F. C. FURLOW.

AUTOMATIC LIMIT STOP.

APPLICATION FILED JULY 11, 1907.

986,377.

Patented Mar. 7, 1911.

2 SHEETS—SHEET 1.

FIG.1.

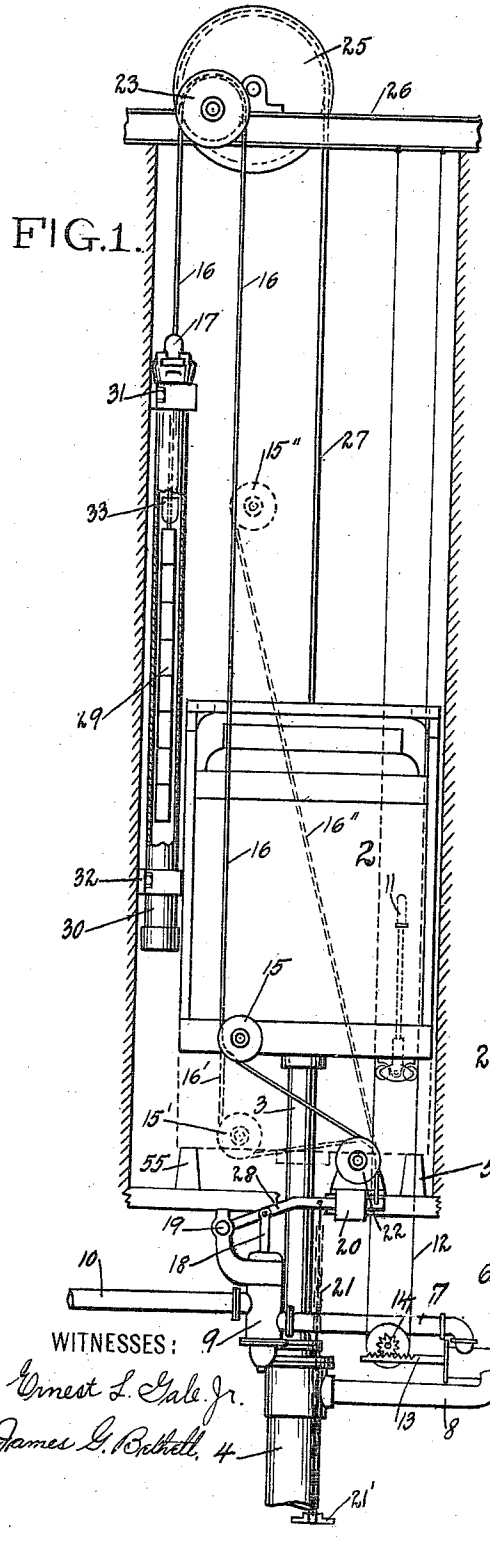



FIG.2.

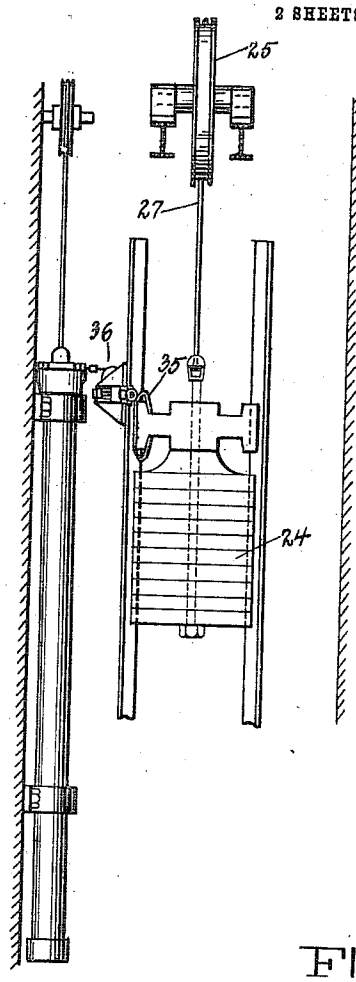
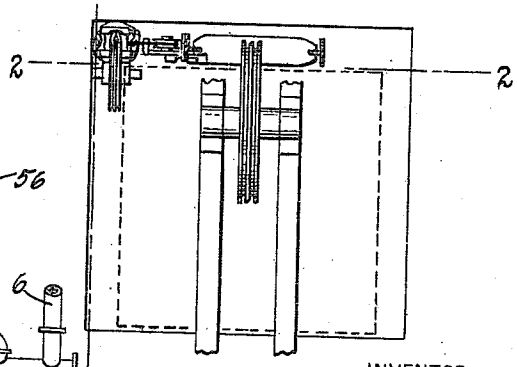



FIG.3.




WITNESSES:

Ernest L. Gale Jr.

James G. Bothell.

INVENTOR

Floyd C. Furlow

BY

C. M. Nissen

ATTORNEY

F. C. FURLOW.

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2 SHEETS—SHEET 2.

Fig. 4

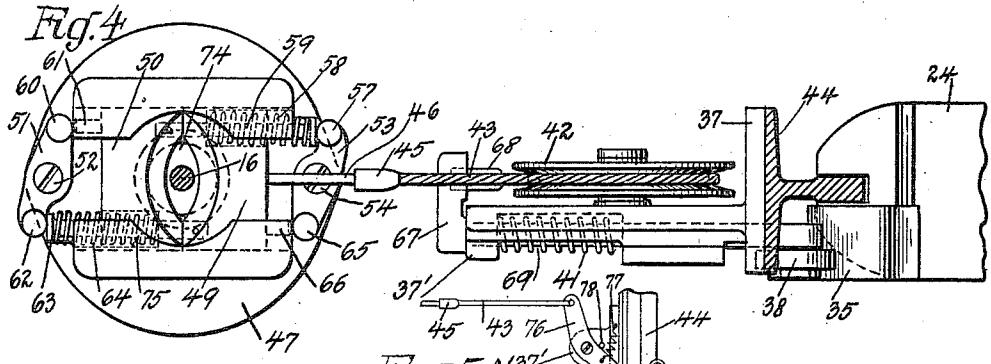


Fig. 5A.

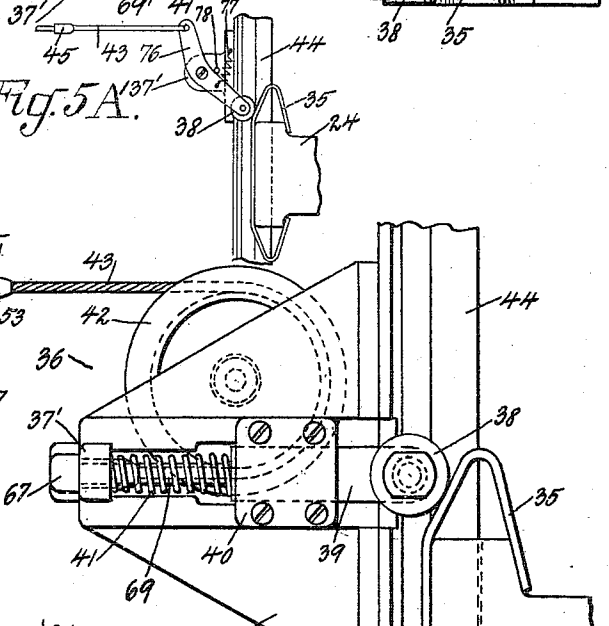


Fig. 5.

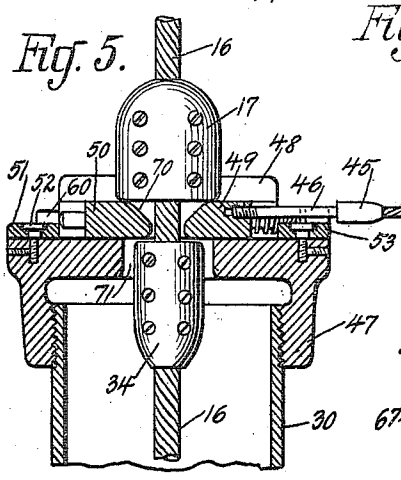


Fig. 6.

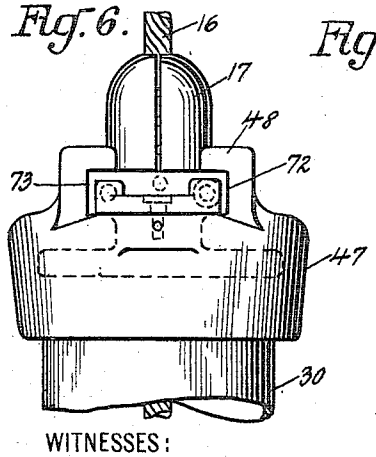
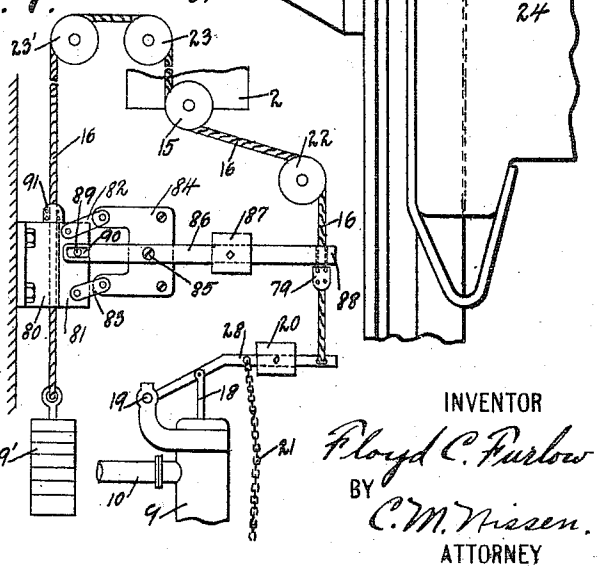


Fig. 7.



WITNESSES:

Ernest L. Gale Jr.

James G. Bethell.

INVENTOR

Floyd C. Furlow

BY

C. M. Nissen.

ATTORNEY

# UNITED STATES PATENT OFFICE.

FLOYD C. FURLOW, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

## AUTOMATIC LIMIT-STOP.

986,377. Specification of Letters Patent. **Patented Mar. 7, 1911.**

Application filed July 11, 1907. Serial No. 383,343.

*To all whom it may concern:*

Be it known that I, FLOYD C. FURLOW, a citizen of the United States, residing in Montclair, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Automatic Limit-Stops, of which the following is a specification.

My invention relates to automatic limit stops for elevators, and one of its objects is to prevent any disarrangement of the automatic stopping means caused by an elevator car running beyond its normal limit of travel.

Other objects of my invention will be pointed out hereinafter.

The accompanying drawings illustrate my invention as applied to a direct acting plunger elevator system.

Figure 1 is a sectional elevation taken on the line 1 in Fig. 3, and showing the elevator system; Fig. 2 is a partial side elevation of the mechanism shown in Fig. 1, and taken on the line 2—2 of Fig. 3; Fig. 3 is a plan view of the device shown in Fig. 2; Fig. 4 is an enlarged plan view of my invention; Fig. 5 is a part sectional elevation of the mechanism shown in Fig. 4; Fig. 5^A shows a modification of part of the mechanism shown in Fig. 5; Fig. 6 is an elevation view taken at right angles to and showing a portion of the mechanism shown in Fig. 5; and Fig. 7 is a view in elevation of a modified form of my invention.

Like figures of reference denote similar parts throughout the various figures.

Referring more particularly to Figs. 1, 2 and 3, 2 designates an elevator car mounted upon a plunger 3 which is adapted to travel in a plunger cylinder 4. 24 designates the usual counterweight which is connected to the car by the cable 27 passing over the sheave 25 mounted upon the overhead beams 26. A lever 11 in the elevator car 2 is operated manually to effect the movement of the main valve 5 by means of the standing cables 12, pinion 14 and valve stem 13. 6 designates the fluid pressure supply pipe. 8 is a pipe connecting the main valve and the plunger cylinder 4, while 7 is a pipe which connects the main valve to the automatic stop valve 9. 10 is the exhaust pipe. The elevator car is raised or lowered in the usual manner by operating the car lever 11 which will cause the main valve to be moved to the left or right, thereby admitting or exhausting fluid pressure to or from the plunger cylinder 4 and effecting the raising or lowering of the car 2 in a well known manner. An automatic stop valve 9 is placed between the discharge pipe 7 and exhaust pipe 10 and it is always open so as to allow a free passage of fluid from one pipe to the other excepting at such times as the elevator is at or near its limit of travel.

The automatic stop valve 9 is provided with a valve stem 18 which is connected to a lever 28 pivoted at 19 and provided with a weight 20 near one end. A deflecting cable 16 is attached to one end of the lever 28 and leads over a pulley 22 mounted on a fixed support at or near the bottom of the hatchway. This cable is deflected by a pulley 15 carried by the car 2, and leads up the hatchway and over a sheave 23. The end of the cable 16 is connected to a weight 29 which is loosely contained in a tube 30 securely fastened to the side of the hatchway at a suitable place by means of the brackets 31 and 32.

The elevator car is shown in Fig. 1 at its lower limit of normal travel. At such position the deflecting cable 16 is deflected in such manner as to cause the right hand end of the lever 28 to be pulled upward thereby raising the weight 20 and automatic valve stem 18 and effecting a closing of the stop valve 9 which cuts off any further flow of fluid pressure through the pipes 7 and 10 and thus the plunger 3 and car 2 are brought to rest. The automatic stop valve 9 is shown in its operative or closed position, any further upward movement of the valve lever 28 being checked by the chain 21 which is securely fastened at its lower end to some stationary object 21′. At a suitable place on the deflecting cable 16 above the inclosed weight 29 is a securely fastened stop ball 33. Two similar stop balls 17 and 34 (see Fig. 5) are also securely fastened to the cable 16 at the upper portion of the tube 30.

Referring more particularly to Figs. 2 and 5 it will be seen that the upper end of the car counterweight is provided with a cam 35 which is adapted to coöperate with a trigger device 36, which in turn operates a releasing means for the cable 16 situated at the upper end of the weight tube 30.

The preferred construction of the aforesaid trigger device and cable releasing means is shown in detail in Figs. 4, 5 and 6

in which 44 designates the usual counterweight guide rail to which is fastened a bracket 37. This bracket is provided with a slot which contains a movable member 39 held in place by a plate 40. The movable member 39 is provided at one end with a roller 38, the other end 69 being turned cylindrical and connected to a piece of metal 67 which stands at right angles to the plane of the bracket 37. Connected to this piece 67 by means of a thimble 68 is a cable 43 which passes around a direction pulley 42 mounted on the bracket 37 and is fastened by means of a thimble 45 to a rod 46. This rod 46 is screw threaded into one of two similar sliding members 49 and 50. The cylindrical portion 69 of the movable member 39 passes through a compression spring 41 which presses against a projection 37′ of the bracket 37 and the movable member 39, causing the latter to assume its outward position as shown in Figs. 4 and 5. The sliding members 49 and 50 are adapted to slide in grooves 72 and 73 in the guiding lugs 48 formed on the cap or upper portion 47 of the tube 30. The sliding members 49 and 50 have arc shaped adjoining surfaces thus forming an oval opening 74 at the center into which the cable 16 loosely fits. The arc-shaped adjoining surfaces of the members 49 and 50 are beveled off at 70 the purpose of which will be pointed out later. A central circular opening 71 is provided in the cap 47 of larger diameter than that of the stop ball 34. This stop ball is tapered at its lower end. The stop ball 17 is somewhat larger than the stop ball 34 and has a larger diameter than that of the hole 71 in the cap 47; the stop ball 33 (Fig. 1) is of the same diameter as the ball 17. On top of the cap 47 and at diametrically opposite points are located two similar levers 53 and 51 pivoted by the locked screws 54 and 52 respectively. Each lever is provided with raised circular projections 57, 65 and 62, 60 respectively. The movable member 50 has firmly fixed thereto a rod 59 provided with a head at one end and having a compression spring 58 thereon. This spring lies in a recess formed in the member 49 and presses against the head of the rod 59. A similar rod 75 is fastened to the member 49 and carries a spring 64 lying in a recess formed in the member 50. The rod 75 is provided with a head 63 against which the spring presses. A stud 66 is fastened to the member 49 and is in contact with the raised circular projection 65 on the lever 53. A similar stud 61 carried by the member 50 is in contact with the raised circular projection 60 on the lever 51. The head on the rod 59 engages the projection 57 and the head 63 engages the opposite projection 62. The weight 29 is considerably heavier than the weight 20 and the excess in weight of the former is carried by the stop ball 17 supported by the sliding members 49 and 50 at the top of the weight tube 30.

Under ordinary running condition of the elevator car except at such times when the same is at or near its lower limit of travel the deflecting cable 16 is in one of many positions such as indicated by the broken lines 16″ and the deflecting pulley 15 carried by the car is in a corresponding position 15″. Under these conditions the automatic stop valve 9 is open on account of the weight 20 holding the lever 28 and valve stem 18 downward. The stop ball 17 held stationary at the top of the weight tube 30 constitutes practically a fixed point for the cable 16. As the car, however, approaches its lower limit of normal travel, that shown in full lines in Fig. 1, the pulley 15 effects a deflection of the cable 16 and thereby exerts an upward pull upon the end of the valve lever 28 causing the same to be raised to gradually close the automatic stop valve 9. The closing of this valve prevents any further flow of fluid pressure from the plunger cylinder 4 and the car is brought to rest. The chain 21 prevents an excessive upward movement of the valve lever 28. 55 and 56 are positive stops or buffers at the bottom of the hatchway.

In all elevators operated by fluid pressure there is always some leakage since it is practically impossible to make a valve or packed joint absolutely tight. Now it is customary where an elevator is not in active operation at all times to allow the car at such times to remain at the lower limit of its travel. In such position the automatic stop valve is closed and the car rests on the column of fluid contained in the plunger cylinder 4. If the car is left stationary for a considerable time, say overnight, the tendency is for the car to settle or creep slowly downward past its normal limit of travel owing to a leakage of fluid.

In practice the upper end of the deflecting cable 16 is rigidly fixed to the overhead beams 26 or at some place in the hatchway. Such being the case as soon as the car reaches it normal downward limit both ends of the cable 16 are immovable, and should leakage allow the car to creep or settle it is readily seen that the cable 16 will have a great strain placed upon it and should this cable not be broken, it would either be permanently lengthened or else the automatic valve apparatus would be broken or disarranged, either condition being fatal to the proper operation of the elevator. One of the objects of my device is to prevent any disarrangement of the automatic stop apparatus caused by excessive car travel. The manner in which this is accomplished is as follows: Just as soon as the car reaches its normal lower limit and the automatic stop

valve has closed the exhaust from the plunger cylinder 4, the counterweight 24 has been raised to such a position that the cam 35 carried thereby engages the roller 38 forming a part of the trigger device 36. Any further downward movement of the elevator car and subsequent upward movement of the car counterweight causes the sliding member 39 to slide to the left causing a pull on the cable 43 and movable member 49. As soon as the movable member 49 is pulled to the right the pin 66 thereon pushes against the cylindrical projection 65 of lever 53 which causes the cylindrical projection 57 on the opposite end of the lever to exert a push against the rod 59. This rod is connected to the movable member 50 and hence the latter is moved to the left. In this way the members 49 and 50 are caused to move in opposite directions or separate, thereby enlarging the opening 74 formed between them and permitting the stop ball 34 to be pulled upward through the increased opening thus formed. The weight 29 keeps a uniform tension on the cable 16 while at the same time the cable can now move said weight as the car descends and the valve apparatus can in no wise be injured. The stop ball 33 prevents the cable 16 from being pulled up too far. As soon as the elevator car is caused to ascend the counterweight 24 descends and the cam 35 carried thereby moves away from the roller 38. The spring 41 forces the sliding member 39 outward and releases the pull on the cable 43. The springs 64 and 58 return the movable members 49 and 50 to their original position, since the spring 58 acting through the lever 53 and pin 66 tends to move the member 49 to the left and the spring 64 acting through the lever 51 and pin 61 tends to move the member 50 to the right. Thus the moving members 49 and 50 constitute a latching device to retain the cable 16 in proper position. Should however the counterweight cable 27 change its length allowing the latching device to close before the cable 16 and stop balls 17 and 34 are in proper position the weight 29 will cause the stop ball 34 to force its way through the members 49 and 50 since the lower tapered end of this stop ball will engage the inclined surfaces 70 of the sliding members and wedge them apart. They will immediately spring back into position however as soon as the stop ball 34 has passed through. As the car continues to ascend the deflection of the cable 16 becomes less and less and the weight 20 on the stop valve lever 28 is allowed to drop and open the stop valve automatically.

The modified trigger device shown in Fig. 5[A] comprises a lever 76 pivoted to a bracket 137′ fastened to the counterweight guide rail 44 and carrying a roller 38 adapted to engage the counterweight cam 35 as before described in connection with my preferred construction. The cable 43 is connected to this lever 76 at one end and a spring 77 and stop 78 tend to keep the lever in proper operative position. This modified device operates precisely as the trigger device heretofore described.

The modification of my invention as illustrated in Fig. 7 shows a stop valve cable releasing and gripping device. In this instance I show two direction pulleys 23 and 23′ mounted at the top of the hatchway. The tension weight 29′ is somewhat heavier that the combined weights 87 and 20, and may or may not be inclosed in a tube as desired. A clamp bracket 80 is secured to the side of the hatchway at a desirable place and is provided with a vertical U shaped slot in which lies the stop valve cable 16. A gripping block 81 is adapted to enter the U slot in the bracket 80 and pinch or grip the cable 16. Two parallel links 82 and 83 are pivoted to the gripping block 81 and are also pivoted to a bracket 84 which is immovably fastened at some convenient place. A lever 86 has a slot 90 at one end in which is a pin 89 fastened to the gripping block 81 and is pivoted to the bracket 84 at 85. This lever has an adjustable weight 87 upon it and contains a hole 88 through which the stop valve cable 16 freely passes. A stop ball 79 is firmly fastened to the cable 16 a short distance below the lever 86. The weight 87 tends to move the right hand end of the lever 86 downwardly. This causes the gripping block 81 to move upwardly and owing to the parallel links 82 and 83 the block 81 is forced outwardly and thereby clamps the cable 16 between the block and the bracket 80. A stop ball 91 is firmly clamped to the cable 16 and normally rests upon the bracket 80 thereby limiting the downward movement of the weight 29′. The illustration shows the position of parts corresponding to the lower limit of normal travel of the elevator car, the automatic stop valve 9 being closed. It will be noticed that the limiting chain 21 is slightly slack. If the elevator car should creep below its normal lower limit the stop valve lever 28 is raised, the chain 21 is pulled taut and the stop ball 79 engages the lever 86 and raises it up. This lever now swings about the pivot 85 and exerts a downward thrust on the pin 89 causing the block 81 to move downward and also outward away from the cable 16 owing to the parallel links 82 and 83. The cable 16 is now free to move upward raising the weight 29′ as the car settles. As soon as the car moves upward the cable 16 is deflected less and less and the weight 29′ moves downward until the stop ball 91 rests upon the bracket 80. The weight 29′, it is evident, can go no lower

and as the elevator car continues to rise the weights 87 and 20 will descend until finally the clamp block 81 grips the cable 16 when the weight 87 will remain stationary. The weight 20 however is free to descend and thus the automatic stop valve 9 is opened and the operation of the elevator car is again normal.

From the foregoing description of my improved device it is evident that neither the deflecting cable which effects the closing of the automatic stop valve at such times as the car reaches its lower limit of travel nor the stop valve apparatus itself is subjected to any undue strain at any time even should the car overrun its normal limit of travel. It is also evident that my device could readily be adapted to operate at the upper limit of car travel equally well or adapted to operate at both top and bottom limits, and while I have chosen a direct acting plunger type of elevator in order to illustrate the operation of my device it is apparent that it could readily be applied to any and all elevator systems. In the case of an electric elevator it would only be necessary to substitute a limit switch for the stop valve 9.

While I have described my invention in connection with a typical elevator system and have shown modifications thereof, I do not wish to be limited to the precise construction or arrangement of parts as shown, since various changes could be made without departing from the spirit or scope of my invention.

What I claim as new, and desire to have protected by Letters Patent is:—

1. In an elevator, the combination of a car and moving means therefor, an automatic stop device, mechanism to positively operate the stop device at a predetermined point in the travel of the car, and means to render said mechanism ineffective as a positive operating means when the car reaches a predetermined position beyond the point at which the stop device is arranged to operate, and thereby prevent derangement of the stop device.

2. In an elevator, the combination with a car and moving means therefor, of a stop device, a connection between the car and stop device for positively operating the stop device as the car approaches its normal limit of travel, and means to prevent abnormal strain on said connection when the car moves beyond its normal limit of travel.

3. In an elevator, the combination with a car and moving means therefor, of a stop device, means for positively operating the stop device as the car approaches its normal limit of travel, and means to release the positively operating means as the car passes beyond its normal limit of travel.

4. In an elevator, the combination with a car and moving means therefor, of a stop device, means for positively operating the stop device as the car approaches its normal limit of movement, and means to automatically release the positively operating means if the car passes beyond its normal limit of travel.

5. In an elevator, the combination with a car and driving means therefor, of a stop device, operating means for the stop device comprising a flexible member connected to the stop device and normally held at one point against movement, operative connections between the car and the flexible member, and means for releasing the flexible member at the point where held against movement when the car passes beyond its normal limit of travel.

6. In an elevator, the combination with a car, driving means and a stop device, of means for operating the stop device comprising a cable, means connected to the cable for holding it in tension, means normally operative to positively hold the cable at one of its ends against movement, means for operating the cable to actuate the stop device, and means for releasing the stationary end of said cable when the car moves beyond its normal limit of travel.

7. In an elevator, the combination with a car, driving means therefor, and a stop device, a cable connected to the stop device at one of its ends, a tensioning device connected to the other end of said cable, means for holding said other end and said tensioning device normally from movement, a device carried by the car to engage the cable and deflect the same to operate the stop device as the car approaches its limit of travel, and means for operating said holding means to release the cable and tensioning device and permit the cable to move the tensioning device when the car passes beyond its normal limit of movement.

8. In an elevator, the combination with a car, hydraulic moving apparatus therefor, and valve controlling mechanism, an automatic stop valve, means for positively operating said stop valve and means to prevent an abnormal strain on such operating means when the car moves beyond its normal limit of travel.

9. In an elevator, the combination with a car, plunger, receiving cylinder, and change-valve apparatus, of an automatic stop valve for stopping the car at the limit of its travel, a stationary cable connected to said stop valve and to a fixed support, a device carried by the car for engaging said cable to deflect the same and operate said stop device, and means for preventing undue strain on the cable if the car moves beyond its normal limit of travel.

10. In an elevator, the combination with a load carrying device, moving means therefor, and controlling apparatus, a stop device

for automatically stopping the car at a predetermined point in its travel, a cable connected to said stop device and arranged to be operated by movement of the load carrying device when approaching such predetermined point in its travel, a device for holding one end of said cable stationary, and means for automatically releasing said cable if the car passes beyond such predetermined point.

11. The combination with an elevator car and controlling means therefor comprising a cable, of a clamp associated with said cable and having a stationary support, said clamp holding the cable during the normal travel of the car, and means operated by a moving part of the elevator for automatically operating the clamp to release the cable.

12. In an elevator, the combination with a stop device, of a cable connected thereto, a clamp holding the cable in operative position, a movable cam, and actuating connections operated by said cam to release said cable.

13. In an elevator, the combination with an automatic controlling device, of a cable connected thereto, means for holding one end of said cable from movement, a movable cam, a movable member in the path of the cam, a flexible connection between said member and said holding means for operating the latter, and means for automatically returning said member after release by the cam.

14. The combination with an elevator-car, of a controlling device therefor, a cable connected to said device at one end, means for holding the other end of said cable stationary, a cam carried by a movable part of the elevator, a movable member in the path of the cam, a flexible connection between said member and a part of said holding means, and means for returning the movable member to normal position after operation and release by the cam.

15. The combination with an elevator-car and a controlling device therefor, of a cable connected to said device, means for holding one end of said cable from movement, a cam carried by a movable part of the elevator, a pulley mounted on a fixed pivot or bearing, a slidable arm having a portion projecting into the path of movement of the cam, a spring engaging the arm and yieldingly holding it in its normal position, and a flexible connection between the arm and said holding means and passing over said pulley.

16. In an elevator, the combination with a stop device, of a cable connected thereto, appliances normally positioned to actuate said cable and stop device, and means for releasing said cable to render said appliances inoperative to further operate said stop device.

17. In a stop device for elevators, the combination with a cable, of a stop secured thereto, one or more movable members in the path of said stop, a stationary support for holding said members in position to prevent movement of said cable in a predetermined direction, means for moving said members out of the path of said stop to permit movement of said cable, and means for operating the cable while said members are in the path of said stop.

18. In a stop device for elevators, the combination with a cable, and two stop balls or abutments secured to said cable, of slidable members between said abutments, a stationary support for said members to prevent movement of the cable in either direction, means for moving said slidable members to release said cable, and controlling mechanism operated by said cable while held by said members.

19. In a controlling device for elevators, the combination with a cable, of a stop secured to the cable, slidable members on opposite sides of the cable and in the path of movement of the stop to prevent movement of the rope, a lever of the first class adjacent the outer end of one member having one end in engagement with its adjacent member, a projection from the other member engaging the opposite end of said lever, a spring on said projection operating between the end of said projection and the first member to yieldingly hold the members together, a second lever, projection and spring similar to the first-named parts and similarly arranged with respect to the second member, and means for moving the slidable members out of the path of the stop.

20. In a controlling device for elevators, the combination with a cable, of two stops on the cable adjacent each other, an engaging member between the stops, means for automatically retracting said engaging member, and mechanism operated by said cable while said engaging member is between the stops.

21. In a controlling device for elevators, the combination with a cable, of two stops carried by the cable adjacent each other, the upper stop being larger than the lower one, and the lower one being tapered downwardly, a pair of sliding members between the stops and yieldingly held in position in the path of the stops, the upper surfaces of the sliding members being beveled downwardly, and means to retract the sliding members to permit the lower stop to move upwardly, the lower stop engaging said beveled members and spreading them apart to permit said stop to return to its normal position.

22. In a controlling device for elevators, the combination with a cable, of an upper stop and a lower stop carried by said cable adjacent each other, the lower stop having its lower end tapered, a pair of sliding mem-

bers between the stops and having their upper surfaces beveled, means for yieldingly holding said members in the path of movement of said stops, means to retract the sliding members and permit the lower stop to move upwardly, such retraction being insufficient to permit the upper stop to move downwardly, and means connected to the cable below the stops tending to return the cable to normal position, the tapered lower end of the lower stop engaging the beveled surfaces of the sliding members and spreading the latter apart automatically until they again assume their normal positions.

23. In a controlling device for elevators, the combination with a cable, of a stop carried by said cable, a device in the path of said stop to prevent movement of the cable in a predetermined direction, automatic mechanism for operating said device to permit movement of said cable in said direction, and an additional stop on said cable to limit such movement of the cable.

24. In a controlling device for elevators, the combination with a cable, of a stop carried thereby, an additional stop of a different size adjacent thereto, yielding members in the path of said stops and between the same, means for releasing said members to permit movement of the cable, a tensioning weight connected to said cable, and an additional stop to limit the movement of said cable when said yielding members are released.

25. In a controlling device for elevators, the combination with a cable, of a weight connected to the end of said cable, a receptacle for containing said weight, and releasable stop mechanism associated with said receptacle for controlling the movement of the end of the cable connected to said weight.

26. The combination with an elevator car and controlling means therefor comprising a cable, of a holding device having a stationary support and associated with said cable and holding it during the normal operation of the car, and means operated by a moving part of the elevator for automatically operating the holding device to release the cable.

27. In an elevator, the combination with a stop device, of a cable connected thereto, a stationary device for normally holding the cable, a movable cam, and actuating connections operated by said cam to release said holding device.

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

FLOYD C. FURLOW.

Witnesses:
W. W. LIGHTHIPE,
CHAS. W. TRIGGEN.