open air, but as that is controlled by regulator 113, any very high pressure in branch 114 will actuate regulator 113 to move valve 115 to close pipe 112 and restrict the escape of air and the lessening of pressure.

The car having been arrested by the high pressure created in the cylinder by its runaway movement, is by the resistance brought gently to a stop, and it will be noted that this has been done without the interference of the operator but wholly by the automatic action of the device. Indeed if the break of the cable be complete or its slackening sufficient, valve 55 will in an instant move through the intermediate positions to the last one, and the action be substantially as though no valve were there and no outlet, such as 47, provided. The operator might himself have effected the same result by an upward pull upon the hand piece 81, and this means of adjusting the pressure is always open to him, even though there be no accident. He may for instance, if the pressure in the cylinder is below that in reservoir 42, avail himself of its additional power to assist in lifting a heavy load whenever desired, and this too without in any way interfering with the automatic devices already described. The piston, on its over rapid downward movement, may not only be retarded, but also be specially cushioned by constructing the cylinder of such a length that it will extend somewhat below the ordinary downward limit of the piston movement, and placing its lower outlet, 107, at or a trifle above such downward limit, thus leaving a closed pocket below the piston, the air in which would act as a powerful cushion. At the upper end I prefer to employ a modified arrangement which I have devised. It consists first in placing a short supplemental cylinder 116, (usually a little longer than one-half of the desired additional movement of the car), above the primary cylinder 22. It is preferably of somewhat greater diameter than the primary cylinder and contains a disk piston 117, fitting it closely and fitting closely about the piston rod 33 which passes directly through it. It also has one or more passages from one face to the other, governed by flap or other check valve 118. A pipe, 119, provided with a valve 120, leads from the upper part of cylinder 116 to a point where the valve 120 may be reached.

If the piston 27, on its upward movement, should run over slightly, it would only lift piston 117 and be brought to rest and returned to normal position by the gravity of that piston 117 reinforced by the air pressure behind it, since some of the air compressed by piston 27 on its upward movement would enter supplemental cylinder 116 through the passages in piston 117, and be held from return by check valve 118. If, however, it were desired to give the car a longer downward run, for instance, to run to the sub-cellar, one which normally ran to a basement or first floor, the manager need only open valve 120. The compressed air in cylinder 116 would escape, the piston 27 would rise, carrying piston 117 up with it till that came near the cylinder head, thus lengthening the piston movement by that distance and the car run by twice as much. Having accomplished the desired extra run, the manager may close valve 120, and upon running the car up and down again, normal conditions will be restored. A supplemental cylinder or extension may be arranged at the lower end also, if desired. As an additional element of safety, I prefer to connect reservoir 41, and cylinder 22, by a pipe 82, opening into the cylinder at such point that the piston will uncover it when the car has nearly reached its upper limit of travel. It has a self-closing valve 83, and to automatically open this valve, I lead a cable 84, from the lever of valve 83, to and about pulley 85, and thence to a bell crank lever 86, supported on a bracket 87 and connected by a link 88, to a striker arm 89, pivoted near the path of the car. Then I mount a trip 90, in a screw-threaded support upon the car and provide it with a hand wheel 91. If trip 90, be run out far enough to strike the arm 89, then the series of levers and cables will be operated to open valve 83, and add the pressure of the air in reservoir 41, to that in cylinder 22. When this is not desirable, the trip is run back till it will not make contact with arm 89. The plunger 95, sliding in box 97, is also connected by a link 98, to a lever 99, pivoted at 105. At the further end, lever 99, is connected to an indicator 100, moving in ways 101, and provided with a trip 102, adapted to strike the end of the lever 103, which acts as a bell hammer for the gong 104. By their con-

joint action, which is apparent from a mere glance at the drawings, they will announce to both eye and ear any considerable movement of the plunger 95.

The piston rod is not called upon to bear a crushing strain and may be made of tubing. The general manner of constructing it is shown in Fig. 6, that is in sections threaded and screwed together and locked by a key, 34; but to increase its tensile strength I sometimes employ one or more, preferably four small wire cables, 124, extending through it as shown in Figs. 4, 5, 6 and 7 and carefully secured at each end. Then to give such play as will obviate any binding in case the cylinder should be slightly sprung, I make the packing at one end slightly yielding, cut away the body of the piston enough to insure that it shall not bind, and make the close working packing at the other end, preferably the lower one. That may be readily accomplished by cutting a series of disks or leather, 121, or any variety or varieties of packing, punching them with a series of holes (those for the top having a central opening to accommodate the piston rod), then halving the disks and placing them in position sequentially, breaking joints each time and securing them by screw bolts 122 inserted in the punch holes and turned down into threaded apertures in the piston, as shown. The screw bolts may be readily locked by boring their heads and passing a stout wire, 123 through the bores and from one head to another.

To provide access to the piston for repacking or adjustment, I prefer, at some convenient point, (for instance immediately below one of the floors supporting the cylinder) to provide a short section or special packing ring, preferably divided at an angle, as shown at 125, Fig. 11. This section or packing ring may be banded or otherwise firmly secured in place, but upon removing the bolts from the flanges and the bands, if bands are used, it may be readily removed. Thereupon a sequential section of the cylinder may also be removed, the piston run down to the vacant space and there repacked or otherwise adjusted as desired. Any thick packing ring that could be removed and thus permit removal of a section of the cylinder, would accomplish the main object sought.

Instead of the style of regulator shown in Fig. 2 and there attached to pipe 106 and consisting of a closed pipe 114, provided with a branch running to an open pipe 112, provided with a coil and a valve 115, connected to a diaphragm regulator 113, the further side of which opens into pipe 114, I may use a ball. For pipe 107, this would be particularly efficient. In constructing it, I would countersink the opening in the pipe so that it would make a good seat 130, for a ball valve. Then secure to the pipe an enlargement or cage 127, to constitute a runway, very slightly inclined, for the ball 129, and close the enlargement with a screen 128, or equivalent, to prevent the escape of the ball 129.

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

1. The combination of an elevator car, a cylinder provided with an air inlet a reciprocating piston within said cylinder, a piston rod, a connection between the piston rod and the car whereby the piston will move in unison with the car, said connection being independent of the operating cable, an outlet pipe leading from the cylinder, means for retarding the flow of air from said cylinder, a valve in the outlet pipe, a pressure governor controlling said valve and a pipe connection leading to said governor from the air-containing space of the cylinder and its connections, whereby the rise of pressure in the cylinder and connections, beyond a determined limit, will operate said governor to close the valve in the outlet, all substantially as set forth.

2. The combination of an elevator car, a cylinder provided with an outlet and an inlet, a reciprocating piston within said cylinder, a piston rod, a connection between the piston rod and the car whereby they will move in unison, said connection being independent of the operating cable, an operating cable, an air reservoir, a pipe leading from said reservoir to the cylinder and provided with an air flow controlling valve, and means, partly within the car, and connected with the operating cable, for automatically controlling said air flow valve, all substantially as set forth.

3. The combination of an elevator car, a main cylinder a reciprocating piston therein, a supplemental cylinder in line with and above the first cylinder, a supplemental piston, normally closing the passage from the first cylinder to the supplemental cylinder, but itself provided with a valve-controlled air passage, a piston rod connected to the first piston and extending through the second, a valve-controlled escape pipe leading from the upper part of the supplemental cylinder, a connection between the piston rod and the car whereby the piston will move in unison with the car, said connection being made independent of the operating cable, an air inlet to the main cylinder, and an air outlet pipe leading from the main cylinder at the same end as the inlet, and provided with means for retarding the flow of air from said cylinder.

4. The combination of an elevator car, a main cylinder a reciprocating piston therein, a supplemental cylinder of larger diameter than the main cylinder, in line with and above the first cylinder, a supplemental piston, normally closing the passage from the first cylinder to the supplemental cylin-

der, but itself provided with a valve-controlled air passage, a piston rod connected to the first piston and extending through the second, a valve-controlled escape pipe leading from the upper part of the supplemental cylinder, a connection between the piston rod and the car whereby the piston will move in unison with the car, said connection being made independent of the operating cable, an air inlet to the main cylinder, and an air outlet pipe leading from the main cylinder at the same end as the inlet, and provided with means for retarding the flow of air from said cylinder.

5. The combination of an elevator car, a main cylinder a reciprocating piston therein, a supplemental cylinder in line with and above the first cylinder, a supplemental piston, normally closing the passage from the first cylinder to the supplemental cylinder, but itself provided with a valve-controlled air passage, a piston rod connected to the first piston and extending through the second, a valve-controlled escape-pipe leading from the upper part of the supplemental cylinder to a point convenient of access to the operator, a connection between the piston rod and the car whereby the piston will move in unison with the car, said connection being made independent of the operating cable, an air inlet to the main cylinder, and an air outlet pipe leading from the main cylinder at the same end as the inlet, and provided with means for retarding the flow of air from said cylinder.

6. The combination of an elevator car, a cylinder provided with a passage which is an air inlet when the piston moves in one direction and an air outlet when the piston moves in the reverse direction, means for retarding the flow of air through said outlet, a reciprocating piston within the cylinder, a piston rod, a connection between the piston rod and the car whereby the piston will move in unison with the car, an air reservoir, a pipe leading from said cylinder to said reservoir and a valve located in said pipe and controlling the passage of air through the same.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this 6th day of February 1907.

WALLACE P. GROOM.

Witnesses:
WILLIAM B. COLE,
A. G. N. VERMILYA.