No. 754,432. PATENTED MAR. 15, 1904.

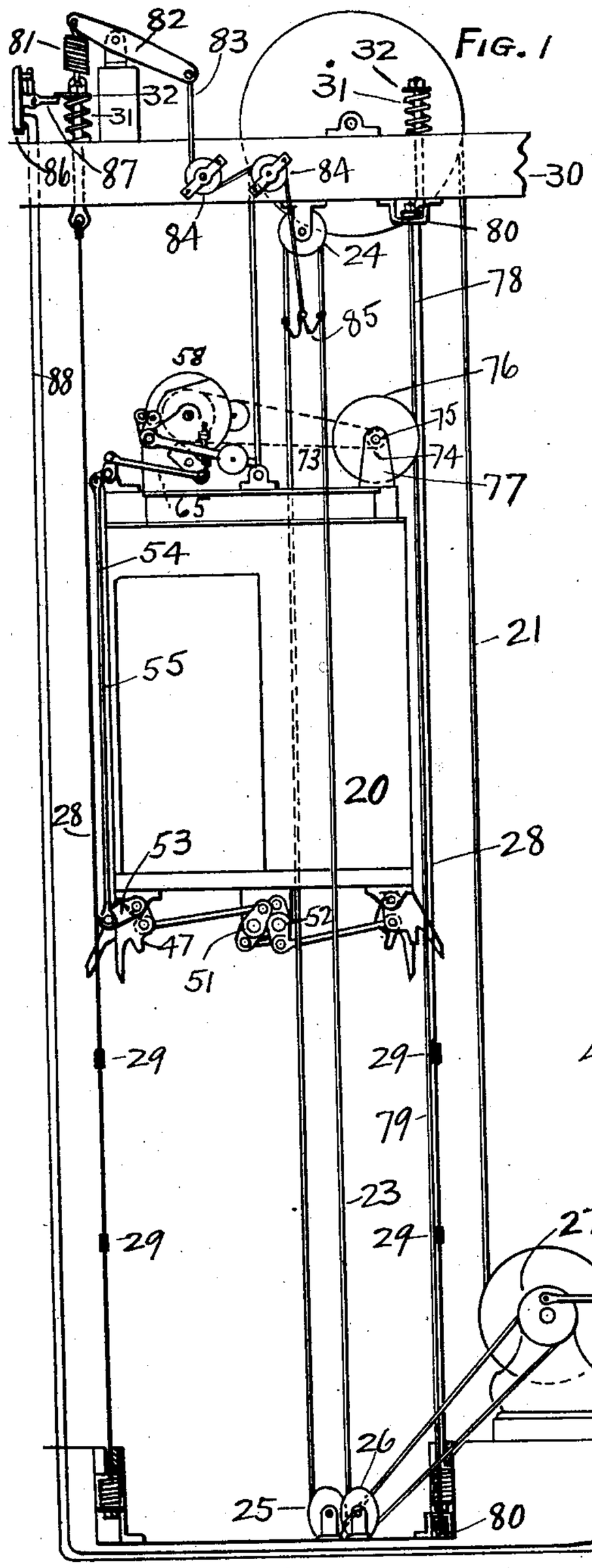
J. CRUICKSHANK & C. S. BURNHAM.

SAFETY APPLIANCE FOR ELEVATORS.

APPLICATION FILED JAN. 9, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

FIG. 1



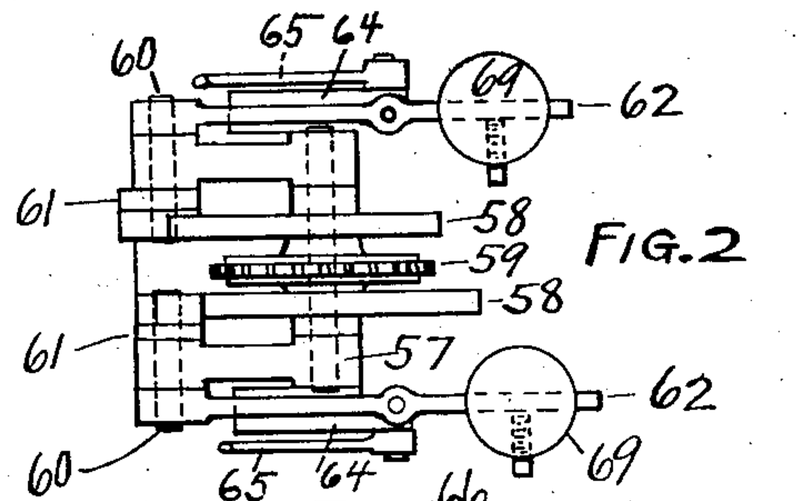


FIG. 2

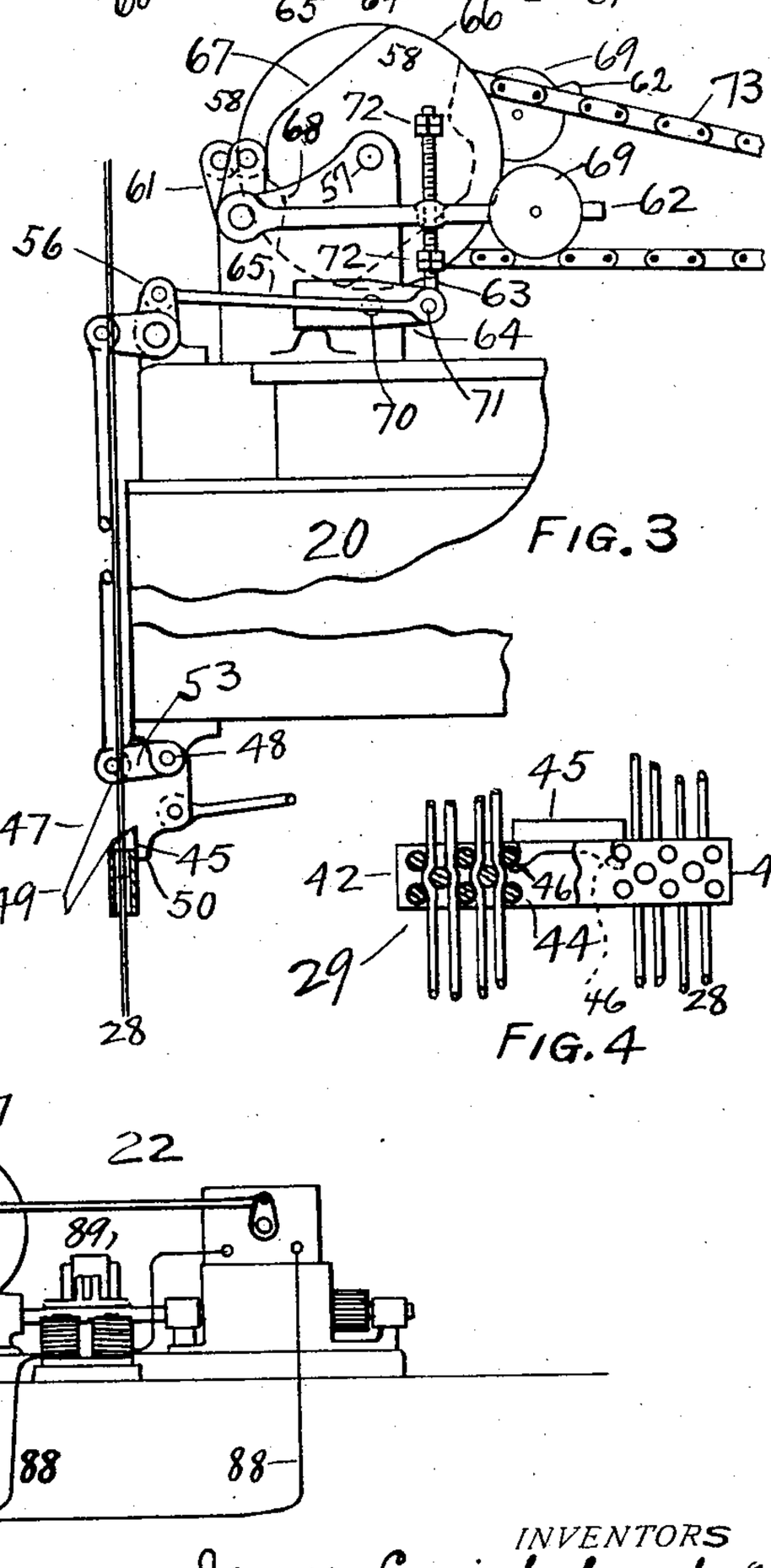


FIG. 3

FIG. 4

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NO MODEL. 3 SHEETS—SHEET 2.

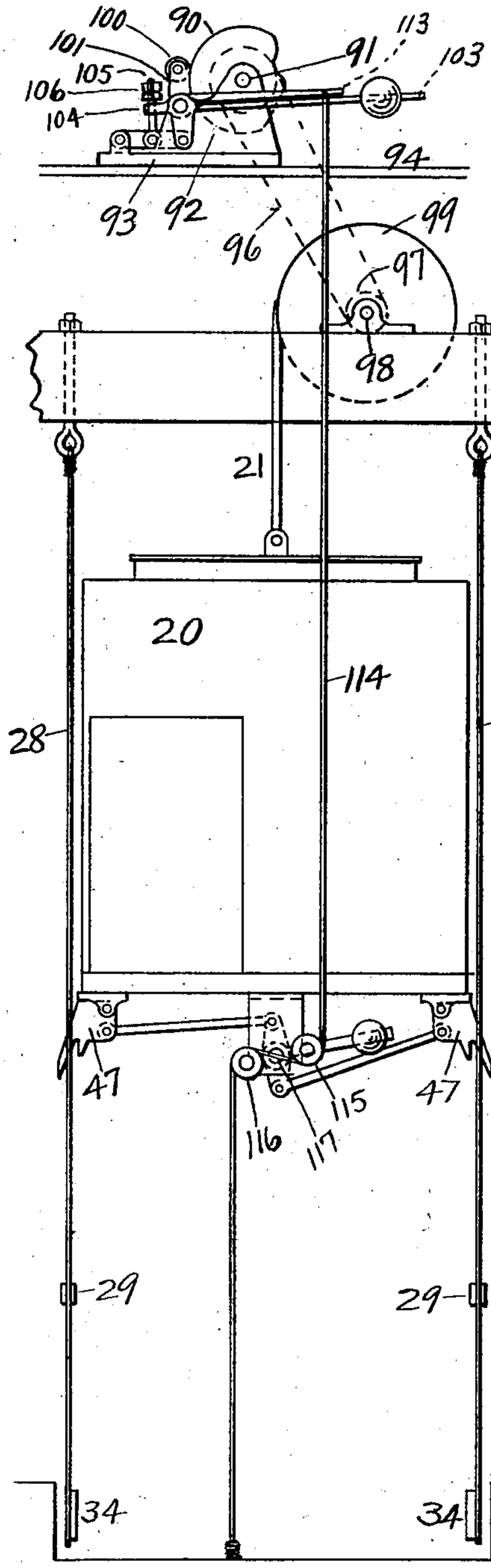

FIG. 5

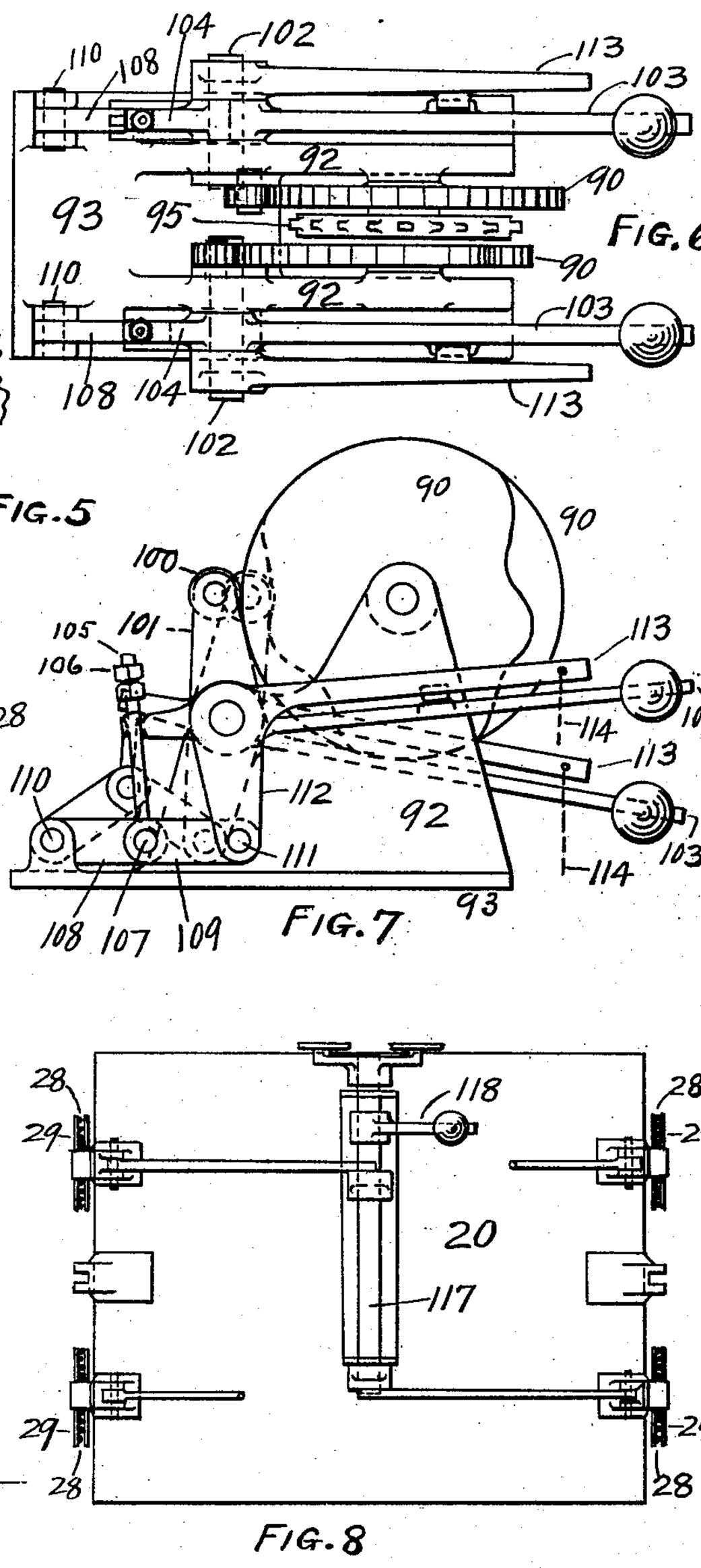

FIG. 6

FIG. 7

FIG. 8

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NO MODEL. 3 SHEETS—SHEET 3.

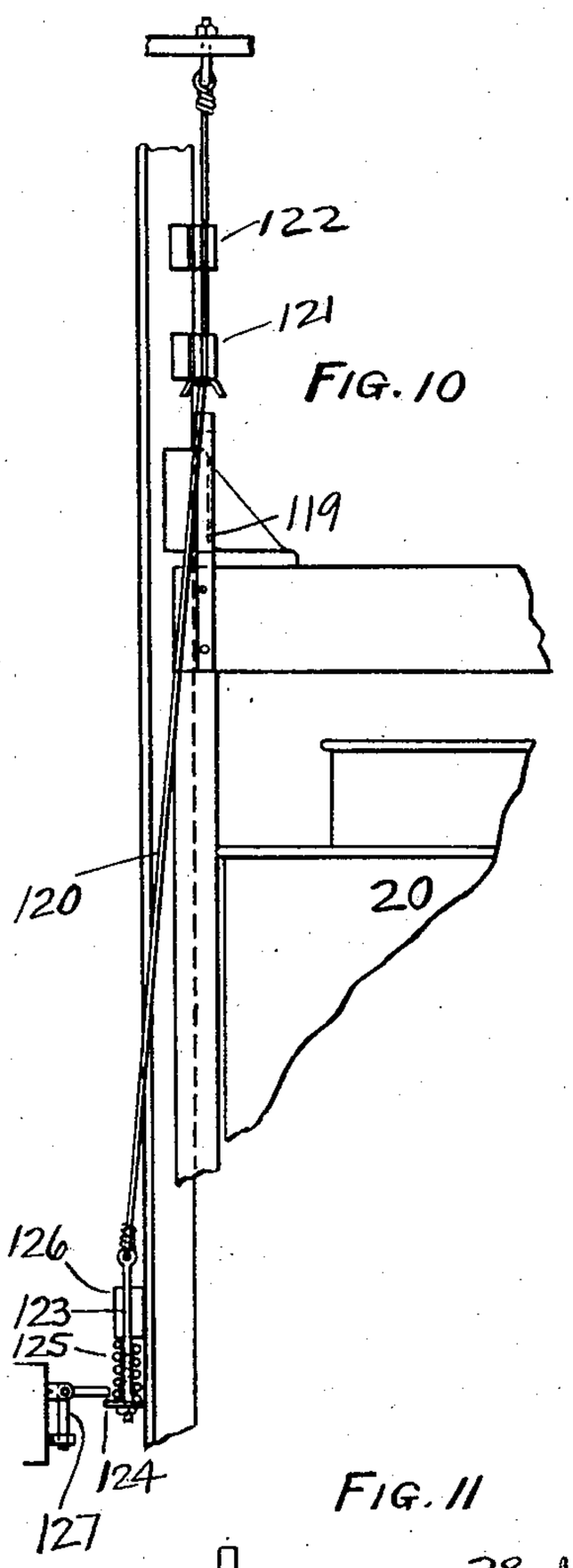


FIG. 10

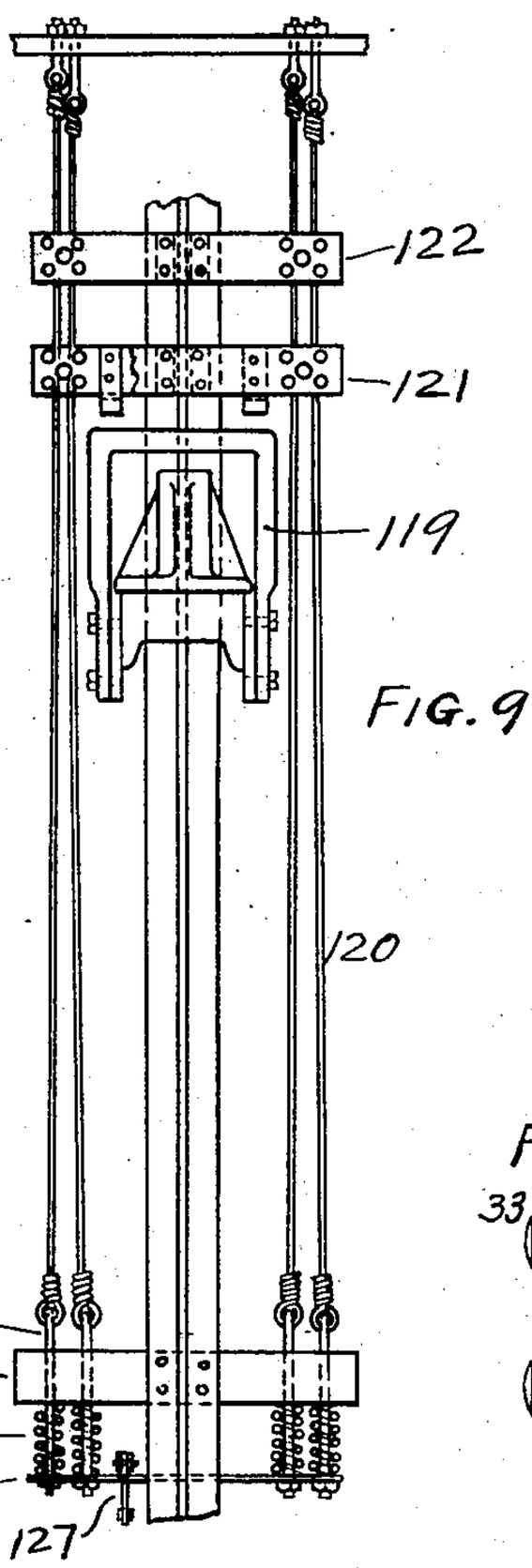


FIG. 9

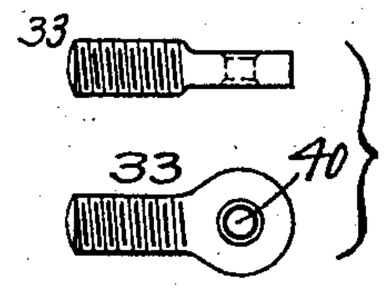


FIG. 15

FIG. 11

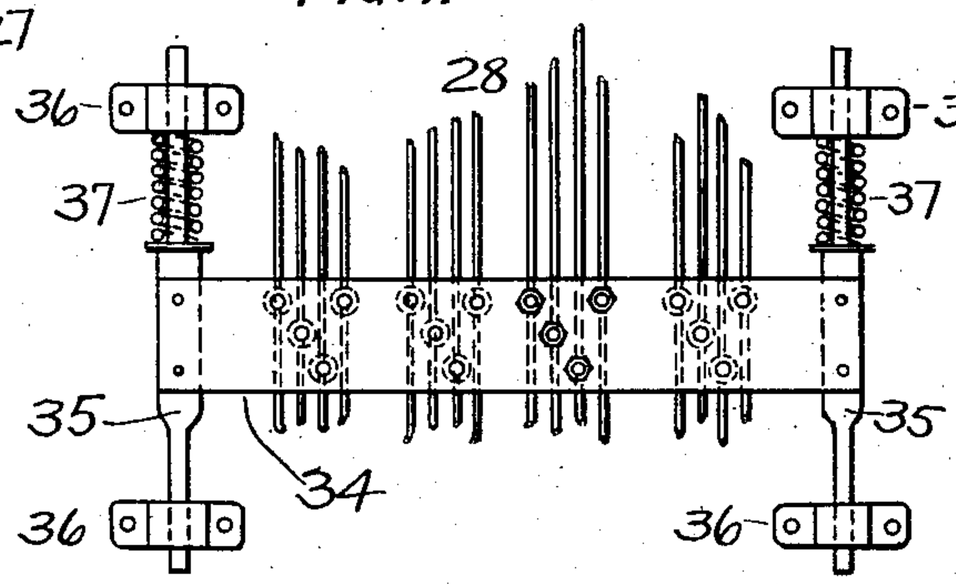


FIG. 12

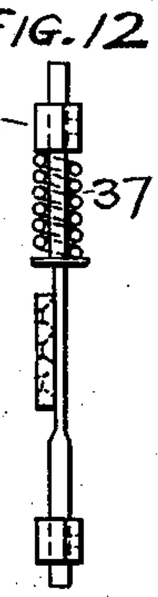


FIG. 13.

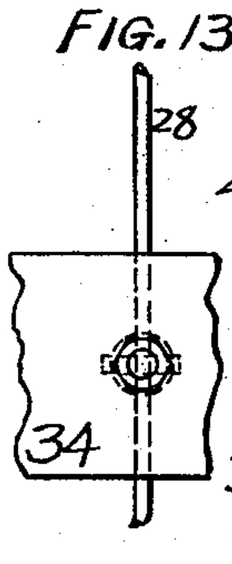
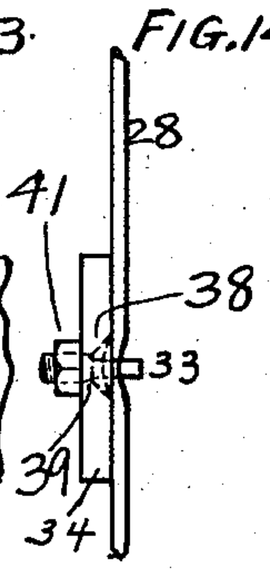


FIG. 14



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No. 754,432. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

JAMES CRUICKSHANK, OF NEW YORK, N. Y., AND CHARLES S. BURNHAM, OF PHILADELPHIA, PENNSYLVANIA; SAID BURNHAM ASSIGNOR TO SAID CRUICKSHANK.

SAFETY APPLIANCE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 754,432, dated March 15, 1904.

Application filed January 9, 1903. Serial No. 138,365. (No model.)

To all whom it may concern:

Be it known that we, JAMES CRUICKSHANK, residing at the city of New York, in the county and State of New York, and CHARLES S. BURNHAM, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, citizens of the United States, have jointly invented certain new and useful Improvements in Safety Appliances for Elevators, of which the following is a specification.

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

The object of the invention is to effect the gradual stoppage of an elevator-car in case of excessive speed in the same, and consequently to avoid the accidents and consequences due or likely to result from a fall or runaway of an elevator-car.

In general respects the present invention relates to certain improvements, which will be pointed out hereinafter, upon the apparatus described and claimed in Letters Patent of the United States No. 601,909, dated April 5, 1898, and No. 618,141, dated January 24, 1899, for improvements in elevators.

The present invention will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which—

Figure 1 may be considered as a vertical section through a portion of an elevator-shaft equipped with a car and safety appliances constructed in accordance with and embodying our invention. Fig. 2 is a detached top view of a portion of the governor mechanism carried by the car. Fig. 3 is an enlarged side elevation of the car, partly broken away, and the governor mechanism. Fig. 4 is a detached face view, partly broken away and partly in section, of one of the retarders disposed on the suspended wire rods by which in case of accident the car becomes arrested. Fig. 5 is a view corresponding substantially with Fig. 1, but illustrating a slight modification of the invention in that the governor devices instead of being carried by the car, as shown in Fig. 1, are arranged upon the structure at the upper end of the elevator-shaft. Fig. 6 is a detached top view of the governor mechanism presented in Fig. 5. Fig. 7 is a side elevation of same. Fig. 8 is a detached bottom view of a portion of the mechanism carried by the lower end of the car. Fig. 9 is an elevation of certain appliances whereby upon the car attaining an undue speed on its upward movement it may be retarded and also effect the stoppage of the motor-power used for operating the car. Fig. 10 is a side or edge view of same, the car being partly broken away. Fig. 11 is an elevation of the means at the lower end of the elevator-shaft for holding and maintaining the due relation of the series of suspended wire rods upon which the retarders to arrest the car are placed. Fig. 12 is an edge view of same. Fig. 13 is an enlarged elevation of a portion of the plate or frame shown in Fig. 11. Fig. 14 is an edge view of same, and Fig. 15 presents an edge view and top view of one of the eyebolts for securing the individual suspended wires to the frame illustrated in Fig. 11.

In the drawings, 20 designates the usual passenger-car or hoist, 21 the usual hoisting-cable, and 22 the customary engine for operating the car, said engine being, as usual, equipped with suitable means for stopping and starting the same, said means being normally under the control of the attendant in the car by means of an endless cable 23, passing through the car in the usual manner and around a pulley 24 at the top of the elevator shaft or well, around the pulleys 25 26 at the base of the elevator shaft or well, and around a pulley 27, connected with the stopping and starting devices of the engine. The hand rope or cable 23 is of usual character, and one section of the same passes through the car in position to be grasped by the attendant and moved upwardly or downwardly for actuating the starting and stopping devices, and thereby placing the

movement of the car under the control of the attendant or operator. In accordance with our invention we provide, as hereinafter described, means for stopping the engine, as well as arresting the car upon the latter attaining an undue speed.

Extending vertically of the elevator shaft or well and at the opposite sides of the path of the car 20 are the series of vertical wire rods 28 of the general character shown and described in the aforesaid Letters Patent of the United States No. 618,141, dated January 24, 1899, upon which wires are the retarders 29, to be engaged by dogs carried by the car in case the latter attains an undue speed and preferably arranged in staggered order with respect to the opposite sides of the elevator shaft or well—that is to say, that some of the retarders 29 at one side of the elevator shaft or well will not be in line with other retarders arranged at the other side of the shaft or well, but will be disposed at one side of the shaft on horizontal planes intermediate the horizontal planes of the retarders at the other side of the shaft or well, this arrangement of the retarders 29 not being absolutely essential, but desirable. In the present instance we provide improved means for maintaining the series of vertical wire rods 28 and also an improved construction of retarder 29 for use on said wire rods 28. The wire rods 28 extend upwardly through apertures in the upper structural beam 30 and are encompassed by the coiled springs 31, engaging at their lower ends the beam 30 and at their upper ends the plates 32, whereby the wire rods 28 become yieldingly suspended. At their lower ends the wire rods 28 are secured, by means of bolts 33, Fig. 15, to a plate 34, whose ends are secured to bars 35, held in guides 36, the said bars 35 below the upper guides 36, Figs. 11 and 12, being encompassed by the coiled springs 37, which yieldingly resist the upward movement of the plate 34 and bars 35, said plate and bars constituting a yielding frame to which the lower ends of the wires 28 are firmly secured. The plate 34 has formed in it the conical recesses 38 and apertures 39, said apertures being at the base of said recesses and receiving the shank of the bolts 33, through the eyes 40 of which the individual wire rods 28 are passed. After the lower ends of the wires 28 have been passed through the eyes 40 of the bolts 33 the latter are secured to and pulled toward the plate 34 by means of the nuts 41, the tightening of which upon said bolts serves to draw the head of the latter, with the wires 28, into the recesses 38 of the plate 34, and in this manner the lower portions of the wires 28 are effectually and each independently secured to the plate 34.

The retarders 29 comprise a pair of plates 42 43, which correspond with each other and are connected together by the series of pins or rods 44, between which the wires 28 are passed and which preserve in said wires a bend, as shown in Fig. 4, there being a series of the pins 44 and wires 28 adjacent to each end portion of the retarder 29, while intermediate said end portions of said retarder and intermediate the series of wires 28, at the respective ends thereof, is provided the contact-plate 45, to be engaged by the dogs hereinafter described, at the proper time carried by the car 20, and this contact plate or bar 45 extends upwardly above the plates 42 43 and from the upper inner edge thereof inclines downwardly and outwardly, as shown in Fig. 3, said plate or bar 45 in that portion thereof located above the plates 42 43 constituting a head bearing upon the upper horizontal edges of said plates, while that portion of the said plate or bar 45 extending downwardly intermediate the plates 42 43 forms a shank 46, recessed at its opposite vertical edges to engage the facing sides of the two upper central pins or rods 44, as shown in Fig. 4, whereby said plate or bar 45 becomes by said pins or rods 44 effectually secured in position. The head formed at the upper end of the plate or bar 45 has a firm bearing upon the upper edges of the plates 42 43, and the purpose of inclining the upper surfaces of said head in an outward and downward direction is to insure the proper engagement therewith of the dogs 47, carried by the car 20. The form of the dogs 47 is clearly illustrated in Figs. 1 and 3, and these dogs are pivotally secured at 48 and formed with the outwardly and downwardly extending members 49 and inner substantially vertical member 50, there being created between the members 49 and 50 a triangularly-shaped jaw adapted at the proper time to receive and bear firmly upon the head of the contact plates or bars 45 constituting a portion of the retarders 29, the dog 47 in Fig. 3 being illustrated as having passed into contact with one of the said plates or bars 45. The member 49 of the dogs 47 inclines outwardly and downwardly, so as to assuredly when necessary engage the contact plate or bar 45 and effect the inclosure of the upper or head end of said plate or bar within the space intermediate the upper portion of said member 49 and the inner member 50. In the preferred construction there will be two of the dogs 47 at each side of the lower end of the elevator-car, and said dogs will be so mounted and connected up with their operative mechanism that a dog at each side of the lower end of the car will be held in its outer or engaging position, while the other dogs—one at each side of the lower end of the car 20—are held in their inner inoperative position, and in the present instance we mount below the car 20 the rock-shafts 51 52, and from one of said rock-shafts through ordinary crank-arms and connecting-rods the pair of diagonally opposite dogs 47 (one dog being at each side of the car) are operated—that is, moved outwardly

into operative position to engage the retarders or inwardly to pass said retarders, as occasion may require—and from the other one of said rock-shafts the other diagonally opposite dogs, one at each side of the car, are by suitable crank-arms and connecting-rods actuated and controlled. One dog at the left-hand side of the car 20 is by means of a crank-arm 53 connected with a vertically-movable connecting-rod 54, and the other dog 47 at the same side of the car is by means of a similar crank-arm connected with a corresponding connecting-rod 55, and these rods 54 55 extend upwardly along the side of the car and at their upper ends are connected with bell-crank levers 56, mounted upon the top of the car, said bell-crank levers 56 being in operative connection with the governor mechanism, hereinafter described, and adapted under the operation of said mechanism to impart either a downward or an upward motion to the rods 54 55, the construction being such that when the rod 54 is moved downwardly it will throw the dogs 47, actuated from it, inwardly, as shown in Fig. 1, and that at such time the rod 55 will be moved upwardly for the purpose of throwing the dogs with which it is operatively connected in an outward position in the path of the retarders 29, as illustrated in Fig. 1. The governor mechanism is thus of a duplex character and is arranged to impart reverse movement to the rods 54 55 and diagonally-arranged pairs of dogs 47.

The mechanism by which during the travel of the car 20 the rods 54 and 55 and dogs 47 are given their respective movements and during certain intervals maintained in their respective positions comprises in the constructions shown in Figs. 1, 2, and 3 a main supporting-shaft 57, a pair of reversely-arranged cams 58, secured thereon, a sprocket-wheel 59, secured on said shaft intermediate said cams 58, means operated by the car for imparting rotary motion to said shaft, cams, and sprocket-wheel, rock-shafts 60, carrying at one end crank-arms 61, having rollers to engage the peripheries of the cams 58, weighted arms 62, rigidly secured to the other end of said rock-shafts 60, vertical rods 63, passing through said weighted lever-arms 62 and at their lower ends secured to the weighted lever-cranks 64, and connecting-rods 65 at one end pivotally secured to said lever-cranks 64 and at the other end pivotally secured to the aforesaid bell-crank levers 56, connected with the vertical operating-rods 54 55. The cams 58 are duplicates of one another; but one of said cams is set one-half turn in advance of the other, so that said cams become thereby reversely arranged and are enabled to impart through the intermediate mechanism reverse movements to the vertical rods 54 55, through which and the suitable crank-arms and connecting-rods below the car 20 the proper alternate or reverse movements are created in the pair of dogs 47. Each of the cams 58 is formed along its periphery with a rather extended concentric surface 66, an inclined surface 67, and a distinct concavity or recess 68, and it is over the peripheries of the cams 58 that the rollers carried by the crank-arms 61 travel, being normally maintained against said peripheries by the weighted arms 62, these arms being equipped with the adjustable weights 69 to insure the proper action of said rollers with respect to the peripheries of said cams. The weighted levers 64 are pivotally mounted, as denoted at 70 in Fig. 3, and at their outer ends the said levers 64 are by means of the bolts 71 pivotally connected with the rods 65 and lower ends of the vertical rods 63. The rods 63 are threaded at their upper and lower portions to receive the nuts 72, which serve as contacts or stops for the lever-arms 62 during the movement of the latter. The shaft 57 and cams 58 receive their motion from the sprocket-wheel 59, and this wheel 59 receives its motion through a sprocket-chain 73, connecting it with a sprocket-wheel 74, mounted upon a shaft 75 with a drum 76, said shaft 75 being suitably supported in standards 77 upon the top of the car 20, as shown in Fig. 1. The drum 76 is grooved spirally, and to it is secured one end of the cables 78 79, the upper end of the cable 78 being secured to the beam structure 30 at the top of the elevator-shaft, while the lower end of the cable 79 is secured to the base of the elevator-shaft, and the upper end of the cable 78 and lower end of the cable 79 will preferably be equipped with spring take-ups 80 of any suitable character. The cables 78 79 are utilized as the means for during the travel of the car 20 imparting motion to the drum 76, and through said drum, shaft 75, sprocket-wheel 74, and chain 73 to the sprocket-wheel 59 and cams 58. As the car 20 descends the cable 78 will unwind from the drum 76, the latter turning, and the cable 79 will wind upon said drum, and during the ascent of the car 20 the cable 79 will unwind from the drum 76 and the cable 78 will be wound upon said drum. The drum 76 thus during both the descent and ascent of the car 20 is rotated, with its shaft 75, and the motion of said drum will be communicated through the chain 73 to the cams 58, the latter therefore performing a constant rotation during the travel of the car. One cam 58 is employed for each system of the dogs 47, and by means of the cams 58 and the parts operated therefrom the dogs 47 are during the normal or safe speed of the car made to pass the retarders 29 without contacting with the same. While the surfaces 66 of the cams 58 are moving against the rollers of the crank-arms 61 the dogs 47 will be held in their outer or engaging position in the path of the retarders 29, and when the depressions 68 of said cams reach the said rollers the latter will,

if the car is traveling at a safe speed, enter said depressions under the action of the weighted arms 62 and allow said arms 62 to descend against the lower stop-nuts 72, depressing the outer end of the weighted levers 64 and operating through the rods 65 to turn the dogs 47 inwardly, as shown in Fig. 1, so that they may pass the retarders 29 next below them. After the rollers carried by the crank-arms 61 leave the depressions or recesses 68 of the cams 58 the weighted lever-arms 62 are gradually restored to their normal position, and the dogs 47 are moved outwardly again into the path of the retarders 29, being given their full outward position upon the surfaces 66 of said cams reaching said rollers. If the car should attain an undue speed, the rollers carried by the crank-arms 61 will not have an opportunity, due to the then rapidity of motion of the cams 58, to enter the recesses 68 of said cams, and at such time the dogs operated by the respective cams will not be turned inwardly to pass the retarders 29 next below them, but will be left in their outer or engaging position to strike upon the contact-bars 45 of said retarders, as illustrated in Fig. 3, and the engagement of said dogs with said retarders will result in the car being brought to a gradual stop, the retarders 29 at such time moving downwardly upon the wire rods 28 for a limited distance until both the retarders and car come to rest.

The time at which the dogs 47 either strike upon or pass the retarders 29 is when the rollers carried by the crank-arms 61 are about opposite to the projecting portion of the cams 58, intermediate the recesses or depressed surfaces 67 68 thereof. When the car is traveling upwardly, the surfaces 67 of the cams 58 permit the arms 61 to turn inwardly far enough to allow the arms 62 to effect such inward movement of the dogs 47 as will enable them to pass the retarders 29, and when the car is traveling downwardly at a safe speed, especially if it is moving slowly, the recesses 68 of the cams 58 present themselves to the rollers carried by the crank-arms 61 and permit said arms to turn inwardly far enough to allow the arms 62 to effect such inward movement of the dogs 47 as will enable them to pass the retarders 29. The recesses 68 of the cams 58 are somewhat deep and short, so that a rapid elevator-car may with safety travel at such speed that the said recesses will pass the rollers of the arms 61 without said rollers entering said recesses, said rollers at such time moving inwardly and meeting the projecting surface intermediate the depressions 67 68 of the cams 58, which surface is set inwardly far enough to allow, when said rollers move against them during safe conditions, the inward movement of the dogs 47 from the path of the retarders 29. When a car is traveling downwardly at an unsafe speed, the rollers carried by the arms 61 will not have an opportunity to move inwardly to a sufficient extent for the dogs 47 to pass the retarders 29, and under such condition the dogs will strike upon the retarders at the time said rollers are about opposite to the projecting surface intermediate the depressions 67 68 of the cams 58, and then upon such contact of the dogs with the retarders the arms 61 will turn inwardly against the said projecting surface, as shown in Fig. 3. The surfaces 67 of the cams 58 are made flat instead of short and deep, as the depressions 68, because it is not desired during the upward travel of the car that said surfaces 67 shall pass the rollers carried by the arms 61 without affording abundant opportunity to said arms to turn inwardly and effect the passage of the dogs 47 by the retarders 29. The dogs 47 have but one reciprocation, inward and then outward, during each rotation of the cam 58, this being due to the position of the upper nuts 72, although during each rotation of the cam 58 the arms 62 have two movements, one being a slight movement, while the projecting surface intermediate the depressions 67 68 is passing the roller carried by the crank-arm 61.

The governor mechanism just above described as carried upon the car 20 and operated during the travel of said car constitutes a portion of our invention sought to be protected hereby, and in this connection we desire it to be understood that the invention is not limited to the special means shown for imparting rotary motion to the cams 58.

In addition to providing means for gradually stopping the car in case of accident or in the event that the car should for any cause obtain an undue speed we provide means for stopping the elevator-motor 22, as may be understood by reference to Fig. 1, which illustrates two styles of apparatus for stopping the motor or engine 22 when the dogs 47 of the car 20 contact with the retarders 29. When the dogs 47 strike the retarders 29, the upper portion of the rods 28 will yield downwardly under the compression of the springs 31, and this downward pull upon the rods 28 at the left-hand side of Fig. 1 will be imparted through the spring 81 to the short arm of the pivoted lever 82 and thence through the longer arm of said lever to the rope 83 (passing over sheaves 84) and check-rope 85, whose ends are fastened to the opposite sides of the cable 23, with the result that a pull will be exerted on the cable 23 sufficient to stop the engine or motor 22. In accordance with our invention we thus not only prevent the fall of the car 20, but also stop the elevator-motor. It will not be necessary to employ the lever 82, rope 83, and check-rope 85 in every instance, since the motion of the wire rods 28 when the weight of the car 20 is brought upon the retarders 29 may be utilized in connection with an electric brake for stopping the motor or engine 22, and thus at the left-hand side of Fig. 1 we

illustrate adjacent to the beam 30 a cut-out switch 86 with a bell-crank lever 87 in position when the rods 28 are pulled downwardly to be contacted with and moved by the plate 32 to break the circuit of the wires 88, connecting the motor and magnet-brake 89. The stoppage of the motor or engine 22 may thus be accomplished either mechanically or electrically from the motion imparted to the wire rods 28 upon the striking of the dogs 47 upon the retarders 29.

In Figs. 1 and 3 we illustrate the governor mechanism as being carried upon the upper end of the car 20; but we do not desire to confine the invention to the placing of such mechanism upon the car, since it may be arranged upon the structure at the upper end of the elevator-shaft, and hence in Figs. 5, 6, and 7 we indicate a method of employing the governor mechanism in stationary position above the elevator-shaft. The car 20, hoisting-cable 21, wire rods 28, retarders 29, and dogs 47 shown in Fig. 5 correspond with the like-numbered features hereinbefore described with reference to the structure of Fig. 1, and in the structure of Figs. 5, 6, and 7 the governor-cams (numbered 90) are mounted upon a shaft 91, which has its bearings in the standards 92, forming a part of a general supporting-frame 93, suitably supported upon a base 94, and upon the shaft 91 is secured, intermediate the cam-disks 90, a sprocket-wheel 95, which is by means of a sprocket-chain 96 connected with a sprocket-wheel 97, mounted upon the shaft 98 for the upper wheel 99, over which the hoisting-cable 21 passes, whereby motion may be imparted from the said wheel 99 to the cams 90, the latter being thus made to rotate during the movement of the car 20. The cams 90 of Figs. 5, 6, and 7 are reversely arranged with respect to each other, so that each cam 90 may operate its own system or pair of dogs 47. The cams 90 are at their peripheries engaged by small rollers 100, carried by the crank-arms 101, which are secured upon the inner end of rock-shafts 102, upon which are secured the weighted lever-arms 103, having short extensions 104, movable upon the vertical rods 105, the latter corresponding with the rods 63 of Fig. 3 and having at their upper ends the stop-nuts 106. The weighted lever-arms 103 normally keep the rollers 100, carried by the crank-arms 101, against the peripheries of the cams 90. The lower ends of the vertical rods are secured upon pivots 107, connecting the meeting ends of the toggle-levers 108 109, as more clearly shown in Fig. 7, the outer end of the levers 108 being secured upon pins 110, Fig. 6, while the outer ends of the levers 109 are secured by pins 111 to the arms 112 of bell-crank levers 113, the latter being upon the outer ends of the rock-shafts 102, as shown in Fig. 6, and having connected with the outer ends of their longer arms the cables or ropes 114, which, as shown in Fig. 5, extend through the length of the elevator-shaft and are secured at their lower ends to the base of said shaft. The ropes or cables 114 are utilized to impart motion to the pairs of dogs 47, one of said cables being utilized for one diagonally-arranged pair of said dogs and the other cable being furnished for the other pair of diagonally-arranged dogs 47 and each cable 114 having an independent operation controlled by its cam 90. The dogs 47 (shown in Fig. 5) have the same movements imparted to them as the dogs shown in Fig. 1; but in Fig. 5 the dogs receive their motion by the movement of the lever-arms 113 and cables 114 in lieu of, as in Fig. 1, from the vertically-movable rods 54 55. The cables 114 (shown in Figs. 5 and 7) pass over pulley-wheels 115 116, mounted upon crank-arms and adapted, through intermediate crank-arms and connections, to actuate the dogs 47, subject to the movement imparted to said cables and their lever-arms 113 from the cams 90. The rock-shaft 117 is provided with a weighted arm 118, which places a tension upon the cables 114 and aids the latter in securing to the dogs 47 their proper positions. The cams 90 contain the reversely-arranged depressions, as shown in Figs. 5 and 7, and these depressions while passing the rollers 100 of the crank-arms 101 normally allow the lever-arms 113 to have such movement that the cables 114 will assure the passing of the dogs 47 around the retarders 29; but upon an undue speed in the car 20 the said rollers 100 will not pass into the deeper part of the said depressions, and in such event the dogs 47 will be left in their outward position in the path of the retarders. When the rollers 100 enter the depressions of the cams 90, the weighted arms 103 turn downwardly at their weighted ends, and this causes the short extensions 104 of said arms to move upwardly against the nut-stops 106 on the vertical rods 101, with the result that said rods are moved upwardly and turn the toggle-levers 108 109 into the position in which they are shown in Fig. 7 by dotted lines, and after the rollers 100 have passed upon the concentric portion of the periphery of the cams 90 the crank-arms 101 are by the cams forced outwardly and straighten out the toggle-levers 108 109, as shown by solid lines in Fig. 7.

The construction shown in Figs. 5 to 8, inclusive, performs the same functions as the structure shown in Figs. 1, 2, and 3; but in lieu of the governing devices being carried by the car, as in Fig. 1, they are in the construction shown in Figs. 5, 6, and 7 mounted upon the stationary structure above the elevator-shaft. At the left-hand side of Fig. 1 we illustrate means for stopping the motor or engine 22 from the retarder-wires 28 during the descent of the car 20. An occasion may arise when it may be desired to also stop the motor or engine 22 during the ascent of the car 20,

and hence in addition to the devices presented in Fig. 1 we may equip the elevator-shaft with means for arresting the car during its ascent in case it should attain undue speed and also stopping the motor or engine 22, and in Figs. 9 and 10 we present such means, having omitted them from Fig. 1, so as not to complicate the illustration there presented. In Figs. 9 and 10 it will be seen that we provide the upper portion of the car with a frame 119 and the sides of the elevator-shaft with wires 120, bearing retarders 121 122 corresponding with the retarders 29 for arresting the car during its descent. The wires 120 are secured at their upper ends to the overhead structure and at their lower ends to rods 123, carrying plates 124 and springs 125, the latter being interposed between said plates 124 and stationary bars 126, through which said rods 123 will be guided, as shown in Fig. 9. Should the car attain an undue speed during its upward motion, the frame 119, carried by the top of the car, will contact with the retarders 121 and become arrested thereby, and at this time the upward pull on the wires 120 will cause the ascent of the plates 124 against the switch-levers 127, corresponding with the switch-levers 87 of Fig. 1, for the purpose of breaking the circuit connecting the motor and its magnet-brake. The construction shown in Fig. 1, coupled with that shown in Figs. 9 and 10, thus present means for arresting the car in case of undue speed in the latter during its descent and stopping the motor or engine 22 and also means for arresting the car during its ascent in case of undue speed in the car and stopping the motor or engine 22. It will be understood that the wires 120 and retarders 121 122 and frames 119 (shown in Figs. 9 and 10) will be duplicated at opposite sides of the elevator shaft or well, and in Figs. 9 and 10 we illustrate two retarders 121 122, so that in case of accident the retarder 121 while moving upwardly on the wires 120 may contact with the retarder 122, and thus arrest the car 20 before it has an opportunity to crash into the overhead structure.

The rods 28 and 120 are preferably of plain round wire; but said rods instead of being round may be either oval or rectangular in cross-section.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In safety appliances for elevators, the car, a movable dog carried thereby, the vertical rod secured in the elevator-shaft adjacent to the path of the car, the retarder thereon to be engaged at the proper time by said dog, the rotary cam with intermediate connections for controlling the position of said dog and enabling it to pass said retarder when the car is traveling at a safe speed, and means for rotating said cam in harmony with the movement of said car; substantially as set forth.

2. In safety apparatus for elevators, the car, movable dogs carried by and at the opposite sides of said car, the vertical rods secured at opposite sides of the elevator-shaft adjacent to the path of said car, the retarders on said rods to be engaged at the proper time by said dogs, the rotary cam with intermediate connections for controlling the position of said dogs and enabling them to pass said retarders when the car is traveling at a safe speed, and means for rotating said cam in harmony with the movement of said car; substantially as set forth.

3. In safety apparatus for elevators, the car, movable dogs carried by and at the opposite sides of said car, the vertical rods secured at opposite sides of the elevator-shaft adjacent to the path of said car, the retarders on said rods to be engaged at the proper time by said dogs, the rotary cam-disks with intermediate connections for controlling the position of said dogs and enabling them to alternately move inward from the path of said retarders when the car is traveling at a safe speed, and means for rotating said cam-disks in harmony with the movement of said car, said cam-disks having reversely-arranged surfaces to effect an alternate movement of said dogs; substantially as set forth.

4. In safety apparatus for elevators, the car, sets of movable dogs carried by and at the opposite sides of said car with the dogs at one side respectively connected with the dogs at the other side to move therewith, the vertical rods secured at opposite sides of the elevator-shaft adjacent to the path of said car, the retarders on said rods to be engaged at the proper time by said dogs, the rotary cam-disks with intermediate connections for respectively controlling the position of said connected sets of dogs and enabling them to alternately move inward from the path of said retarders when the car is traveling at a safe speed, and means for rotating said cam-disks in harmony with the movement of said car, said cam-disks having reversely-arranged surfaces to effect an alternate movement of said connected sets of dogs, whereby when one set of dogs is moved into position to pass the retarders next below them the other set of dogs are given a position to engage the retarders next below them; substantially as set forth.

5. In safety apparatus for elevators, the car, the dogs carried at opposite sides of the car, means connecting the diagonally-arranged dogs in sets to effect the simultaneous movement inward and outward of the dogs of each set, the vertical rods in the elevator-shaft, the retarders on said rods to be engaged at the proper time by said dogs, the rotary cam-disks with intermediate connections for respectively controlling the position of said sets of dogs, and means for rotating said cam-disks in harmony with the movement of said car; substantially as set forth.

6. In safety apparatus for elevators, the car, a movable dog carried thereby, the vertical

rod secured in the elevator-shaft adjacent to the path of said car, the retarder thereon to be engaged at the proper time by said dog, the rotary governor-cam for controlling the position of said dog, the crank-arm engaging at one end the surfaces presented by said cam, means for yieldingly maintaining the said arm against said cam, means connecting said crank-arm and dog whereby the latter may be moved from said arm, and means for rotating said cam in harmony with the movement of said car; substantially as set forth.

7. In safety apparatus for elevators, the car, a movable dog carried thereby at each side thereof, means connecting said dogs for securing their simultaneous inward and outward movement, the vertical rods in the elevator-shaft at opposite sides of the path of said car, the retarders thereon to be engaged at the proper time by said dogs, the rotary governor-cam for controlling the position of said dogs, the crank-arm engaging at one end the surfaces presented by said cam, means for yieldingly maintaining the said arm against said cam, means connecting said crank-arm and set of dogs whereby the latter may be moved from said arm, and means for rotating said cam in harmony with the movement of the car; substantially as set forth.

8. In safety apparatus for elevators, the car, the dogs carried at opposite sides of the car, means connecting the diagonally-arranged dogs in sets to effect the simultaneous movement inward and outward of the dogs of each set, the vertical rods in the elevator-shaft, the retarders on said rods to be engaged at the proper time by said dogs, the rotary governor-cams reversely arranged for controlling the position of said dogs, the independent crank-arms respectively engaging at one end the surfaces presented by said cams, means for yieldingly maintaining the said arms against said cams, means independently connecting said crank-arms with the respective sets of dogs whereby the latter are moved from said arms, and means for rotating said cams in harmony with the movement of the car; substantially as set forth.

9. In safety apparatus for elevators, the car, the movable connected dogs carried thereby, the vertical rods adjacent to the opposite sides of the path of said car, the retarders on said rods to be engaged at the proper time by said dogs, the rotary cam for controlling the position of said dogs, the crank-arm engaging the surfaces presented by said cam, the weighted arm yieldingly pressing said crank-arm against said cam, a second crank to be actuated by the first-mentioned crank-arm, means connecting this second crank with said dogs for moving them as required, and means for rotating said cam in harmony with the movement of the car; substantially as set forth.

10. In safety apparatus for elevators, the car, the dogs carried at opposite sides of the car, means connecting the diagonally-arranged dogs in sets to effect the simultaneous movement inward and outward of each set, the vertical rods in the elevator-shaft, the retarders on said rods to be engaged at the proper time by said dogs, the rotary governor-cams for controlling the position of said dogs, the independent crank-arms engaging the reversely-arranged surfaces presented by said cams, the weighted arms yieldingly pressing said crank-arms against their respective cams, independent cranks to be respectively actuated by said crank-arms, means independently connecting said independent cranks respectively with said sets of dogs for moving them as required, and means for rotating said cams in harmony with the movement of the car; substantially as set forth.

11. In safety apparatus for elevators, the car, the vertical rod and retarder thereon, the movable dog carried by the car to engage said retarder at the proper time, the rotary governor-cam mounted on the car, the crank-arm engaging said cam, and means connecting said arm and dog, combined with the drum 76 carried by the car, the cables 78 and 79 connected with said drum and also at the top and bottom of the elevator-shaft, and means for communicating motion from said drum to said cam; substantially as set forth.

12. In safety apparatus for elevators, the car, the vertical rods and retarders thereon, the movable dogs carried by the car to engage said retarders at the proper time, the rotary governor-cams mounted on the car, the crank-arms engaging the reversely-arranged surfaces of said cams, and means independently connecting said arms and dogs, combined with the drum 76 carried by the car, the cables 78, 79 connected with said drum and also with the top and bottom of the elevator-shaft, and means for communicating motion from said drum to said cams; substantially as set forth.

13. In safety apparatus for elevators, the car, the vertical rods and retarders thereon, the movable dogs carried by the car to engage said retarders at the proper time, the rotary governor-cams mounted on the car, the crank-arms engaging the reversely-arranged surfaces of said cams, and means independently connecting said arms and dogs, combined with the drum 76 carried by the car for operating said cams, and means for actuating said drum during and in harmony with the movement of the car; substantially as set forth.

14. In safety apparatus for elevators, the car, the vertical rod and retarder thereon, the movable dog to engage said retarder at the proper time, the rotary governor-cam mounted on the car, the crank-arm 61 engaging said cam, the weighted arm 62 connected with said crank-arm, the vertical rod 62 carrying stops to be engaged by said weighted arm, the pivoted weighted lever-crank 64 connected at one end with said vertical rod, and means intermediate said end of said lever-crank and said

dog for actuating said dog therefrom, combined with means for rotating said cam during and in harmony with the movement of the car; substantially as set forth.

15. In safety apparatus for elevators, the car, the vertical rods and retarders at the sides of the path thereof, the movable dogs carried by and at opposite sides of the car to engage said retarders at the proper time, the corresponding but reversely-arranged rotary governor-cams mounted on the car, the independent crank-arms 61 for said cams, the weighted arms 62 connected with said crank-arms, the vertical rods 62 carrying stops to be engaged by said weighted arms, the pivoted weighted lever-cranks 64 connected at one end with said vertical rods, and means intermediate said end of said lever-cranks and the respective sets of dogs for actuating said dogs therefrom, combined with means for rotating said cams in harmony with the movement of the car; substantially as set forth.

16. In safety apparatus for elevators, the car having the movable dog, and means for controlling said dog, combined with the plurality of flexible wire rods, and the retarder thereon to be engaged at the proper time by said dog, said retarder comprising the plates 42, 43 the pins 44 between which the wire rods are held, and the contact-bar 45 bearing upon the upper edges of said plates and having its lower portion extended between said plates and recessed at its opposite edges to fit between and engage the facing sides of the two upper inner pins 44; substantially as set forth.

17. In safety apparatus for elevators, the car having the movable dog, and means for controlling said dog, combined with the plurality of flexible wire rods, and the retarder thereon to be engaged at the proper time by said dog, said retarder comprising the plates 42, 43 the pins 44 between which the wire rods are held, and the contact-bar 45 whose upper surface inclines downwardly and outwardly, and said dog having the downwardly and outwardly inclined finger 49 and inner finger 50 forming between them a space conforming to the upper portion of said contact-bar; substantially as set forth.

18. In safety apparatus for elevators, the car having the movable dog, and means for controlling said dog, combined with the flexible wire rods having the retarder to be engaged at the proper time by said dog, the springs sustaining said rods at their upper ends, the plate 34 to which said rods are secured at their lower end, the end bars 35 connected with said plate, the guides 36 for said bars, and the springs 37 yieldingly resisting any upward movement of said plate; substantially as set forth.

19. In safety apparatus for elevators, the car having the movable dog, and means for controlling said dog, combined with the flexible wire rods having the retarder to be engaged at the proper time by said dog, the springs sustaining said rods at their upper ends, the plate 34 for the lower ends of said rods and having the recesses 39 and apertures 38, and the bolts and nuts 33, 41, said bolts being adapted to said recesses and apertures and having the eyes 40 in their head end to receive said rods and bind them to said plate; substantially as set forth.

20. In safety apparatus for elevators, the car having the movable dog, means for controlling said dog, the rod having the retarder thereon to be engaged at the proper time by said dog and the spring connected with one end of said rod and allowing the same a limited lengthwise movement when said dog contacts with said retarder, combined with appliances to be actuated by the pull on said rod against the resistance of said spring for stopping the elevator-motor; substantially as set forth.

21. In safety apparatus for elevators, the car, the rod having a retarder thereon to be engaged by a part carried by the car should the latter attain undue speed, said rod being allowed a limited lengthwise movement under such engagement, and the spring to resist such movement of said rod, combined with appliances to be actuated by such movement of said rod in opposition to said spring for stopping the elevator-motor; substantially as set forth.

22. In safety apparatus for elevators, the car having the movable dog, means for controlling said dog, the rod having the retarder thereon to be engaged at the proper time by said dog for arresting the car, the spring suspending said rod and allowing a limited movement in the same under such engagement, and the stopping and starting cable 23, combined with the pivoted lever 82 at one end connected with said rod, and means connecting the other end of said lever with said cable 23 for stopping the elevator-motor under the action of said pivoted lever; substantially as set forth.

23. In safety apparatus for elevators, the car, the dogs carried thereby, means for controlling said dogs, and the wire rods having retarders thereon to be engaged by said dogs at the proper time for arresting said car during its descent, combined with the sets of inclined wire rods 120 having retarders thereon adjacent to and at opposite sides of the top of the elevator-shaft to be engaged by the car in case the latter should attain undue speed during its upward travel; substantially as set forth.

24. In safety apparatus for elevators, the car, the dogs carried thereby, means for controlling said dogs, the wire rods having retarders thereon to be engaged by said dogs at the proper time for arresting said car during

its descent, said rods being allowed a limited lengthwise movement when said dogs strike the retarders, and means to be set in motion by such movement of said rods for stopping the motor, combined with the sets of additional wire rods 120 having retarders thereon adjacent to and at opposite sides of the top of the elevator-shaft to be engaged by the car in case the latter should attain undue speed during its ascent, and means operable from said additional wire rods for stopping the motor; substantially as set forth.

Signed at New York, in the county and State of New York, this 7th day of January, A. D. 1903.

JAMES CRUICKSHANK.
CHARLES S. BURNHAM.

Witnesses:
CHAS. C. GILL,
ARTHUR MARION.