No. 634,966. Patented Oct. 17, 1899.

S. B. TRAPP.

SAFETY APPLIANCE FOR ELEVATORS.

(Application filed June 17, 1899.)

(No Model.) 6 Sheets—Sheet 1.

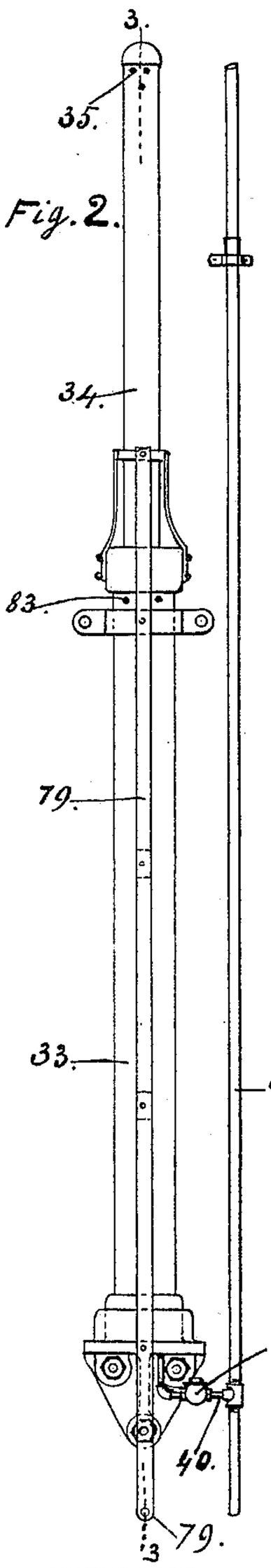

Fig. 2.

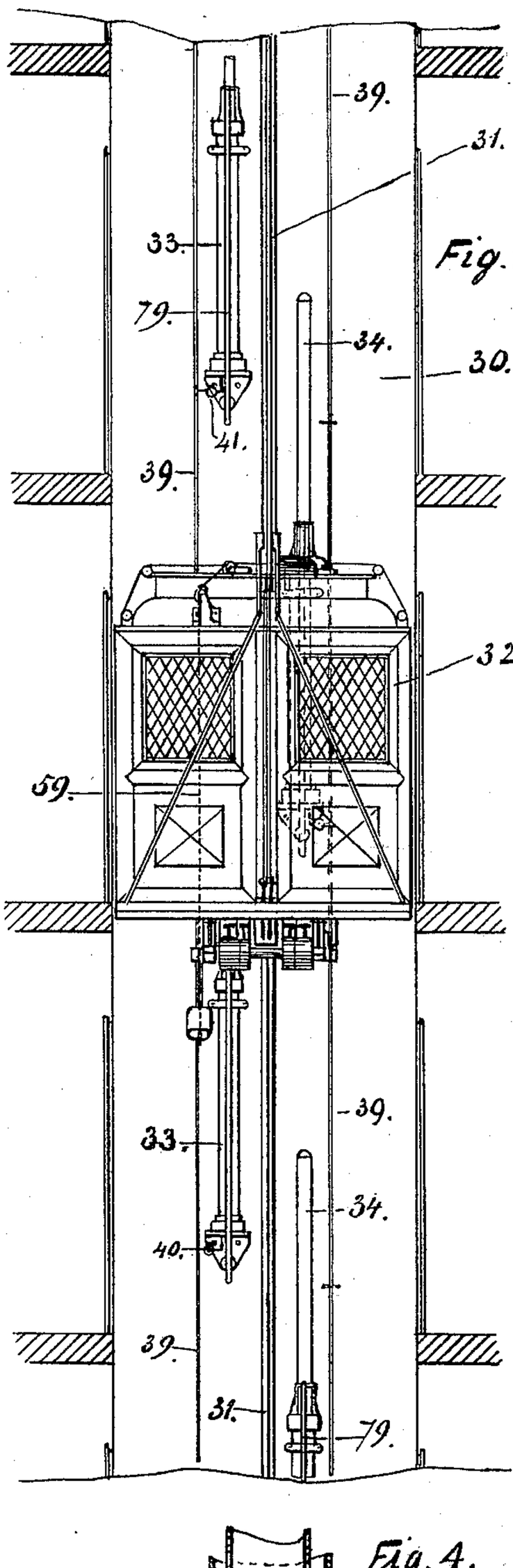

Fig. 1.

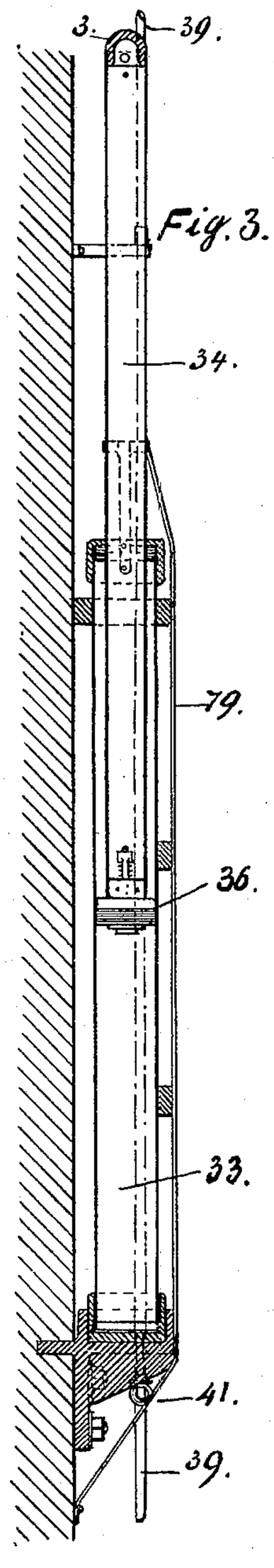

Fig. 3.

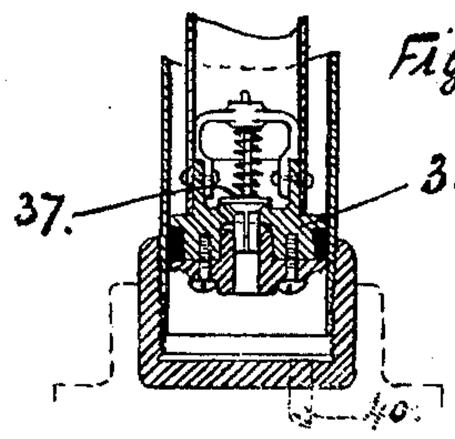

Fig. 4.

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No. 634,966. Patented Oct. 17, 1899.

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(No Model.) 6 Sheets—Sheet 2.

Fig. 11.

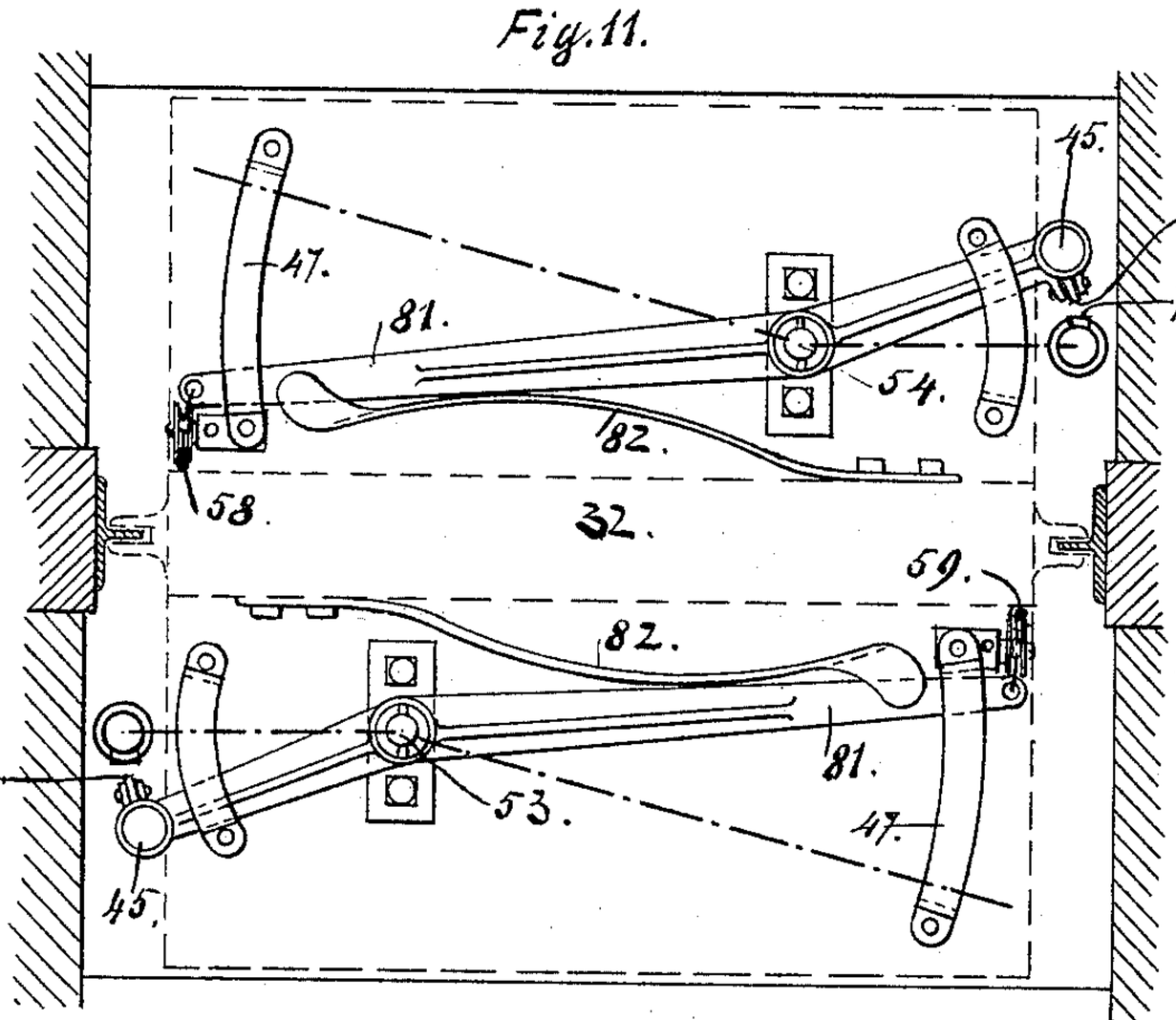


Fig. 12.

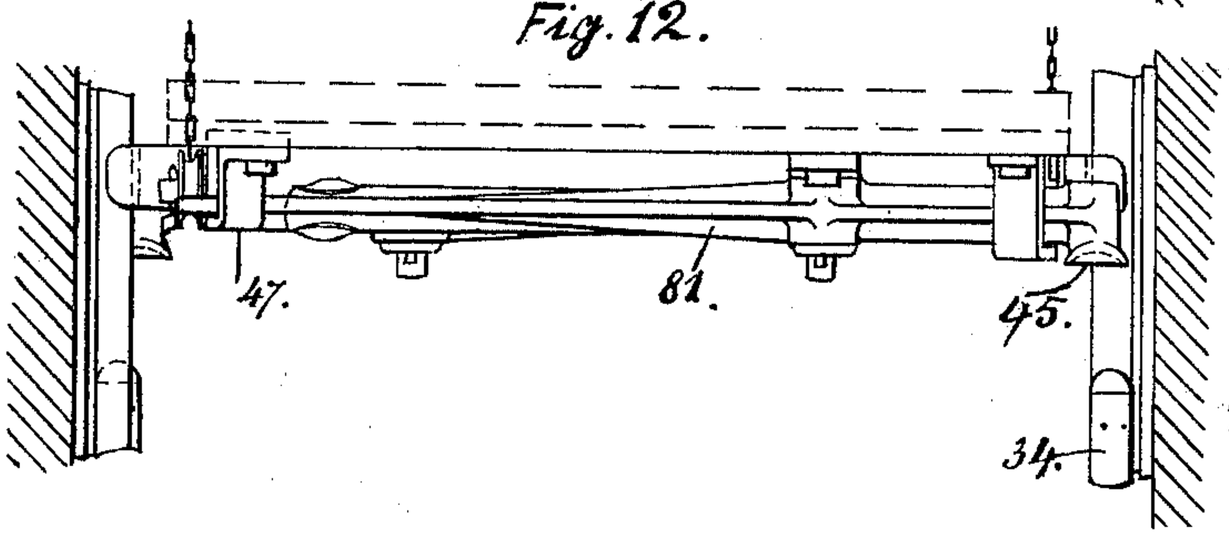
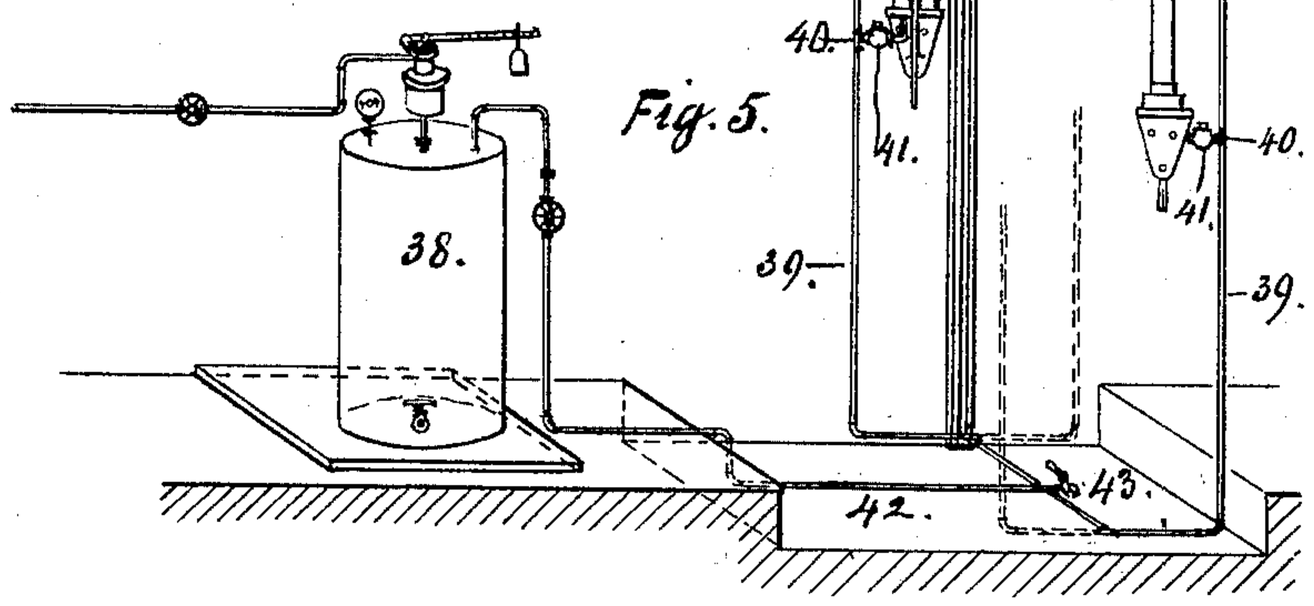


Fig. 5.



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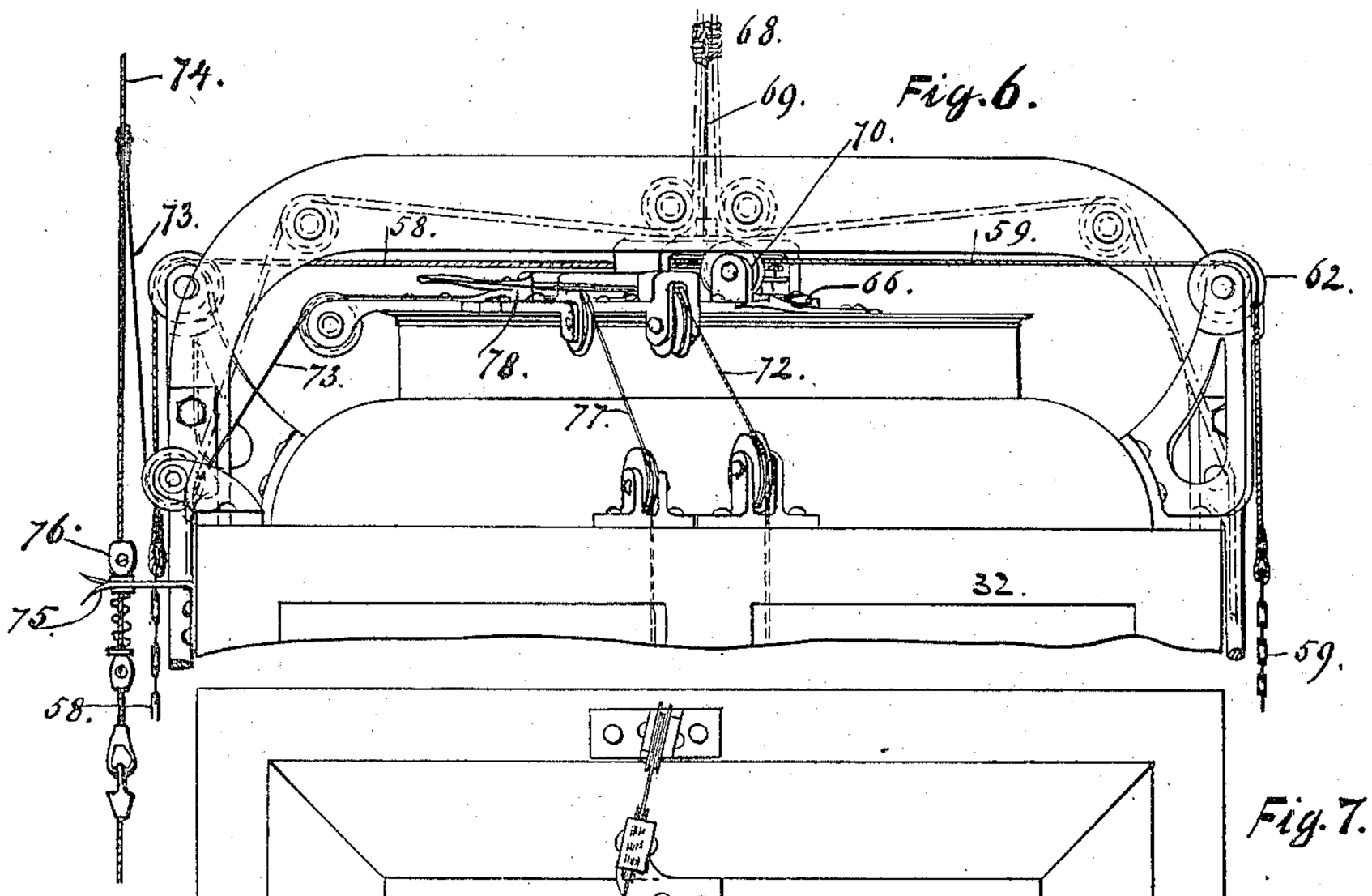

Fig. 6.

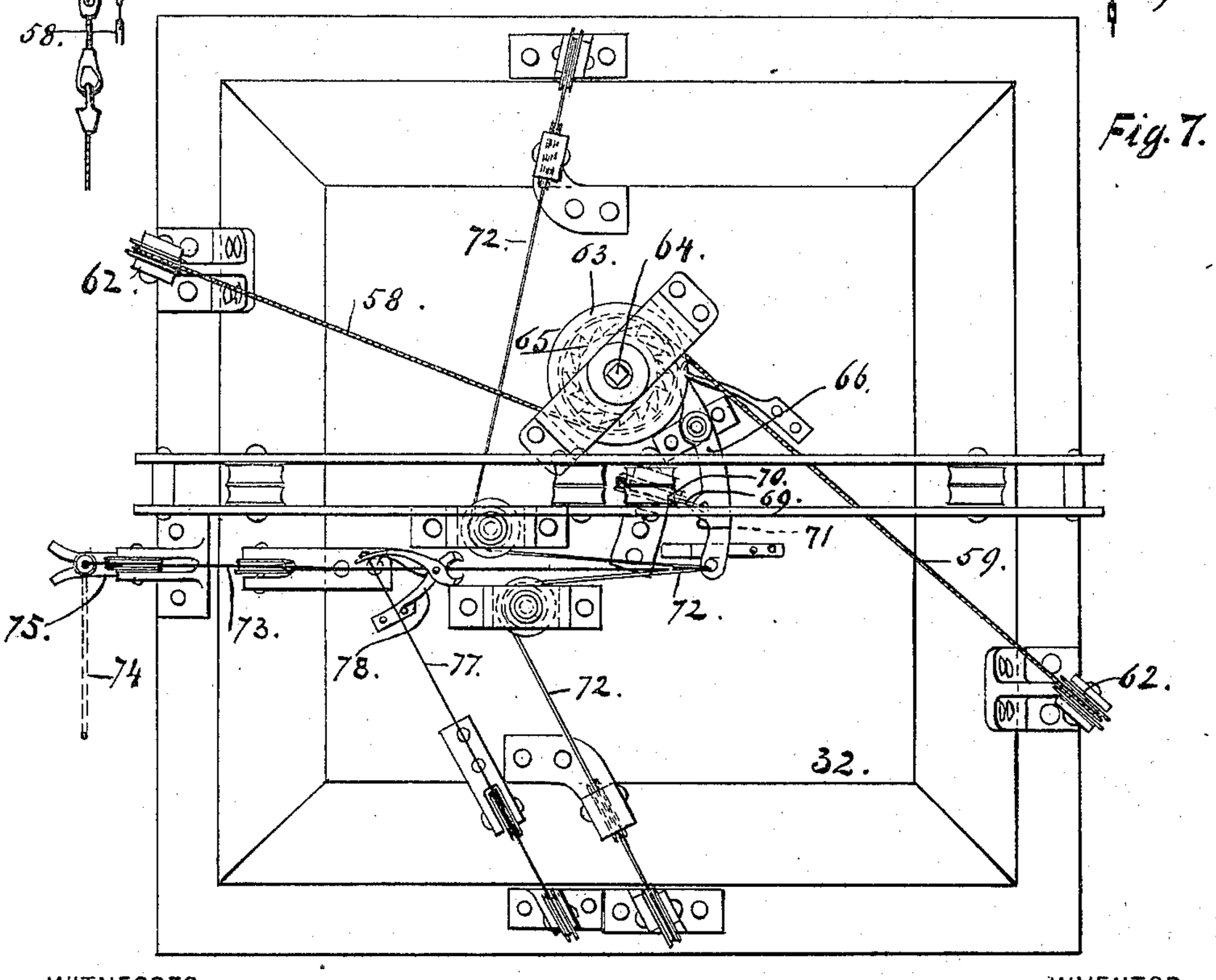

Fig. 7.

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Fig. 8.

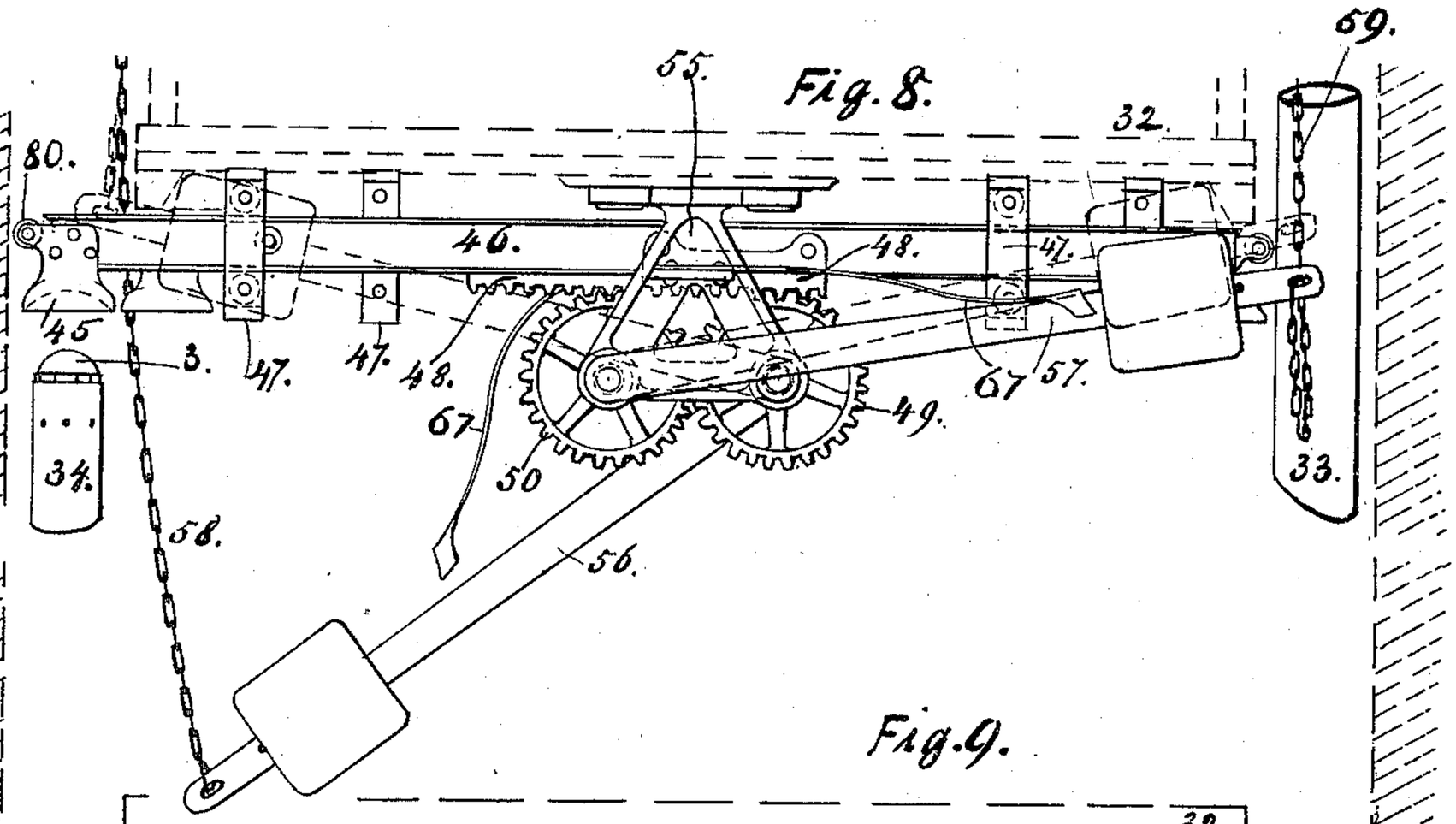

Fig. 9.

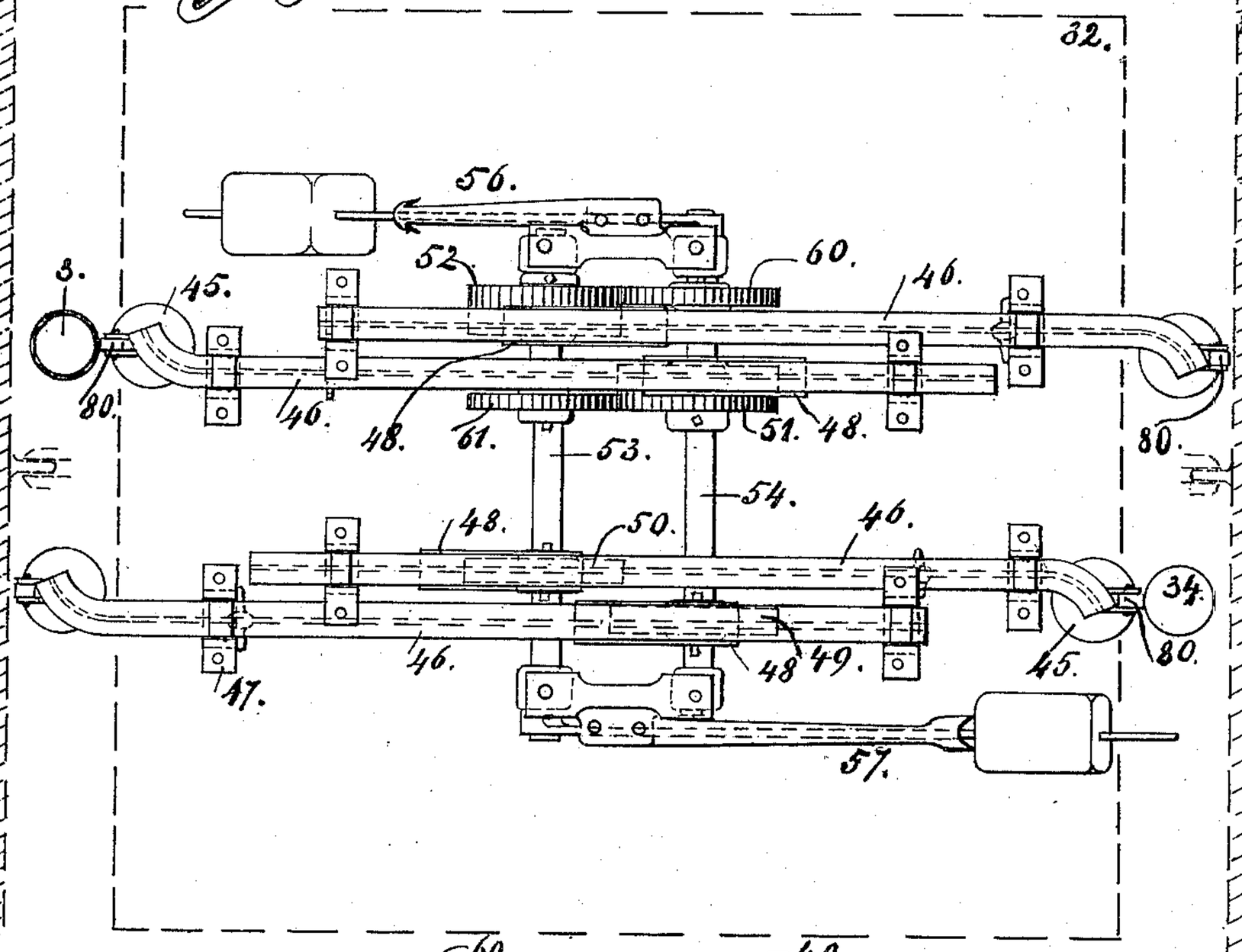

Fig. 10.

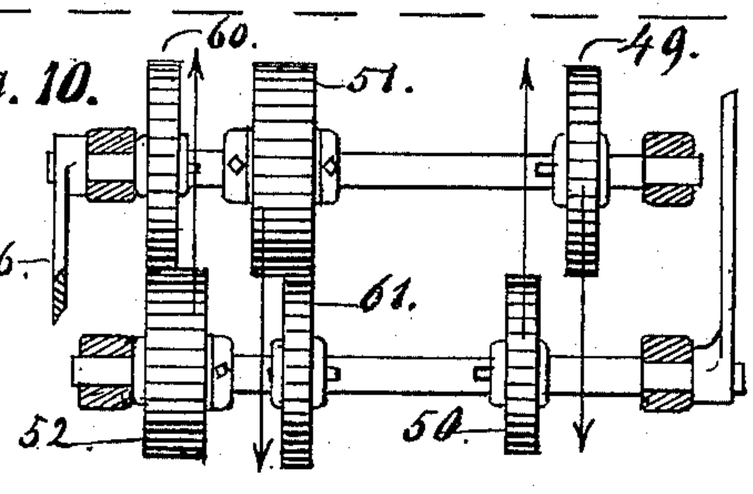

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Fig. 16.

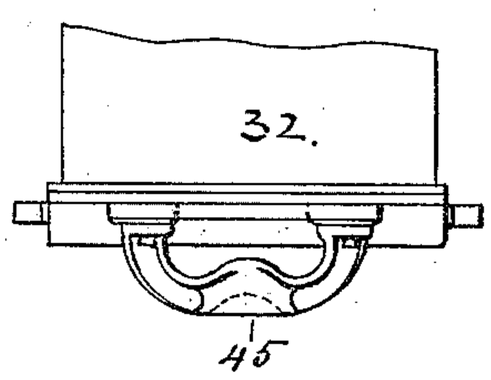


Fig. 18.

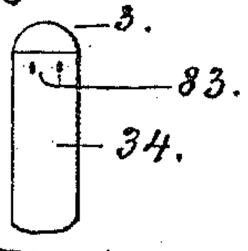


Fig. 17.

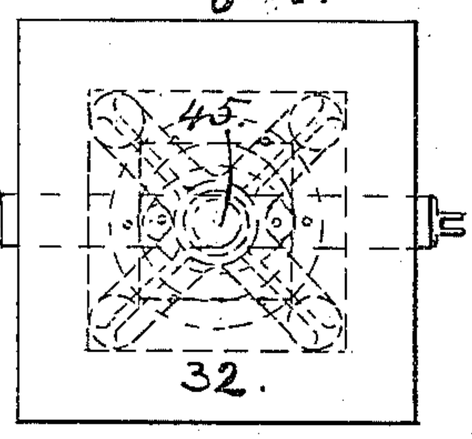


Fig. 19.

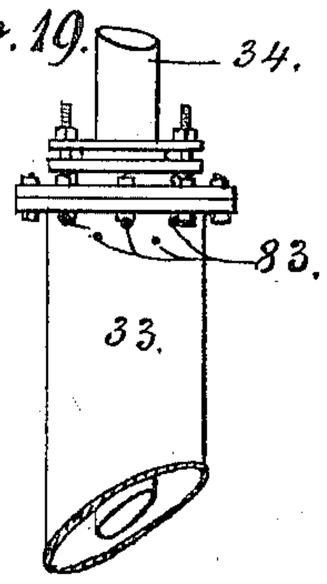


Fig. 13.

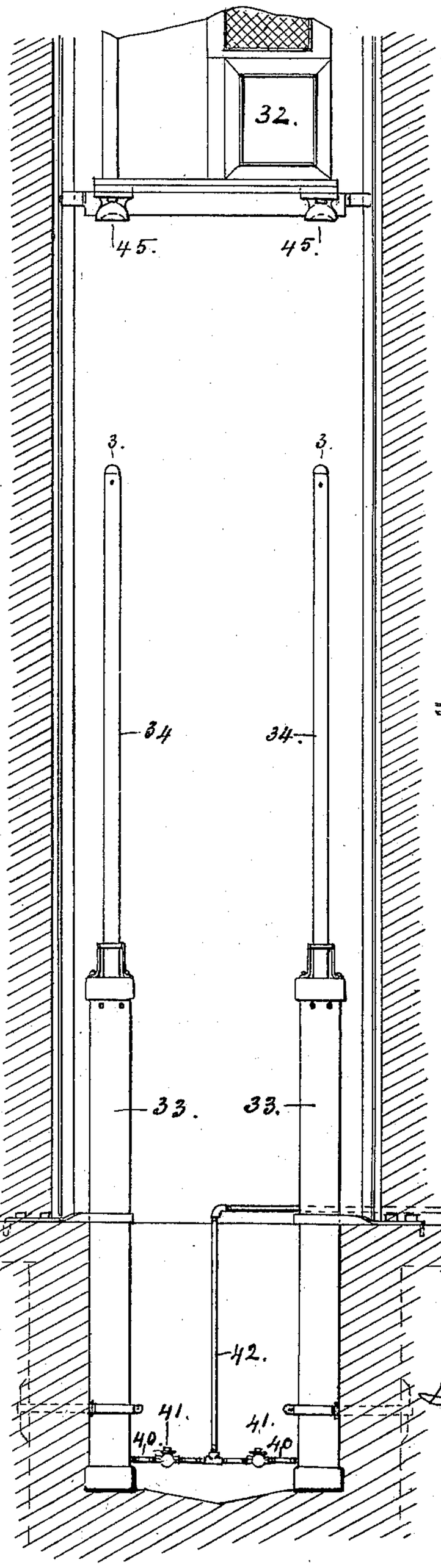


Fig. 15.

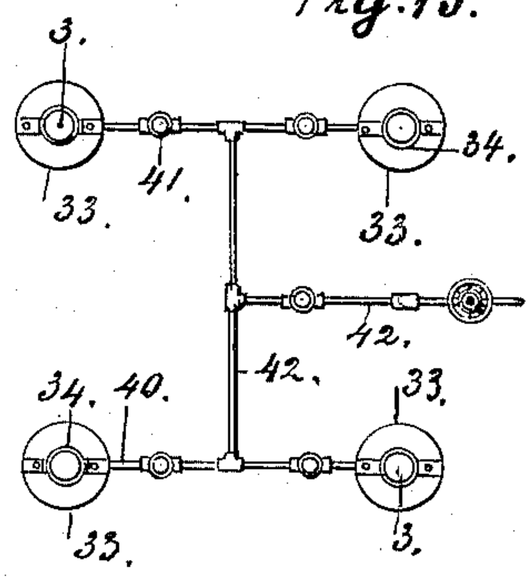
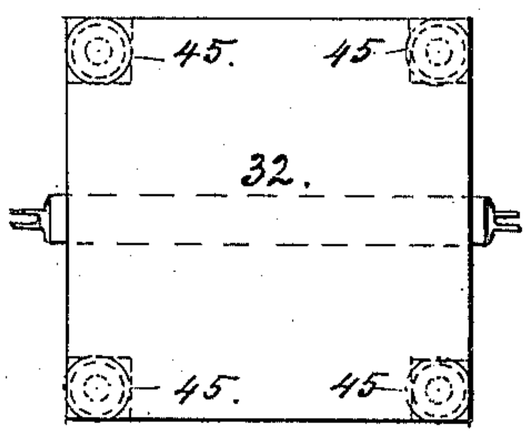


Fig. 14.



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SAFETY APPLIANCE FOR ELEVATORS.

(Application filed June 17, 1899.)

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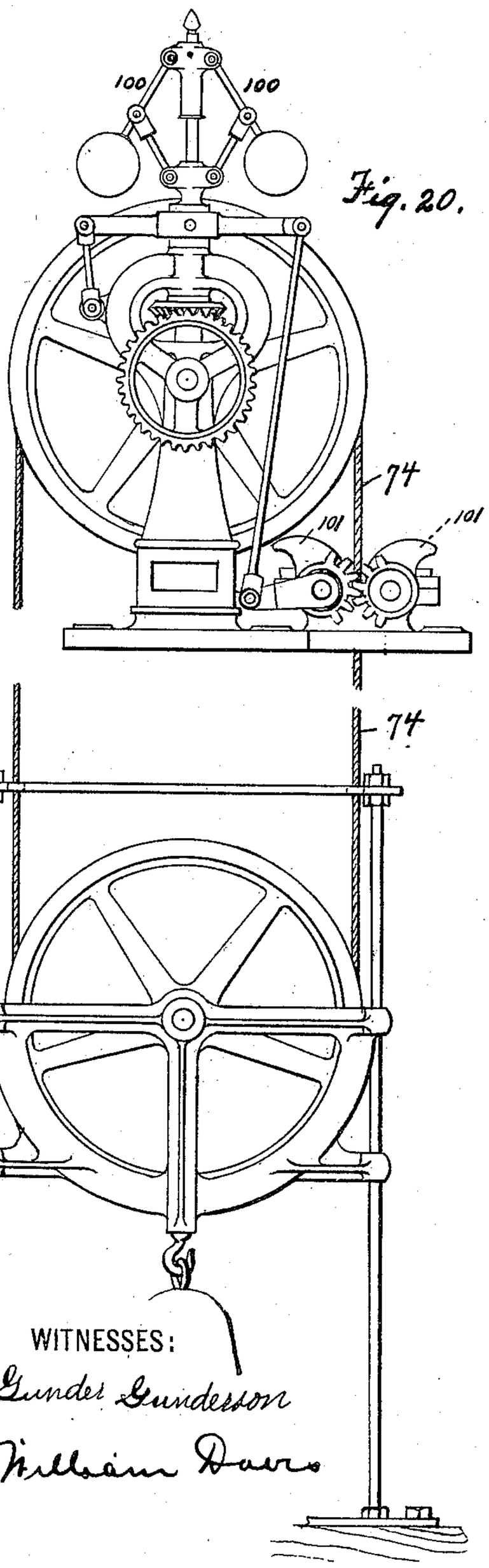

Fig. 20.

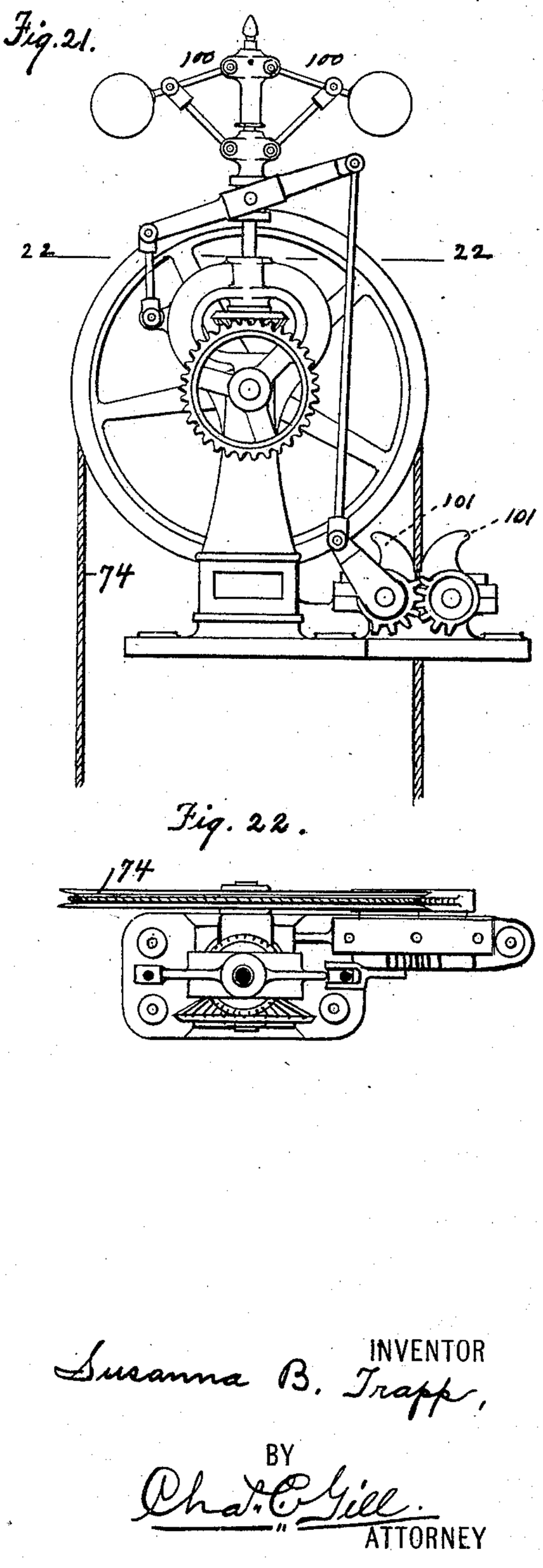

Fig. 21.

Fig. 22.

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UNITED STATES PATENT OFFICE.

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SAFETY APPLIANCE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 634,966, dated October 17, 1899.

Application filed June 17, 1899. Serial No. 720,932. (No model.)

To all whom it may concern:

Be it known that I, SUSANNA B. TRAPP, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Safety Appliances for Elevators, of which the following is a specification.

The invention relates to improvements in safety appliances for elevators; and it consists in the novel features and combinations of parts hereinafter described, and particularly pointed out in the claims.

The invention comprises means for arresting the car in case of accident at any one of the several floors of a building and in so cushioning the car upon the stoppage thereof as to relieve the car from breakage and its passengers from unnecessary shock or jar.

The invention comprises air-cushioning apparatus located at the several floors of the building combined with means carried by the car for arresting the latter, in case of accident, upon said apparatus, and these apparatus and means will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical sectional view through the elevator-shaft of a building equipped with safety apparatus constructed in accordance with and embodying the invention. Fig. 2 is an enlarged side elevation of one set of the apparatus located at each floor of the building, said apparatus being duplicated at each floor and at each floor comprising a lower main cylinder for air and an upper piston or plunger cylinder coupled with means for supplying the lower cylinder with air under pressure. Fig. 3 is a central vertical section of same on the dotted line 3 3 of Fig. 2. Fig. 4 is an enlarged central vertical section of a portion of same, this figure being presented to more clearly illustrate the valve construction at the lower end of the upper or piston cylinder. Fig. 5 is a diagrammatic view showing the arrangement of the air-cushioning appliances at the various floors of the elevator-shaft, together with the air-reservoir for supplying the several air-cylinders of said appliances. Fig. 6 is an enlarged detached side elevation of the upper portion of a passenger-car and illustrating the features carried thereby for coöperation with the elements carried at the bottom of the car. Fig. 7 is a top view of same. Fig. 8 is a side elevation of the lower end of a passenger-car equipped with mechanism for engaging the air-cushioning appliances located at the several floors of the building. Fig. 9 is a bottom view of same. Fig. 10 is a detached view of the gearing carried at the lower end of the car and illustrated in Figs. 10 and 11. Fig. 11 is a transverse section through an elevator-shaft looking upward at the lower end of a passenger-car having at said end a modified form of apparatus for the stops, which are normally held out of the path of the air-cushioning appliances and which in case of accident are moved into said path, so as to contact with said appliances and arrest the car. Fig. 12 is a side elevation of same. Fig. 13 is a vertical sectional view through an elevator-shaft equipped at its lower end with the air-cushioning mechanism comprising a portion of the invention. Fig. 14 is a detached bottom view of the passenger-car represented in Fig. 13. Fig. 15 is a detached top view of the air-cushioning mechanism represented at the lower end of the elevator-shaft shown in Fig. 13. Fig. 16 is an enlarged side elevation of a modified form of stop-plate carried at the lower end of the passengear-car, the modification consisting in the employment of the one central stop-plate in lieu of the four corner stop-plates shown in Figs. 13 and 14. Fig. 17 is a top view of same. Fig. 18 is an enlarged side elevation of the upper end or portion of the upper or piston cylinder. Fig. 19 is an enlarged detached elevation of the upper portion of the lower air-cylinder and the lower portion of the upper or piston cylinder. Fig. 20 is a detached side elevation, partly broken away, of a usual form of speed-governor mechanism for elevators. Fig. 21 is a like view of the upper portion of same, the clamping-jaws being shown in position clamping the speed-governor cable; and Fig. 22 is a horizontal section of same on the dotted line 22 22 of Fig. 21.

In the drawings, 30 denotes a usual form of elevator-shaft equipped with the ordinary guides 31 for the passenger-car 32.

I will first describe the air-cushioning appliances located at or adjacent to the various

floors of the building and then the mechanism carried by the car for engaging in case of accident said appliances.

At or adjacent to, preferably, each floor of the building is secured upon suitable brackets of any convenient description an air-cushioning appliance comprising the lower air-cylinder 33 and the upper piston or plunger cylinder 34, (clearly illustrated in Figs. 2 and 3,) the upper end of the piston 34 having suitable small outlet-apertures 35 and the lower end of said cylinder being provided with the piston head 36, containing the upwardly-acting valve 37. (More clearly illustrated in Fig. 4.) The air-cylinder 33 is stationary, and the piston-cylinder 34 is adapted to have a vertical movement within said cylinder and with it form an air-cushioning appliance which is a duplicate of the other cushioning appliances arranged throughout the elevator-shaft, and hence in Figs. 2, 3, and 4 I illustrate, on an enlarged scale, one of the said appliances. Each of the cylinders 33 of the cushioning appliances is to be supplied with air under pressure, and hence at a lower floor or in the basement of the building or elsewhere, if preferred, will be provided the reservoir 38 for compressed air, and this reservoir will be in communication with stand-pipes 39, extending upward through the elevator-shaft and connected by small branch pipes 40 with the lower ends of the cylinders 33. Each of the branch pipes 40 will be provided with a customary check-valve 41, which will admit of the passage of the air from the stand-pipes 39 into the cylinders 33, but will prevent the return of said air into said stand-pipes in the event of an accident, by which the piston-cylinders 34 may be driven downward into the cylinders 33. The arrangement of the reservoir 38 and stand-pipes 39 is illustrated in Fig. 5, and in Fig. 2 one of the said stand-pipes, with its branch 40, containing the check-valve 41, is presented on an enlarged scale. Intermediate the reservoir 38 and stand-pipes 39 is the connecting-pipe 42, and it likewise will be provided with an automatic check-valve 43, Fig. 5, by which the air after having passed into the stand-pipes 39 is prevented from returning through the pipe 42 to the reservoir 38.

In the normal condition of the air-cushioning appliances, each comprising the cylinder 33 and its piston, air compressed to suit the size of and weight to be carried by the elevator car or platform will be forced into the air-cushion cylinder 33 below the piston-head therein, the pressure of this air always being sufficient to force the said piston upward and maintain the same at the upper end of the cylinder 33, said appliance when thus supplied with the compressed air being in condition to be brought into immediate action. In the absence of any accident the air-cushioning appliances will remain normal and inactive and perform no function whatever, said appliances only coming into use in case of accident and then only when certain stop-plates carried by the car are moved to a position directly in the path of the piston-cylinders 34.

The air-cushioning appliances will be arranged, preferably, at opposite sides of the elevator-shaft; but the invention is not limited to any special arrangement of the air-cushioning appliances, since their location and relation to one another will vary according to individual judgment and the conditions to be met in the buildings and shafts to be equipped with the elevators and the devices embodying my invention.

The pistons or plungers 34 will be guided by any suitable means, and these need not be specifically described.

In case of accident the upper end 3 of the appropriate pistons 34 will be engaged by the stops 45, (see Figs. 8, 9, and 10,) which will be carried by the car and will normally be out of the path of said pistons 34 in order that they may not strike the latter during the ordinary safe travel of the car. The stops 45 will be connected with means whereby they may automatically or by design be moved from their normal position into a position in the path of the pistons 34, whereby upon the car reaching said pistons the said stops 45 will contact with the upper ends of the same, and by driving the latter downward under the force of the car will bring the latter to a gradual stop.

In Figs. 8 and 9 it will be seen that the stops 45 are in the nature of blocks or plates having concave lower surfaces to engage the upper convex ends 3 of the pistons 34 and that said stops are secured to the outer ends of sliding bars 46, mounted in suitable guides 47, and adapted to be moved outward and inward, so as to either hold the stops 45 at their normal inward position underneath the floor of the car 32 or to carry said stops outward into a position where they will be in the path of the pistons 34 in order to contact with said pistons and arrest the car.

In Fig. 8 I illustrate one of the stops 45 as having been moved outward into the path of the pistons 34, and in Fig. 9 I illustrate two of the stops 45, one at each side of the car, as having been moved outward into the path of the pistons 34, and also two of the stops, one at each side of the car, in the position they will assume if when started outward they meet the side of the pistons 34 or cylinders 33 instead of passing into space directly over or in the path of said pistons 34. Should the pistons and cylinders be arranged in the manner shown in Fig. 1, it would follow that when the stops 45 started outward they would naturally assume the position in which they are illustrated in Figs. 8 and 9. The car 32 will be provided with means whereby all of the stops 45 are normally held at their inward position out of the path of the pistons 34, since said stops are never to be moved to their outward position in the path of the

pistons 34 except in case of an accident or some other occasion rendering their use necessary for the stoppage of the car.

In Figs. 8, 9, and 10 I illustrate one set of mechanism for controlling the movement of the stops 45, and in Figs. 11 and 12 I illustrate a modified form of mechanism for accomplishing the same result.

In Figs. 8 and 9 it will be seen that the stops 45 are carried at the outer ends of the sliding bars 46 and that said bars are formed along a portion of their lower surfaces with the racks 48 to engage the gear-wheels denoted by the numerals 49, 50, 51, and 52, said gear-wheels being upon the parallel shafts 53 and 54, mounted in suitable hangers 55. The gear-wheels 49 and 50 are keyed upon their respective shafts, and the gear-wheels 51 and 52 are free or loosely mounted on their respective shafts, as indicated in Fig. 10. Upon one end of the shaft 54 is secured a weighted lever 56, and upon one end of the shaft 53 is secured a weighted lever 57. The levers 56 and 57 when in their normal position are held upward against the bottom of the car 32 by means of the chains 58 and 59, whose lower ends are secured to said levers and whose upper ends are connected with mechanism carried at the top of the car 32 and which normally hold said chains taut, so that said chains may maintain the levers 56 57 in their upper position. In Fig. 8 I illustrate at the left-hand side of said figure the lever 56 in its lower position by full lines and in its upper position by dotted lines, and at the right-hand side of said figure I show by dotted lines the lever 57 in its upper position and by full lines the said lever in the position it will assume when the chain 59 becomes slackened and said lever has descended the short distance permitted before the stop 45 at the right-hand side of the car contacts with the side of one of the cylinders 33 and becomes thereby stopped in its outward movement and stops said lever 57 in its downward movement. The movement of the levers 56 and 57 is intended to operate the shafts 53 and 54, and through said shafts and the gear-wheels 49, 50, 51, and 52 the sliding bars 46, carrying the stops 45, and the parts of this connected set of mechanism are so disposed that when the levers 56 and 57 are held in their normal upward position the sliding bars 46 and the stops 45 will be at their inward position, said stops 45 then being below the car and out of the path of the pistons 34, as indicated at the upper portion of the left-hand side and the lower portion of the right-hand side of Fig 9, and that when said levers 56 and 57 are permitted to descend to their lower position the sliding bars 46 and stops 45 will take their outer position, the stops 45 being then in the path of the pistons 34, as illustrated at the lower portion of the left-hand side and the upper portion of the right-hand side of Fig. 9. If, for illustration, the lever 56 should descend to its lower position, as indicated in Fig. 8, it will operate the shaft 54 and cause said shaft to turn the gear-wheel 49 to move its sliding bar 46 outward to the left (see Fig. 9) and at the same time will turn the narrow gear-wheel 60 against the gear-wheel 52 and in that way cause the loose gear-wheel 52 to move its sliding bar 46 outward toward the right. When the lever 57 descends, it operates the shaft 53 and causes the gear-wheel 50 to move its sliding bar 46 outward toward the right, and at the same time the rotation of the shaft 53 is communicated to the gear-wheel 61 and by the latter to the loose gear-wheel 51, with the result that the gear-wheel 51 will move its sliding bar 46 outward toward the left. Thus each of the levers 56 and 57 may during its descent effect the outward movement of two bars 46 (one moving toward the right and the other toward the left) to carry their stops 45 into the path of the pistons 34 in order that said stops 45 may strike upon the upper ends of the appropriate pistons 34 and thereby bring the car to a gradual stop.

The mechanism carried at the bottom of the car for sustaining and operating the stops 45 may be varied in many respects, the purpose of said mechanism being simply to hold the stops 45 inward underneath the car and out of the path of the pistons 34 during the safe travel of the car and to project said stops 45 outward into the path of said pistons 34 in the event of any accident or condition which would render it necessary or desirable to arrest the car by the contact of said stops 45 with the upper ends of the pistons 34.

The means for holding the levers 56 and 57 upward in their normal inoperative position are the chains 58 and 59, and these chains extend upward along the sides of the car 32 and after passing over pulleys 62 (see Figs. 6 and 7) are wound upon a drum mounted upon a vertical shaft 64 at the top of the car. The drum 63 is provided with the ratchet-wheel 65, and this ratchet-wheel is engaged by the spring-pressed pawl 66, which prevents any reverse rotation of the drum 63 until it (said pawl) is removed from its engagement with said ratchet-wheel. The upper end of the shaft 64 will preferably be of rectangular shape in cross-section in order to facilitate the rotation of said drum and the winding thereon of the chains or cables 58 and 59. For convenience the chains 58 and 59 may be continued in cable form at the upper portions, as illustrated; but, if preferred, the said elements 58 and 59 may be of chain form throughout or of cable form throughout. In the normal running condition of the elevator-car 32 the cables or chains 58 and 59 will be tightly wound upon the drum 63, so as to be drawn taut, and thereby hold the levers 56 and 57 in their normal upward position against the lower end of the car. Thus it will be obvious that while the pawl 66 remains in engagement with the ratchet-wheel 65 of the drum 63 the levers 56 and 57 will normally hold the stops 45 inward out of the path of

the pistons 34 and that during the ordinary safe travel of the car said stops 45 will remain idle and at rest.

It is the purpose of the invention that in case of accident the drum 63 shall be permitted to unwind and that the stops 45 shall pass into the path of the pistons 34 in order to contact with the upper ends of said pistons during the descent of the car and thereby arrest the latter. If in the construction shown in Figs. 8 and 9 the pawl 66 should be relieved from the ratchet-wheel 65, the weighted levers 56 and 57 of their own gravity and assisted, if desired, by springs 67 Fig. 8, will at once turn downward and pull on the cables or chains 58 59, unwinding the latter from the drum 63 and forcing the bars 46 to carry the stops 45 into the path of the pistons 34. I will therefore next describe the means whereby the pawl 66 may, in case of accident, be relieved from the ratchet-wheel 65.

The usual hoisting-cable is designated by the numeral 68, and upon reference to Fig. 6 it will be seen that connected with this cable is a thin wire or cable 69, which passes downward below the grooved wheel or pulley 70 and is connected to an eye 71 of the pawl 66. (See Fig. 7.) During the ordinary travel of the car the hoisting-cable 68 and the wire or cable 69 will maintain a uniform relation, and said cables will, under such circumstances, have no effect upon the pawl 66; but should the hoisting-cable 68 break in any of its most dangerous points (where it passes over the several pulleys carried at the top and sides of the car) the weight of the car would throw a materially-increased strain upon the cable 69, and at such time and under such conditions the cable 69 would exert a direct pull on the outer portion of the pawl 66 and relieve said pawl from its engagement with the ratchet-wheel 65 of the drum 63, the result being that said drum 63 would be unrestrained and the levers 56 and 57 would turn downward, unwinding the cables or chains 58 and 59 from the drum 63 and moving the stops 45 into the path of the pistons 34 in order that said stops might contact with the upper ends of said pistons and stop the car. Thus I have explained one illustration of an accident which would bring the stops 45 into coöperative relation with the air-cushioning appliances, and this illustration is by no means an exceptional one, since it has been found that the hoisting-cables for elevators when they break at all almost uniformly meet with this accident at the points adjacent to the top or sides of the car where the several portions of the hoisting-cable are passed over pulleys carried by the car. Should the hoisting-cable break at some point farther removed from the car, the cable 74 of the speed-governor may be relied upon to release the pawl 66 and permit the stops 45 to move into active position.

An occasion might arise in which the usual stopping and starting cable in the car would fail to perform its duty, and under such condition it would be desirable to enable the stopping of the car by means of the safety appliances embracing my invention, and hence, as illustrated, I connect with the outer end of the pawl 66 the cable 72, which will be passed over suitably-arranged pulleys at the top of the car, as shown in Figs. 6 and 7, and thence pass downward through the car, as indicated by the dotted lines in Fig. 1, in convenient position to be grasped and pulled by the attendant in the car. The pulling on the cable 72 would release the pawl 66 from the ratchet 65, and thereby permit the weighted levers 56 and 57 to turn downward and effect the outward movement of the stops 45 into the path of the pistons 34 for the purpose of enabling the said pistons to arrest the descent of the car.

From what has been said above it will be apparent that the operation of the movable stops 45 (shown in Figs. 8 and 9) is controlled by the release of the pawl 66, and should the car 32 start to travel at an unsafe speed it is obvious that the pawl 66 should be released from the ratchet 65 in order that the levers 56 and 57 might descend and throw out the stops 45, and hence in addition to the means hereinbefore described for releasing the pawl 66 I also connect said pawl 66, as shown in Figs. 6 and 7, by means of a slender cable 73 with the cable 74 for the usual speed-governor. The cable for the speed-governor is the usual speed-governor cable and is operatively connected with the usual governor located at the top of the building and illustrated in Figs. 20, 21, and 22. It is well understood that upon the car attaining an undue speed the arms of the governor will be thrown outward and effect the stoppage of the cable 74, which travels with the car. In Figs. 20 and 21 the governor-arms are designated by the numeral 100, and when, due to an excess of speed of the car, said arms 100 are thrown outward, as shown in Fig. 21, they effect through the usual intermediate connections the binding of the clamping-jaws 101 against the cable 74 in a well-known manner.

In the present instance upon the attaining of an undue speed by the car and the throwing outward of the usual governor-arms the cable 74 will, as usual, be stopped, and upon the happening of said condition the descending car will pull on the slender cable 73 then at one end checked by the cable 74, with the result that the cable 73 will pull on the outer end of the pawl 66 and release said pawl from the ratchet 65, whereby the levers 56 and 57 will be permitted to at once descend and move outward the stops 45 into the path of the pistons 34 of the air-cushioning cylinders to arrest the car. When the speed-governor cable 74 is arrested, under the undue speed of the car said cable will slip from its connection with the car, since in the present instance it is simply connected with the car by

means of the split spring 75, (see Fig. 6,) which straddles the said cable 74 below a stop-block 76 thereon.

Thus in accordance with the features hereinbefore described the car 32 will be automatically arrested by the breakage of the hoisting-cable. It may be arrested by the attendant in the car pulling on the cable 72 at either side of the car, and it may be automatically arrested when under any undue speed of the car the speed-governor cable 74 is checked in its motion.

It may also be desirable in case of fire to run the elevator-car 32 at full speed and to detach the car from the speed-governor cable 74, so that said car may travel at such increased speed as would not be permitted by the speed-governor, and under such conditions it would also be desirable that the safety appliances embracing my invention should remain in operative condition, so that they could be set into operation by the attendant in the car should occasion arise for that result, and to this end I provide within the car a cable 77, extending upward over the top of the car and connected with the movable arm of a pair of cutting-nippers 78, between whose cutting edges the cable 73 will normally lie. If it should be desired to prevent the speed-governor cable 74 from having any influence on the car, the attendant within the car may, by pulling on the cable 77, operate the cutting-nippers 78 to cut the slender cable 73, and thus the connection of the cable 74 with the pawl 66 would be broken and the speed-governor would have no further influence either on the car or the safety appliances provided for the car by my invention.

The invention is not, of course, limited to any special appliances for severing the cable 73; but it will be found that the simple pair of cutting-nippers 78 will answer for that purpose. After the severing of the slender cable 73, so as to break the connection of the speed-governor cable 74 with the pawl 66, the car upon traveling at an undue speed would, upon the checking of the cable 74 by the speed-governor, leave the said cable 74.

During the travel of the car 32 it is desirable in some respects that provision should be made to prevent the stops 45 on any outward movement of the latter from striking upon the upper edges of the cylinders 33, it being the purpose of this invention that said stops shall only strike upon the upper ends of the pistons 34, and to accomplish this result I provide upon the sides of the cylinders 33, facing the car 32, the guard-rails 79, (more clearly shown in Figs. 2 and 3,) which operate as tramways for rollers 80, carried at the outer ends of the bars 46 and projecting outward slightly beyond the edges of the stops 45. Should the bars 46 move the stops 45 outward at a time when said stops are below the upper ends of the first adjacent pistons 34, said rollers would pass downward along the sides of the said pistons and thence meet and pass downward along the tramways 79 until they have passed from the lower ends of the latter, at which time the stops 45 would attain their full outward position and meet the upper ends of the next lower pistons 34, by which the car would be arrested.

From the foregoing description it will be seen that my invention in part comprises air-cushioning cylinders adapted to contain compressed air and located at points along the elevator-shaft convenient to the various floors of the building, combined with stops carried by the car and adapted either automatically or by design to be moved into the path of said cushioning-cylinders, in order thereby to drive the pistons downward therein and increase the pressure of the already-compressed air within said cylinders, whereby the stoppage of the car is effected gradually and without undue shock, the excess of pressure being meanwhile permitted to exhaust through the valves 37. The various air-cylinders 33 are supplied with compressed air from the reservoir 38, and the pressure of this air within the cylinders 33 is sufficient to maintain the pistons 34 in their upward position, ready to be brought into action. The lower end of the pistons 34 carry piston-heads 36, provided with valves 37, as shown in Fig. 4. The valves 37 are upwardly yielding, but are so held down by the springs or otherwise that they will not open upwardly except upon excessive pressure being present within the cylinders 33. In the event of the car being arrested upon the upper end of any one or more of the pistons 34 the said piston or pistons would be driven downward against the compressed air within the cylinder or cylinders 33, and this resulting increased pressure within the cylinders 33 would effect the partial opening of the valves 37, so that the air trapped within the cylinders 33 may gradually and in proper proportion pass upward into the cylindrical piston 34 and find an outlet through the vent-aperture 35 at the upper end thereof. It is my purpose that the cushioning-cylinders shall be placed adjacent to each floor of the building in order that the car, when arrested, will be brought opposite to one of said floors and the occupants of the car be permitted to easily escape therefrom.

I do not, of course, limit the invention to the use of any special number of the air-cushioning cylinders 33, but in tall buildings I recommend that they be provided adjacent to each floor of the building and whenever possible at opposite sides of the elevator-shaft in order that absolute safety may be guaranteed to the occupants of the car. All of the cylinders 33 may be supplied with compressed air from the one reservoir 38.

The invention is not limited to the special means (shown in Figs. 8, 9, and 10) carried at the bottom of the car for operating the stops 45, and hence in Figs. 11 and 12 I illustrate a modified form of this mechanism. In Figs. 11 and 12 the stops 45 are carried at the outer

ends of pivoted levers 81, which are held at their inward position by the chains 58 and 59 against the force of the springs 82, flexed against them, and normally operating to so turn said levers 81 as to throw the stops 45 into the path of the pistons 34. The levers 81 of Figs. 11 and 12 operate horizontally and take the place of the levers 56 and 57 of Figs. 8 and 9, which operate vertically. In Figs. 11 and 12 the springs 82 take the place of the weights applied to the levers 56 and 57 of Fig. 9. In view of the fact that the levers 81 of Fig. 11 operate horizontally and carry the stops 45 in a direction substantially parallel with the sides of the elevator-shaft the tramways 79 should be placed at that side of the air-cylinders 33 which faces the rollers 80 carried by the said levers 81.

Figs. 11 and 12 are presented merely to indicate that the invention is not in every instance limited to the specific mechanism shown in Figs. 8 and 9 for moving when released the stops 45 into the path of the pistons 34.

In some buildings it might prove to be unnecessary to have the air-cushioning appliances at the several floors thereof, and in such cases the air-cushioning appliances may be provided at the lower end only of the elevator-shaft, as illustrated in Fig. 13, in which the stops 45 are shown as stationary and secured to the bottom of the car directly in the path of the pistons 34, so that in case of accident the car may descend to the lower end of the shaft and be arrested by the contact of said stops 45 with the upper ends of the pistons 34, the cylinders 33 for which will be charged with compressed air from the reservoir, the same as has been described hereinbefore with respect to the cylinders located at the several floors of the building. I shall usually prefer to employ four of the air-cylinders 33 and pistons 34 at the lower end of the elevator-shaft, as indicated in Fig. 15, the use of the four pistons 33 necessitating the employment of the four stops 45 on the bottom of the car, as illustrated in Fig. 14. It is obvious, however, that the four cylinders 33 and four pistons 34 need not in every instance be employed and that in lieu thereof but one centrally-disposed cylinder 33 and piston 34 may be employed, in which case the bottom of the car would be provided with but one centrally-arranged stop 45, as shown in Figs. 16 and 17, said stop being directly in line with the piston 34, so as to contact with the same in case of the fall of the car.

I provide the upper ends of the cylinders 33 with the necessary vent-apertures 83 to permit of the proper movement of the pistons within said cylinders.

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

1. In combination with the car, the cylinder, the reservoir connected with and for supplying said cylinder with fluid under pressure, a check-valve to prevent the return of the compressed fluid to said reservoir, the piston within said cylinder, and a valve for retaining said compressed fluid within said cylinder under normal conditions and until the same is further compressed by the force of the car driving said piston against said fluid; substantially as set forth.

2. In combination with the car, the cylinder and piston, the valve in said piston to open under the force of excessive air-pressure, and means for supplying the said cylinder with air under pressure and thereby maintaining said piston in position to be driven against the air confined within said cylinder when the force of the car is exerted against said piston; substantially as set forth and for the purposes described.

3. In combination with the car, the cylinder for receiving air under pressure, the hollow piston having its head within said cylinder and provided at its upper portion with a vent and in said head with the valve to open under the force of excessive air-pressure, and means for supplying the said cylinder with air under pressure and thereby maintaining said piston in position to be driven against the air confined within said cylinder when the force of the car is exerted against said piston; substantially as set forth and for the purposes described.

4. In combination with the car, the cylinder and piston, and means for supplying said cylinder with air under pressure and thereby maintaining said piston in position for operation against the trapped air in the cylinder when the force of the car is exerted against said piston, the said piston being vented to permit the escape of the air from the cylinder under a condition of excessive air-pressure; substantially as set forth and for the purposes described.

5. In combination with the car, the cylinder and piston, and means for supplying the said cylinder with air under pressure and thereby maintaining said piston in position for operation against the trapped air in the cylinder when the force of the car is exerted against said piston, the said piston being vented to permit the escape of the air from the cylinder under a condition of excessive air-pressure, and said cylinder being vented at its upper end above the piston-head; substantially as set forth and for the purposes described.

6. The car having a stop, and means for moving said stop from its normal inactive position to an active position, combined with a cylinder, means for maintaining a supply of air under pressure within said cylinder, and the piston within said cylinder and in position to be driven against the air therein under the force of said stop when the latter is in its active position; substantially as set forth and for the purposes described.

7. The car having stops and means for moving said stops from a normal inactive position to an active position, combined with cylinders, means for maintaining a supply of air

under pressure within said cylinders, and the pistons within said cylinders and in position to be driven against the air therein under the force of said stops when the latter are in their active position; substantially as set forth and for the purposes described.

8. The car, a series of cylinders located at points along the sides of the elevator-shaft, means for supplying said cylinders with air under pressure, and the pistons within said cylinders and in position to be driven against the air therein under the force of the car, combined with stops carried by the car and normally inactive, and means for moving said stops into an active position for acting upon said pistons; substantially as set forth and for the purposes described.

9. The car, a series of cylinders located at points along the sides of the elevator-shaft, means for supplying said cylinders with air under pressure, and the pistons within said cylinders and in position to be driven against the air therein under the force of the car, combined with stops carried by the car and normally inactive, and means connected with the hoisting-cable for moving said stops, upon the breakage of said cable, into an active position for operating said pistons; substantially as set forth and for the purposes described.

10. The car, a series of cylinders located at points along the sides of the elevator-shaft, means for supplying said cylinders with air under pressure, and the pistons within said cylinders and in position to be driven against the air therein under the force of the car, combined with stops carried by the car and normally inactive, and means under the control of the attendant in the car for moving said stops into an active position for operating said pistons; substantially as set forth and for the purposes described.

11. The car, a series of cylinders located at points along the sides of the elevator-shaft, means for supplying said cylinders with air under pressure, and the pistons within said cylinders and in position to be driven against the air therein under the force of the car, combined with stops carried by the car and normally inactive, and means connected with the speed-governor cable for effecting the movement of said stops, upon the checking of said cable, into an active position for operating said pistons; substantially as set forth and for the purposes described.

12. The car, a series of cylinders located at points along the sides of the elevator-shaft, means for supplying said cylinders with air under pressure, and the pistons within said cylinders and in position to be driven against the air therein under the force of the car, combined with stops carried by the car and normally inactive, means connected with the speed-governor cable for effecting the movement of said stops, upon the checking of said cable, into an active position for operating said pistons, and means for disconnecting said stops from the influence of said cable; substantially as set forth and for the purposes described.

13. The car, and a series of compressed-air cushions along the elevator-shaft, combined with means for arresting the car upon said cushions; substantially as set forth and for the purposes described.

14. The car, a series of compressed-air cushions along the elevator-shaft, and means for normally maintaining said cushions, combined with means for arresting the car upon said cushions, and means for permitting the escape of the air from said cushions, when the latter are brought into use, so as to relieve the car from undue shock; substantially as set forth and for the purposes described.

15. The car, the series of compressed-air cushions along the elevator-shaft, and means for normally maintaining said cushions, combined with stops carried by the car for engaging said cushions and arresting the car thereon but being normally out of the path of said cushions, lever mechanism for automatically, when released, moving said stops into the path of said cushions, a flexible connection for normally restraining said lever mechanism from moving said stops into their active position, and means for releasing said lever mechanism to move said stops into active position to engage said cushions; substantially as set forth and for the purposes described.

16. The car, the series of compressed-air cushions along the elevator-shaft, and means for normally maintaining said cushions, combined with stops carried by the car for engaging said cushions and arresting the car thereon but being normally out of the path of said cushions, lever mechanism for automatically, when released, moving said stops into the path of said cushions, the drum on the car, the pawl normally preventing reverse motion or unwinding of said drum, the flexible connections at one end wound upon said drum and at their other end normally restraining said lever mechanism from moving said stops into their active position, and means for pulling on said pawl to release said drum, flexible connections and lever mechanism; substantially as set forth and for the purposes described.

Signed at New York, in the county of New York and State of New York, this 16th day of June, A. D. 1899.

SUSANNA B. TRAPP.

Witnesses:

CHAS. C. GILL,

E. JOS. BELKNAP.