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C. S. BURNHAM.

SAFETY DEVICE FOR ELEVATORS.

APPLICATION FILED MAY 9, 1905.

Fig. 1.

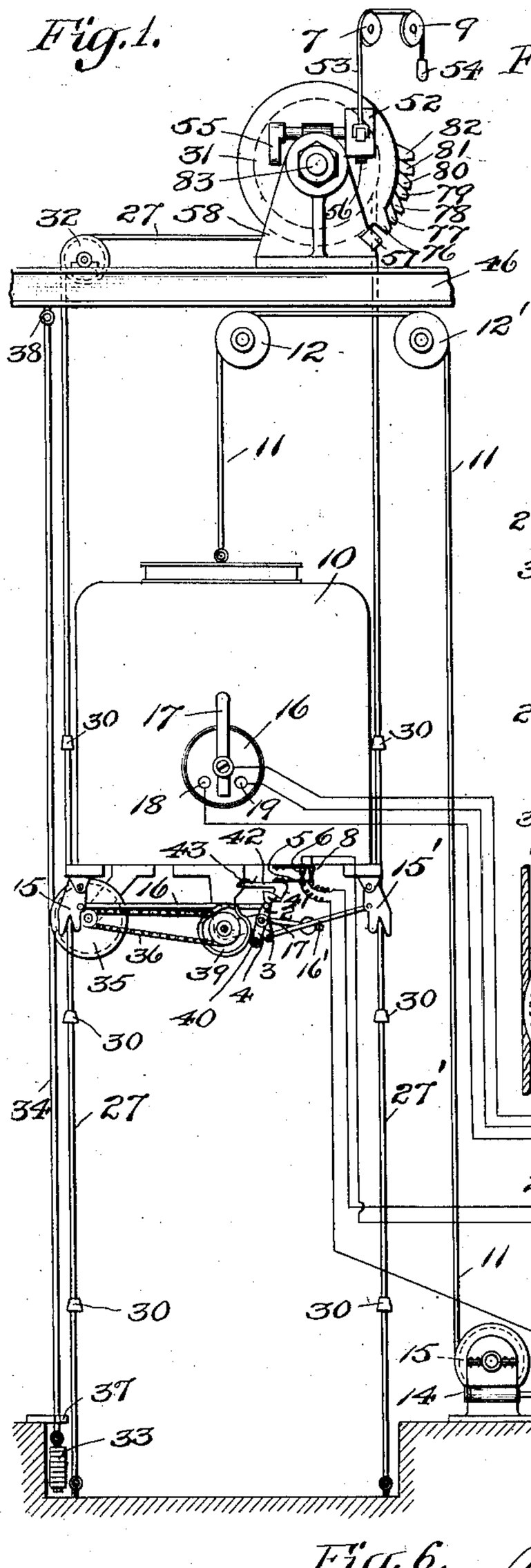


Fig. 2.

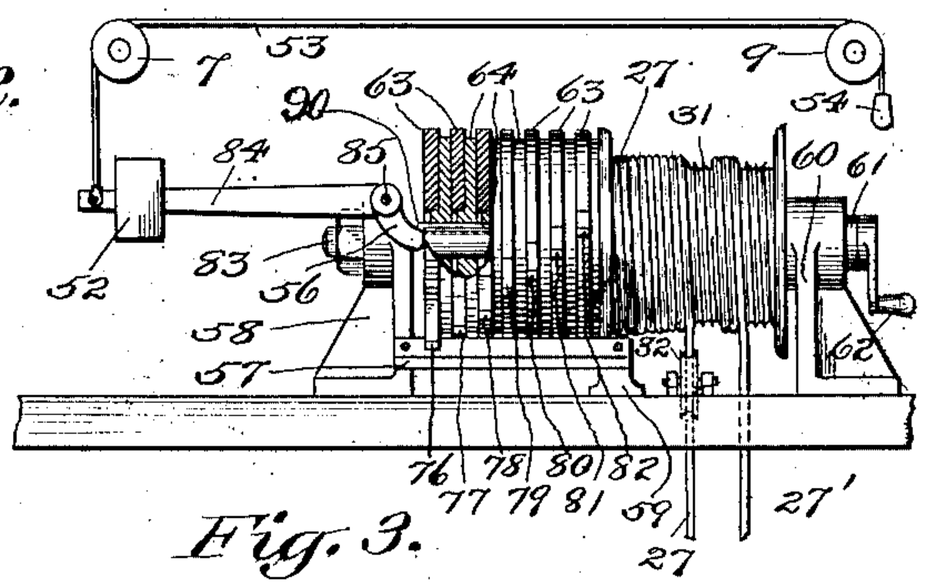


Fig. 3.

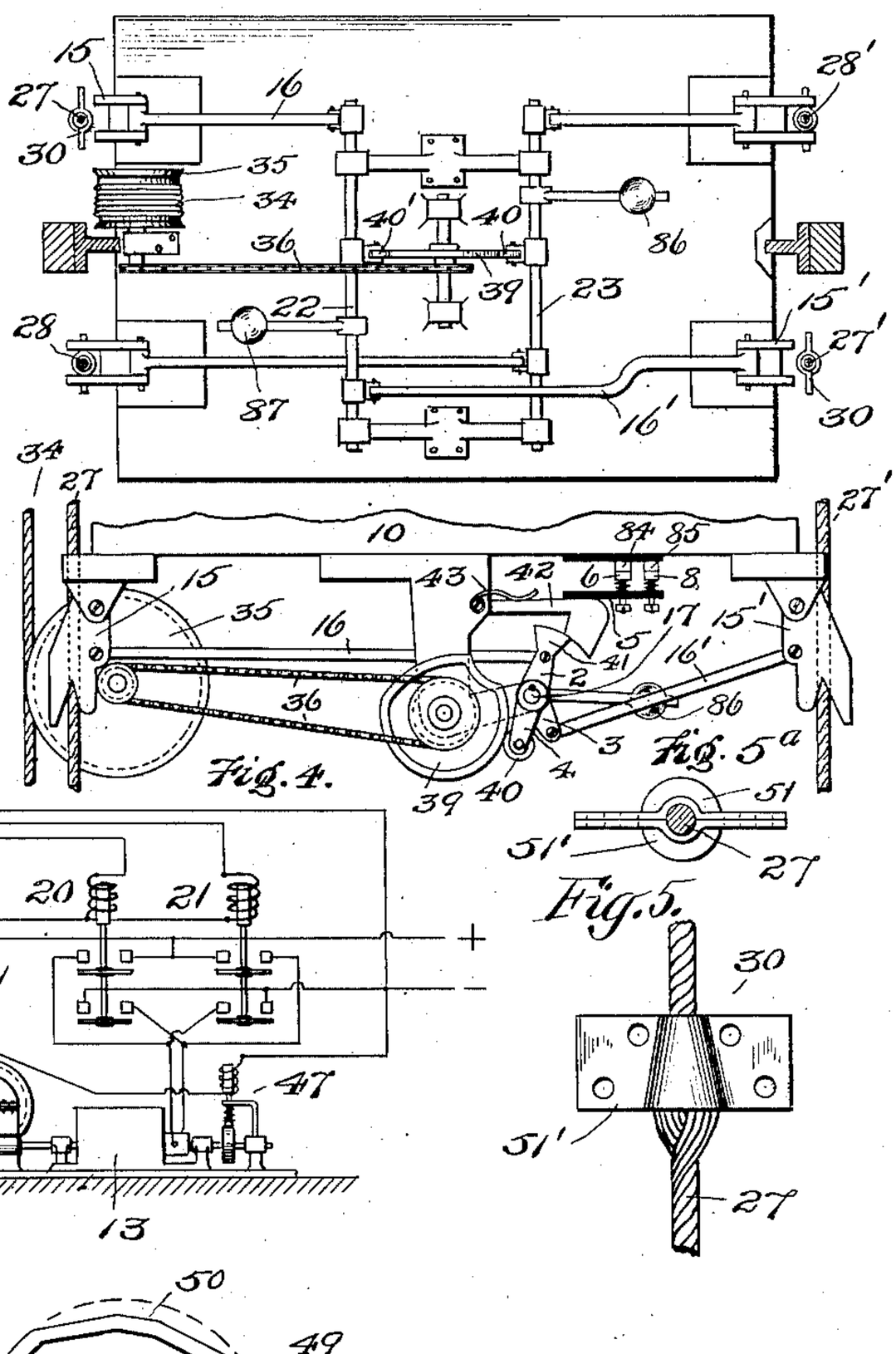
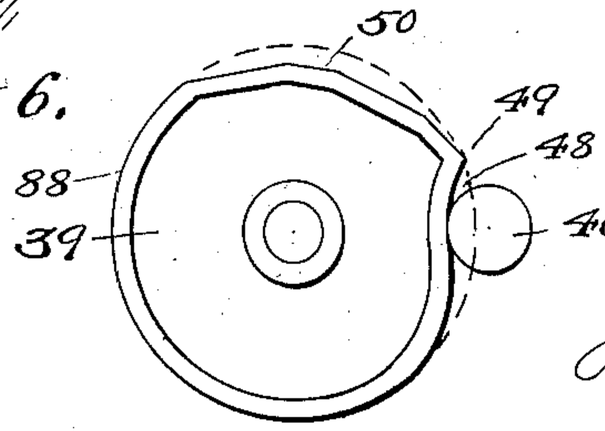


Fig. 4.

Fig. 5a

Fig. 5.

Fig. 6.



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SAFETY DEVICE FOR ELEVATORS.

No. 826,535. Specification of Letters Patent. Patented July 24, 1906.

Application filed May 9, 1905. Serial No. 259,566.

To all whom it may concern:

Be it known that I, CHARLES S. BURNHAM, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented a new and useful Improvement in Safety Devices for Elevators, of which the following is a specification.

My invention relates to improvements in the safety device for elevators shown and described in United States Patent No. 754,432, granted to Cruickshank and Burnham, March 15, 1904, and has for its object the provision of means for preventing any excessive speed of an elevator-car.

The accompanying drawings show an elevator system embodying my invention, and in which—

Figure 1 represents in elevation an elevator system including a car having my safety device applied thereto. Fig. 2 is a view at right angles to Fig. 1 and shows the retarding device at the top of the well. Fig. 3 is a detached view showing the bottom of the car with a portion of the preferred form of my invention thereon. Fig. 4 is an enlarged view in elevation of that portion of my safety device carried on the car. Figs. 5 and 5ª are detail views of the detent, stop, or clamp shown at 30 in Fig. 1; and Fig. 6 is a detailed view of a preferred form of governor-cam.

Similar reference-numerals are applied to similar parts throughout the various views.

In Fig. 1, 10 designates an elevator-car with its hoisting-cable 11 passing over the sheaves 12 and 12′, the latter being mounted in any suitable manner at the top of the hatchway. While the drawings show a hoisting system driven by an electric motor 13, operating through the worm-gearing 14 and hoisting-drum 15, any desired motive power may be used to equal advantage. + and − designate the power-mains. 20 and 21 are reversing-switches, while 16 is the controlling-switch in the car. The handle 17 on being moved to the right or left controls the energization of one or the other of the reversing-switches 20 and 21, which in turn close a circuit to the motor 13, thereby causing it to raise or lower the elevator-car 10 in a well-known way. 47 designates a safety-magnet brake, which is applied to stop the machinery when a circuit to its magnet-coil is broken. Extending vertically in the elevator-well and adjacent to the path of travel of the elevator-car 10 are cables 27 and 27′. These cables, of which two are shown, although any number may be used, are rigidly fastened at their lower ends to the bottom of the well. The upper portions of the cables 27 and 27′ are wound in the same direction about the drum 31, which is herein shown mounted on beam structure at the top of the elevator-well. The cable 27 first passes over the idler or direction pulley 32, and the upper ends of both the cables 27 and 27′ are fastened to the drum 31. The cables 27 27′ may be of any material with the requisite strength; but it is preferable to employ cables composed of strands of steel wire. Mounted upon the cables 27 27′ are shown a number of detents or stops 30, which are rigidly secured to the same. When steel cables are used, I fasten the stops thereon in a novel manner. The cable is untwisted for a portion of its length and the strands of wire spread out somewhat. Two plates or pieces of metal having U-shaped bends at their middle portions are then clamped together in such a way that the conical-shaped recess formed by the bends is filled by the portion of the cable which has been untwisted. Melted solder is then poured into the conical-shaped recess. This solder upon hardening holds the stop with great rigidity upon the cable without in any way affecting or lessening the tensile strength of the cable.

Pivotally mounted upon the bottom of the elevator-car are dogs, of which two are shown on each side in Fig. 3. These dogs are normally held in a position to engage with the stops or obstructions 30 as the car descends. I have herein shown the dogs each provided with two fingers forming a slot to receive the cables. These fingers engage at the proper time the plates of the stop 30. This is clearly shown in Fig. 3. Just as the dogs are about to engage the stops and the car is traveling at its normal rate of speed the dogs are rocked about their pivots and retracted from engagement with the stops, allowing the car to continue in a downward direction. This operation will be more fully described hereinafter. The dogs 15 15′ are connected

by the rods 16 16′ to the levers 2 and 3, respectively, these levers being keyed or otherwise fastened to the rock-shaft 17.

34 designates a standing rope which is fastened at its upper end to the overhead beam 46, and after being wrapped several times about the drum 35 leads to the bottom of the hatchway, where it is fastened to a weight 33.

37 is a guide for the rope 34.

I sometimes use in place of one continuous rope 34 two ropes, one of which is fastened to the beam 46 and wound about the drum 35 a number of times and then fastened rigidly to the drum. The other rope is also fastened to and wound about the drum a number of times in a direction opposite to the other rope, after which it leads to the weight 33, which is for the purpose of keeping the rope 34 taut. The drum 35 is carried by the car and is connected by sprocket-chains 36 to the cam 39.

A roller 40, connected by the lever 4 to the rock-shaft 17, is held in contact with the face of cam 39 by the weight of the dogs 15 and 15′, acting through the rods 16 and 16′ and levers 2 and 3, respectively. Weights 86 and 87 are shown for this purpose, but they may be omitted.

41 designates a latch-detent, which is shown as being an extension of the lever 2, although the same may be a separate detent keyed to the rock-shaft 17. A latch 42 is normally held in engagement with the latch-lever 41 by means of a spring 43. The latch 42 carries an insulating-piece 5, upon which are mounted two spring-pressed contacts 6 and 8, these contacts being normally in electrical connection with two fixed contacts 84 and 85, mounted on the car directly above them but insulated from the car.

The retarding device shown in Figs. 1 and 2 will now be described. A shaft 83 is mounted in bearings in the standards 58 and 60, which are fastened to the overhead beams in the hatchway. On this shaft 83 are keyed or otherwise fastened a drum 31 and a number of disks 64. These disks are loosely keyed, as by means of the key 90, Fig. 2, to the shaft 83, allowing them to have a lateral movement along the shaft but preventing any turning movement relatively to the shaft. Each of these disks 64 is provided with a hub or boss upon which is loosely mounted another disk 63, free to revolve about the hub and having a projection or detent on its periphery, such as 76, 77, 78, 79, 80, 81, and 82. The thickness of these loose disks 63 is slightly greater than the hub of the corresponding and relatively fixed or stationary disk 64 upon which it is mounted. The loose disks 63 therefore alternate with the fixed disks 64. A bell-crank lever 84 is pivotally mounted on the standard 58 and has short arms 55 and 56, which are held against the outside loose disk 63 by means of the adjustable weight 52, which is slidably mounted upon the lever-arm 84. A cross-bar 57, having one end fastened to the standard 58 and the other end secured to the support 59, is placed in such a position with respect to the loose disks 63 as to engage or lie in the path of travel of the projections 76 77 78, &c., above referred to.

A cord 53 is fastened to the outer end of the weighted lever 51, and after running over the two small direction-pulleys 7 and 9 is attached to a handle 54, by means of which the weighted arm 84, together with the weight 52, may be raised, thereby releasing the levers 56 56 from engagement with the disk 63.

At the right-hand end of the shaft 83 and connected to it is a collar 61 and crank-handle 62, the latter being used to revolve the shaft 83.

The operation of my improved safety device is as follows: When the car is in the position shown in Fig. 1, the dogs 15 15′ are held in their outward or engaging position by the roller 40 and cam 39. As the car descends the cam 39 is revolved by the drum 35 until the roller 40 passes onto the flattened portion of the cam at 50, Fig. 6. This will allow the dogs 15 and 15′ to swing inwardly about their pivots, causing them to pass by a set of stops 30. The cam is further revolved until the roller 40 is carried onto the high concentric portion 88 of the cam, when the dogs are once more held in their outward or engaging position. The motion of the cam about its axis is so proportioned to that of the car travel that the cam revolves one complete revolution while the car passes from one set of stops 30 to the next set. It follows from this that as the car descends at normal speed and approaches a set of stops the dogs on the car are swung out of engagement with the stops, and after having passed by the same are returned to their outward or engaging position by the cam 39. The same operation is repeated at every set of stops. Thus it will be seen that the stops offer no obstacle to the descending car during its normal operation. As the dogs 15 and 15′, together with shaft 17, are rocked back and forth by the cam 39 the latch-detent 41 is caused thereby to swing back and forth upon the lower curved surface of the latch-lever 42, the spring 43 insuring a frictional contact between latch-lever 42 and detent 41. The latch-lever 42 is held against any downward movement by the upper curved surface of detent 41. The contacts 6 and 8 on the insulating-piece 5 are thus held in electrical contact with the fixed contacts 84 and 85 directly above them. Assuming the car for any cause to exceed its normal downward rate of speed, the cam 39 being revolved at a speed proportional to that of the car, or, in other words, in harmony therewith, will rotate so fast that as the roller 40 is carried out of the recessed

portion 48 (see Fig. 6) of the cam onto the high point 49 the momentum imparted to the roller 40 by the accelerated motion of the cam will cause the roller to leave the cam-face at the high point 49. At this time the dogs are just about to engage a set of stops. As the roller 40 is thrown off the face of the cam the latch-detent 41 will be rocked or swung to the left an amount sufficient to cause its curved portion, which bears against the corresponding curved face of the latch-lever 42, to pass out of engagement with the latter, allowing the same to drop, and thereby latching or locking the dogs in their outward or engaging positions. The dogs held outwardly against any further movement by the latch 42 will now engage a set of stops and carry them, together with the cables 27 27, downwardly. As these cables are fastened to and wound at their upper ends to the drum 31 the latter will now tend to revolve the shaft 83. The fixed disks 64, carried on said shaft, being connected to the drum will likewise tend to revolve. Now the lever 84, by reason of the weight 52, is at all times exerting a powerful pressure against the disks 63 and 64, and since the disks, both loose and fixed, have a motion transversely along the shaft 83 whatever pressure is put upon one disk will be transmitted to the others. The frictional contact between any adjacent disks depends upon the pressure caused by the weight 52 acting through the lever-arms 84, 55, and 56. As the shaft 83 is revolved by the descending car acting through the cables 27 27′ the disks will also revolve. As soon as the disks have revolved through a very small distance the projection 76 on the circumference of one of them will engage the horizontal bar 57, which will prevent any further rotation of the disk, and it will thus produce a retarding effect on the drum 31 owing to the surface friction produced by the weighted lever 84 on the face of one disk rubbing against an adjacent disk. As the retarded drum 31 continues to revolve the projection 77 will engage the bar 57 and be held from further movement. This will gradually increase the retarding effect on the drum 31 on account of the added rubbing friction. In a similar manner as the drum 31 continues to revolve the projections 78, 79, 80, 81, and 82 of the loose disks will engage the bar 57 in successive order, and as each disk is held from further rotative movement it will add a certain amount to the retarding effect on the drum 31, this amount depending upon the friction caused by the lateral pressure put upon the disks by the weight 52 acting through the lever-arms 84, 55, and 56. The cumulative retardation of the drums 31 when the free disks have all assumed the same position—that is, with their projections all engaging the cross-bar 57—is of such a magnitude that the drum 31 will, through the medium of the cables 27 and 27′, more than suffice to support the weight of the car and its load. The friction between the various disks, and consequently the retarding effect transmitted to the drum 31, may be varied to almost any desired amount by changing the position of the weight 52 along the lever 84. The effect of this retarding device upon the car will be to produce a gradual, easy, and positive stop without the usual shock and strain which is so frequently met with in other devices used for the same purpose. When the latch operates to hold the dogs in their engaging positions, the electrical connection between the contacts 5 and 6 and the contacts 84 and 85, mounted directly above them, is broken. Since these contacts include a circuit to the motor-reversing switches 20 and 21 and also a circuit to the safety magnet-brake 47 upon the latch operating to open these circuits, current is cut off from the motor and at the same time the brake 47 is applied. This would result in stopping the hoisting machinery, and thereby prevent the hoisting-cable 11 from being slacked off the hoisting-drum 35. In order to reset the retarding device or bring it back into its original position after the same has operated to stop the car, it is only necessary to relieve the cables 27 27′ of the weight of the car and then pull on the handle 54. This will raise the arm 84 and weight 52 and relieve the lateral pressure on the disks. The handle 62 may now be revolved freely, thereby turning the shaft 83, together with the drum 31, and thus winding up all slack in the cables 27 27′. The loose disks at the same time are adjusted by hand into their original positions, as shown on the drawings, after which the latch 42 is released from detent 41 and the system is again in running order.

Although one pair or set of dogs may be sufficient, still in actual practice it is desirable to use at least two sets. In such case I use two rock-shafts 22 and 23 and two rollers 40 and 40′, Fig. 3, one on each side of the cam 39 and diametrically opposite each other with respect to the cam. It would be equally practicable to employ two similar cams set one hundred and eighty degrees ahead of each other on the same shaft and using one roller for each cam, as shown in the patent hereinbefore referred to. Other arrangements might be used to advantage, all coming within the scope of my invention. The use of two rollers operated by one cam is shown in Fig. 3, and by reason of the peculiar form of cam used (see Fig. 6) and since these rollers operate diagonally opposite sets of dogs it follows that at least one set of dogs is in an engaging position. When using two sets of dogs, I use four cables—such as 27 27′ and 28 28′. These cables would all wrap around the drum 35, but sometimes I join two adjacent cables near the top of the eleva-

tor-shaft. Two latches may also be used, one for each pair of dogs, the contacts connected to these latches being preferably connected in series with each other, whereby the circuits to the safety magnet-brake and motor-reversing switches would be interrupted should either latch operate to hang up the car.

Fig. 6 shows a preferred form of cam, substantially one hundred and eighty degrees of its peripheral surface being concentric. Whenever a roller is on this circular portion, the dogs controlled thereby are held out in an engaging position. When a roller drops into the recessed portion 48, the corresponding dogs are withdrawn only to be almost immediately thrown outward when the roller reaches the part 49. Upon the flattened portion of the cam-face at 50 is where the roller stands when its dogs are passing by the stops—that is, when the car speed is normal. The dogs are not latched out unless a roller is thrown at the point 49 away from the cam-face an amount sufficient to carry it farther from the center of the cam than the maximum radius of the same.

Having thus disclosed my invention and without limiting myself to the precise construction of details and arrangement of parts herein shown and described, what I claim, and desire to have protected by Letters Patent of the United States, is—

1. The combination with a car having a projecting part thereon, of a stop in the path of travel of said projecting part, and positive means outside the car for actuating said projecting part to move the same to disengaging position.

2. The combination with a car, of a projecting part connected thereto, a plurality of stops in the path of travel of said projecting part, and positive means wholly outside the car for actuating said projecting part to move the same to disengaging position with reference to said stops.

3. The combination with a car, of a projecting part connected to said car, normally fixed stops in the path of travel of said projecting part, and means for intermittently and positively moving said projecting part to allow the same to pass by said stops.

4. The combination with a car, of a projecting part connected thereto, a cable, stops on said cable, and means for positively moving said projecting part at predetermined intervals to allow the same to pass by said stops.

5. The combination with a car, of movable dogs connected thereto, standing cables, fixed stops thereon and in the paths of travel of said dogs, and means for automatically and positively moving said dogs to keep the same from striking said stops when the car runs at a safe speed.

6. The combination with a car, of a movable projecting part, a retarder comprising fixed stops, positive means for retracting said projecting part as it is brought in proximity to a stop and restored to position after passing the stop, and means coacting with said positive means for maintaining said projecting part in engaging position if the car speed is excessive.

7. The combination with a car, of a movable dog carried thereby, a retarding device comprising normally fixed stops, means for shifting said dog to disengaging position as it approaches a stop and restoring same to normal position after leaving the stop, and means for holding said dog in engaging position when the car exceeds a safe speed.

8. The combination with an elevator-car, of dogs pivoted thereto, a plurality of stops in the path of travel of each of said dogs, means for supporting said stops normally in fixed position, and means actuated by the movement of the car for positively moving said dogs to prevent the same from striking said stops except when the car is moving at an excessive rate of speed.

9. The combination with a car, of a movable projecting part, a variable retarding device, connections between said projecting part and said retarding device, and means for moving said projecting part to effect the operation of said variable retarding device to bring the car to a gradual stop when the car exceeds a predetermined speed.

10. The combination with a car, of dogs carried thereby, stops in the paths of travel of said dogs, a variable friction retarding mechanism, connections between said dogs and retarding mechanism, and means for automatically bringing said dogs into engagement with said stops to effect a gradual stopping of the car.

11. The combination with an elevator-car, of dogs carried thereby, stops in the path of travel of said car, a rotative variable friction retarding mechanism, and means connecting said stop with said mechanism for operating the latter when a dog engages a stop.

12. The combination with a car, of a movable dog connected thereto, a shaft, a set of plates in frictional contact with each other, means operated by said movable dog for rotating said plates, and means for successively stopping the rotative motion of said plates to increase the retardation of the motion of the car to bring the same to a gradual stop.

13. The combination with an elevator-car, of a dog carried thereby, a shaft, a drum secured to said shaft to move therewith, disks keyed to said shaft, additional disks alternating respectively with the first-named disks, a fixed stop-bar, lugs on the additional disks arranged to successively engage said fixed stop-bar to gradually increase the rotative retardation by the friction between the rotative and fixed disks, means for exerting a lat-

eral pressure upon the aforesaid disks, a stop for the said dog, and a flexible connection secured to said stop and wound on said drum for rotating the latter and operating the retarding mechanism to bring the car to a gradual rest upon the dog engaging said stop.

14. In an elevator safety device, the combination with a car, of a projecting part connected thereto, stops in the path of said projecting part, means for moving said projecting part as the same approaches a stop to allow said part to pass by said stop when the car's speed does not exceed a predetermined value, a rotatably-mounted shaft and drum, a series of frictionally-mounted disks on said shaft, an adjustable means for holding said disks in contact, means for stopping a plurality of said disks to gradually increase the retardation to rotative motion of said shaft, and a flexible device fixed at one end and having its other end wound on said drum and intermediately supporting said stops.

15. In safety appliances for elevators, the combination with a car, of a movable dog carried thereby, an elevator-shaft for the car, a variable retarding device, a flexible connection between a fixed point at one end of the shaft and said retarding device at the other end of the shaft, a stop on said connection at an intermediate point and arranged to be engaged at the proper time by said dog to operate said retarding device to gradually stop the car, a movable cam with intermediate connections for controlling the position of the dog and enabling same to pass said stop when the car is traveling at a safe speed, and means for moving said cam in harmony with the movement of the car.

16. In safety apparatus for elevators, the combination with a car, of a plurality of sets of movable dogs, each set arranged diagonally on opposite sides of the car, a variable retarding device for bringing the car to a gradual stop, and connections arranged to be engaged by said dogs to operate said retarding device.

17. In safety apparatus for elevators, the combination with a car, of movable dogs carried by and at opposite sides of the car, stops in the path of said dogs to be engaged at the proper time by said dogs, a rotary variable friction retarding device, means fixed at one end and connected at its other end to said retarding device and arranged vertically adjacent the path of travel of said car with the said stops mounted on the vertical portion, a rotary cam with intermediate connections for determining the position of said dogs and enabling them to pass said stops when the car is traveling at a safe speed, and means for rotating said cam in harmony with the movement of said car.

18. In safety apparatus for elevators, the combination with a car, movable dogs carried by and at opposite sides of the car, stops to be engaged by said dogs, a variable friction retarding device, a flexible connection between said stops and retarding device and arranged vertically adjacent the path of the car, a rotary cam-disk with intermediate connections for controlling the position of said dogs and enabling them to move inwardly away from said stops when the car travels at a safe speed, and means for rotating said cam-disk in harmony with the movement of the car.

19. In safety apparatus for elevators, the combination with a car, of movable dogs carried by and at opposite sides of the car, a retarding device, stops in the path of travel of said dogs and arranged to be engaged thereby upon excessive speed of the car, connections between said stops and said retarding device, a single rotary cam-disk with intermediate connections for controlling the position of said dogs and enabling them to alternately move inwardly from said stops when the car is traveling at a safe speed, and means for rotating said cam-disk in harmony with the movement of the car, said cam-disk having a surface to effect an alternate movement of said dogs.

20. In safety apparatus for elevators, the combination with a car, of dogs carried at diagonally-opposite sides of the car, means connecting the diagonally-arranged dogs in sets to effect the simultaneous movement inwardly and outwardly of the dogs of each set, a retarding device, stops arranged in the paths of travel of each of said dogs and to be engaged by said dogs upon excessive speed of the car, connections between said stops and said retarding device, a single rotary cam-disk with intermediate connections for respectively controlling the position of said sets of dogs, and means for rotating said cam-disk in harmony with the movement of the car.

21. The combination with a car, of projecting parts connected thereto, a cam between said projecting parts, a device for stopping the car, and connections for shifting said projecting parts according to the speed of the car.

22. The combination with an elevator-car, of dogs pivoted thereto, a cam mounted between said dogs, intermediate connections for shifting said dogs according to the speed of the car, a retarding device, and connections actuated by said dogs to operate said retarding device when the car speed is excessive.

23. The combination with a car, of movable projecting parts connected thereto, a cam mounted on the car, a retarding device, means for operating said retarding device and arranged to be engaged by said projecting parts, and means coacting with said cam for effecting a positive actuation of said projecting parts to engaging position and controlling

the movement thereof to disengaging position.

24. The combination with a car, of dogs pivoted to the car, a cam-disk mounted on the car, a retarding device, means to be engaged by said dogs for operating said retarding device, and means coacting with said cam-disk and operated on the movement of the car for positively actuating said dogs to move the same to engaging position when the speed of the car becomes excessive.

25. In safety apparatus for elevators, the combination with a car, of a retarder for gradually stopping the car, means for operating said retarder, movable dogs carried by the car to engage said operating means at the proper time, a rotary governor-cam mounted on the car adjacent said dogs, a crank-arm engaging said cam, connections between said arm and dogs, a drum carried by the car, means for imparting motion to said drum upon movement of the car, and means for communicating the motion of said drum to said cam.

26. In safety apparatus for elevators, the combination with a car, of a retarding device for stopping the car, means for actuating said retarding device, movable dogs carried by the car to engage said actuating means upon excessive speed of the car, a single rotary governor-cam mounted on the car, crank-arms engaging said cam, independent connections for said arms and dogs, a drum carried by the car, means for imparting motion to said drum upon movement of the car, and means for communicating said motion to the cam.

27. In safety apparatus for elevators, the combination with a car, of a retarding device for gradually stopping said car, means for operating said retarding device, movable dogs carried by the car to engage said operating means when the car speed exceeds a predetermined limit, a single rotary governor-cam mounted on the car, crank-arms engaging substantially opposite surfaces of said cam, independent connections between said arms and dogs, and means rotating said cam during and in harmony with the movement of the car.

28. The combination with an elevator-car, of a projecting part carried thereby, a retarding device for stopping the car, means for actuating said retarding device and arranged to be engaged by said projecting part when the car speed exceeds a predetermined limit, means for controlling the movement of said projecting part, and a latch for holding said projecting part in engaging position.

29. The combination with a car, of a retarding device of predetermined resistance for gradually stopping the car, operating means for said retarding device, movable dogs connected to the car, means for alternately retracting said dogs from engaging position with said operating means, and restoring the dogs to position when the car speed is normal, and a latch operated upon excessive speed of the car for holding said dogs in engaging position.

30. The combination with a car, of means for starting and stopping the same during its normal operation, a dog carried by the car, a retarding device for arresting the downward movement of the car upon the same attaining undue speed, means coacting with said dog for operating said retarding device, means for controlling the movement of said dog to engaging and disengaging position, and means for latching said dog in engaging position when the car speed exceeds a predetermined limit.

31. The combination with a car, hoisting mechanism therefor, a motor for operating said hoisting mechanism, a movable dog carried by the car, a retarding device, means coacting with said dog for operating said retarding device to bring the car to a gradual stop when said car attains an undue speed, means for controlling said dog to move the same to engaging and disengaging position during the normal operation of the car, means for holding said dog in engaging position when the car speed exceeds a predetermined limit, and means coacting with said holding means for stopping said motor and hoisting mechanism.

32. The combination with a car, of a safety device for the same, hoisting mechanism for the car, an electric motor for operating said hoisting mechanism, a brake for said motor and hoisting mechanism, electromagnetic means for holding said brake in releasing position means for applying said brake, means for controlling the operation of said motor, and means coacting with said safety device for interrupting the circuits to said electromagnetic means and the motor-controlling means when said safety device operates to stop the car.

33. The combination with a car, of a hoisting device therefor, an electric motor for said hoisting device, a brake for stopping the motor and hoisting device, means for applying the brake, electromagnetic means for holding said brake in releasing position during the travel of the car, means for controlling the operation of the motor from the car, a retarding device, a movable dog carried by the car, means coacting with said dog for actuating said retarding device to effect a gradual stopping of the car, means for shifting said dog to disengaging position at predetermined intervals according to the speed of the car, means coacting with said shifting means for holding said dog in engaging position when the car speed exceeds a predetermined limit and also for interrupting the circuits to said

motor-controlling means and said electromagnetic means to effect a stopping of the hoisting device and the motor.

34. The combination with a car, of a retarding device, a cable connected to said retarding device and arranged adjacent the path of travel of the car, a movable dog carried by the car, a stop comprising a clamp on an untwisted portion of said cable to be engaged by said dog to effect the actuation of said retarding device and the consequent gradual stopping of the car, means for moving said dog to disengaging position during the normal operation of the car, and means coacting with said moving means for holding said dog in engaging position when the car speed exceeds a predetermined limit.

35. The combination with a car, of a retarding device, a cable operatively connected thereto and arranged adjacent the path of travel of the car, a stop comprising plates with conical portions secured to an untwisted section of said cable, a movable dog carried by the car, and means for moving said dog to engaging position with said stop, and means coacting with said moving means for holding said dog in such position to effect the actuation of said cable to operate said retarding device upon the car attaining an excessive speed.

36. The combination with a car; of a retarding device comprising a shaft, a series of disks loosely keyed to said shaft to rotate therewith, an additional series of disks mounted on hubs of the first-named series of disks and alternating therewith, a weighted lever exerting pressure on said disks to maintain the same in frictional contact, means for successively stopping said second series of disks upon rotation of said shaft to gradually increase the frictional resistance to rotative movement, a drum fixed to the shaft, a cable wound on the drum and extending adjacent the path of travel of the car; a movable dog carried by the car, means for controlling the position of said dog, and a stop secured to said cable to be engaged by said dog when the car attains an excessive speed.

37. The combination with a car, of a rotative variable retarding device, and means for operating said device from the car to bring the same to a gradual stop.

38. The combination with a car, of rotative variable friction retarding mechanism, and means carried by the car for operating said mechanism to gradually stop the car.

39. The combination with a car, of a set of frictional devices, and means coacting with the car for rotating said devices and gradually reducing the speed of the car.

40. The combination with a car, of a shaft, a set of plates in frictional contact with each other, means actuated by the car for rotating said plates, and means for successively stopping the rotative motion of said plates to increase the retardation of the motion of the car to bring the same to a gradual stop.

41. The combination with a car, of a rotatable drum, disks movable with said drum, additional disks coöperating with the first-named disks, a stop for said additional disks, and means coacting with the car for rotating said drum and causing said disks to act to gradually stop the car.

42. The combination with a car, of a drum, disks movable with said drum, additional disks coöperating therewith, a stop for said additional disks, means for exerting pressure on said disks, and means coacting with the car for rotating the said drum and causing said disks to gradually stop the car.

43. The combination with a car, of a shaft, a drum secured to said shaft to move therewith, disks longitudinally movable on said shaft, additional disks alternating respectively with the first-named disks, a fixed stop-bar, lugs on the additional disks arranged to successively engage said stop-bar to gradually increase the rotative retardation by the friction between the rotative and longitudinally-movable disks, means for exerting a lateral pressure on said disks, and means coacting with the car for rotating said drum to effect a gradual stopping of the car.

44. In an elevator, the combination with a retarding device comprising a shaft, a series of disks longitudinally movable on said shaft and rotative therewith, an additional series of disks in frictional contact with said first-named disks, means for exerting a lateral pressure on said disks, and means for successively stopping said additional disks upon the rotation of said shaft to gradually increase the frictional resistance to rotative movement.

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

CHARLES S. BURNHAM.

Witnesses:

CHARLES M. NISSEN,

WALTER C. STRANG.