No. 879,387. PATENTED FEB. 18, 1903.

J. D. IHLDER.

AMMUNITION HOIST CONTROL.

APPLICATION FILED AUG. 30, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

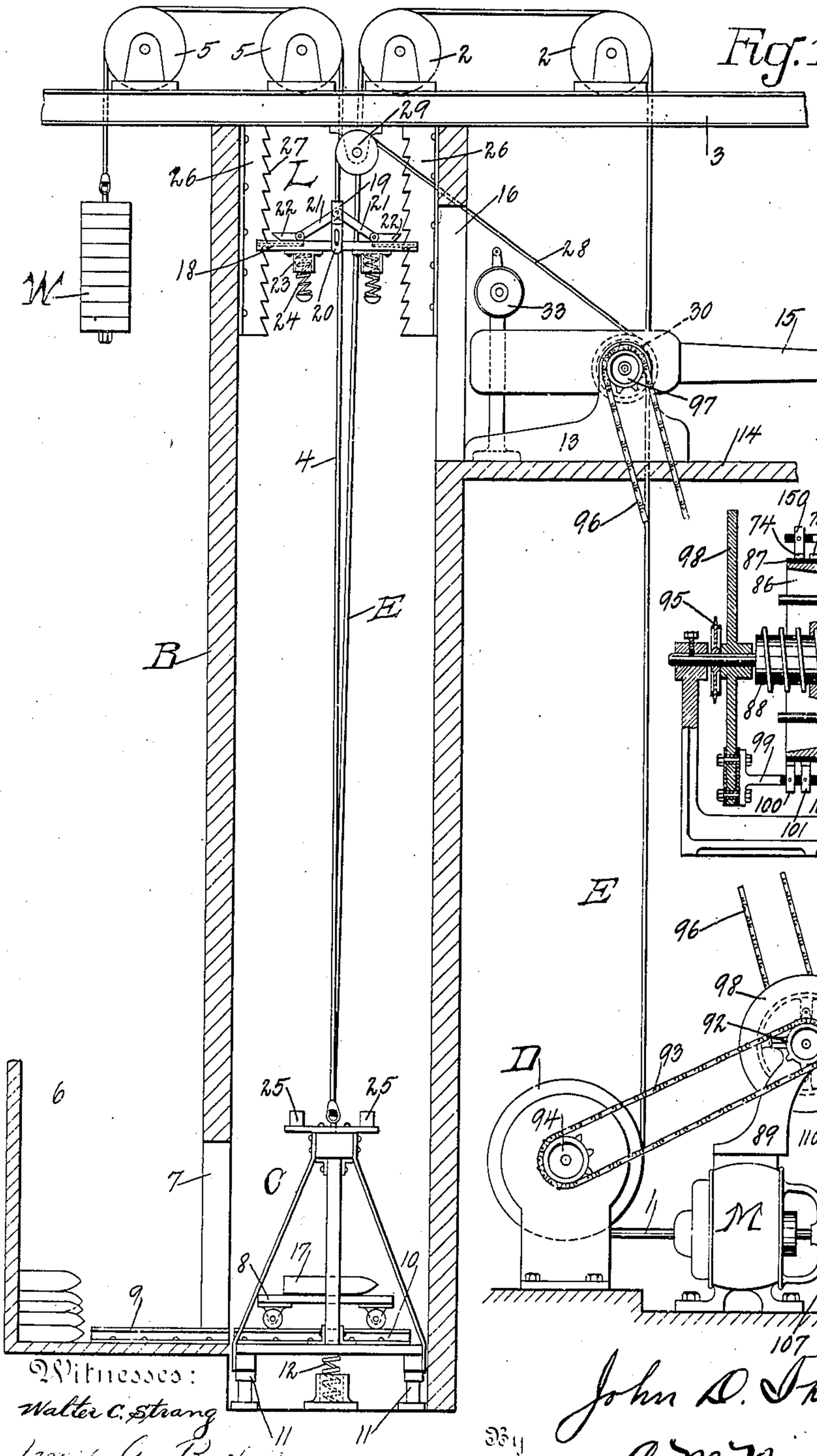

Fig. 2.

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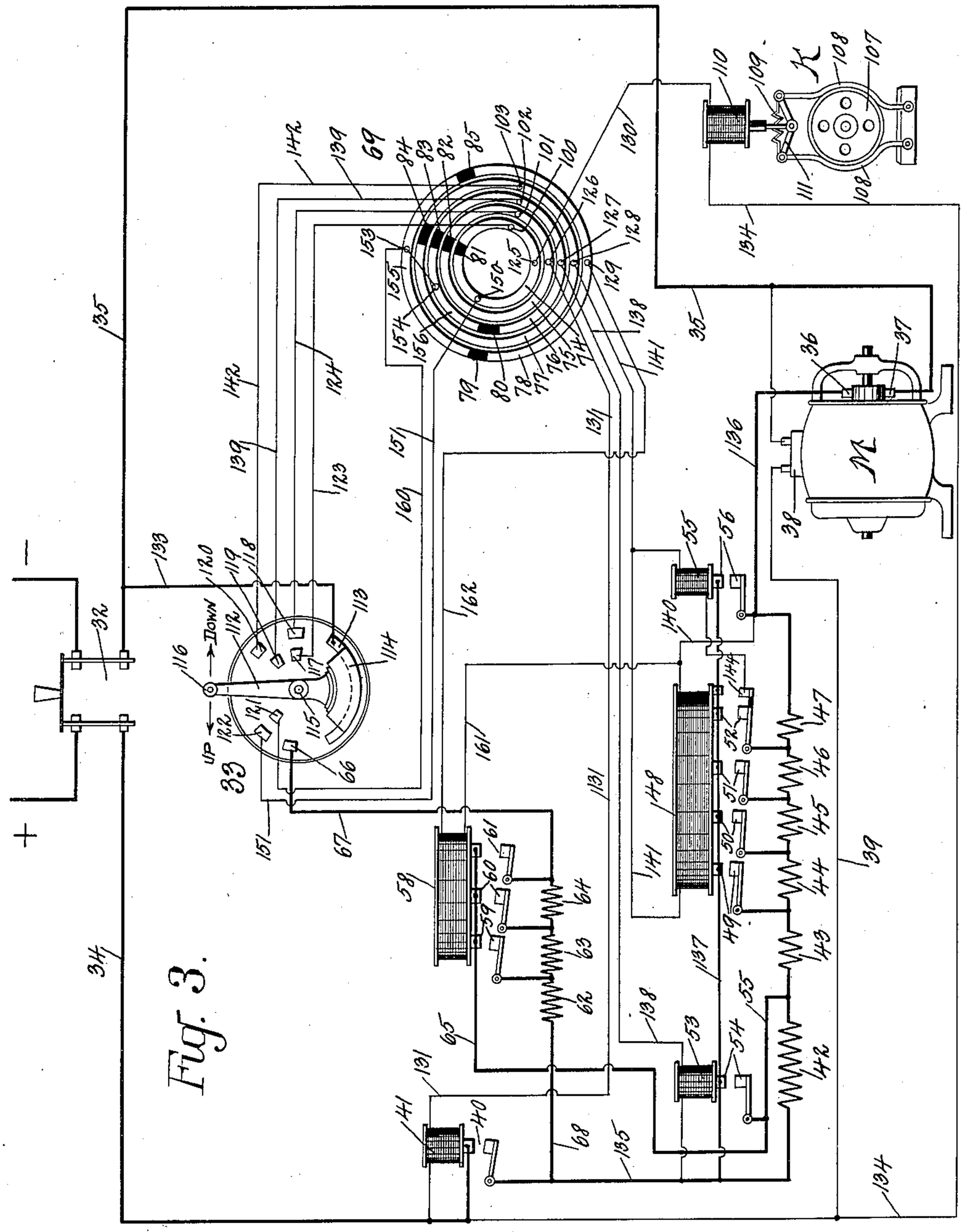

Fig. 3.

Witnesses:
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UNITED STATES PATENT OFFICE.

JOHN D. IHLDER, OF NEW YORK, N. Y., ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

AMMUNITION-HOIST CONTROL.

No. 879,387. Specification of Letters Patent. Patented Feb. 18, 1908.

Application filed August 30, 1907. Serial No. 390,845.

To all whom it may concern:

Be it known that I, JOHN D. IHLDER, a citizen of the United States, residing in New York, in the county of New York and State of New York, have invented a new and useful Improvement in Ammunition-Hoist Control, of which the following is a specification.

My invention relates to hoisting apparatus, and particularly to an ammunition hoist and means for controlling the starting and stopping thereof.

One of the objects of the invention is the provision of means for stopping the hoist at different positions corresponding to the different elevations of the gun.

Another object of the invention is to provide means to vary the position of the upper limit stop against which the hoist is held, to correspond with the gun elevation.

Other objects are to provide simple and effective means for automatically effecting the changes in the positions of the hoist at which the motor controller or stop motion switch operate, and automatic means for varying the position of the upper limit stop to correspond with the elevation of the gun when such limit stop is used.

Other objects of the invention will appear hereinafter, the novel combinations of elements being set forth in the claims.

Referring to the accompanying drawings in which is illustrated more or less diagrammatically a construction embodying my invention, Figure 1 is an elevation of the ammunition hoist and appurtenances; Fig. 2 is a sectional elevation of the automatic stop motion switch; and Fig. 3 is a diagrammatic view of the motor and the controlling system therefor.

In practice it is common to have the ammunition in a compartment located some distance below the gun, and to elevate the ammunition by means of some form of hoist. In the present invention I have shown a hoist which is operated by an electric motor and automatically brought to rest at a point opposite the breach of the gun. As this point varies with the different elevations of the gun, it is desirable that the position in which the hoist is brought to rest should be varied automatically as the position of the gun is changed. The present invention comprises means for accomplishing this result by automatically varying the position of the hoist at which the motor control operates, whether such operation consists in cutting off the current from the motor and applying the brake, or in some other method of controlling the motor. It is the general practice now, however, to stop the hoist, not by applying the motor brake, but by running the hoist up against an upper limit stop under reduced current and holding it in such position by means of the reduced current. In such case it is desirable to automatically vary the position of the upper limit stop as the elevation of the gun is varied, and also to correspondingly vary the time at which the motor controller is operated to reduce the current. The present invention comprehends means for accomplishing these results.

The hoisting mechanism comprises a load-carrying device or carrier C which is raised and lowered in the well or shaft B by means of a motor M. Any suitable form of driving connections between the carrier and the motor may be employed, and in the construction here shown the motor shaft 1 is geared to a hoisting drum D which is connected to the carrier C by a rope or cable E. The cable E passes over direction sheaves 2 on the overhead beam 3. A counterbalance weight W is connected to the carrier C by a rope or cable 4 passing over the sheaves 5. A compartment 6 from which ammunition may be supplied to carrier C is located near the bottom of the shaft B and communicates therewith through a door or opening 7. The ammunition may be conveyed from the compartment 6 to the carrier C by means of a small car or truck 8 which is adapted to travel on rails 9 and 10 on the floors of the compartment 6 and carrier C, respectively, these rails being in alinement when the carrier is at its lower limit of travel. The carrier when in this position rests on the stops 11 and a coil spring buffer 12, or the ammunition may be transferred manually to a holder fixed to the carrier C in the usual way.

The gun carriage 13 is supported by a platform 14 near the upper end of the shaft B, and the gun 15 is mounted on its carriage 13 in the usual way by means of horizontal trunnions which permit the inclination or elevation of the gun to be varied. The shaft B is provided with an opening 16 opposite the gun.

Near the upper end of the shaft B is an automatically adjustable upper limit stop L which operates to bring the carrier C to rest

with the shell or cartridge 17 opposite the breach of the gun. This limit stop comprises a horizontal bar or bars 18 carried by a vertical supporting member 19, and having a pin and slot connection 20 therewith which permits a vertical movement of the bar 18 relative to the member 19. Pivoted to the supporting member 19 near its upper end are downwardly and outwardly inclined arms 21, the outer ends of which rest on the bar 18. These arms each carry a pawl 22 pivoted to its outer end and also resting on the bar 18. Fastened to the under side of the bar 18 are sockets 23 in which are secured depending coil spring buffers 24 in the path of movement of the stops 25 on the carrier C. Secured to the inner walls of the shaft B are stationary ratchet bars 26 formed with ratchet teeth 27 which coöperate with the pawls 22. The limit stop L is suspended by a rope or cable 28 connected at one end to the member 19, passing over a direction sheave 29, and connected at its opposite end to a sheave 30 secured to one of the trunnions of the gun. The sheave 29 is journaled in a bracket secured to the beam 3 in such position that the limit stop will be held midway between the ratchet bars.

The operation of the limit stop L is as follows: As the carrier C approaches the upper limit, the current in the motor is weakened and the speed reduced in a manner explained later. The stops 25 on the carrier C now engage the spring buffers 24 and raise the bar 18, swinging the arms 21 downwardly toward a horizontal direction and moving the pawls 22 into engagement with the ratchet teeth 27. The pawls 22 now form fixed stops to limit the upward movement of the bar 18. The buffer springs 24 are compressed by any further upward movement of the carrier, and bring it gradually and smoothly to rest with the shell 17 in position for loading the gun. When the elevation of the gun is changed the position of the limit stop is correspondingly changed. If, for example, the elevation of the gun is increased, the breach of the gun will be lowered, but the sheave 30 carried by the gun will at the same time be rotated in a direction to lengthen the cable 28, and the limit stop L will move downwardly by its own weight to a lower position, and so operate to stop the car at a lower plane with a shell 17 again opposite the breach of the gun. Obviously the size of the sheave 30 may be adjusted to vary the range of movement of the limit stop for any given movement of the gun, so that the proper relative movement of the parts may be obtained. Also, a system of levers or other means for obtaining a movement of the limit stop in unison with that of the gun could be employed if desired.

The system of control for the motor which is shown diagrammatically in Fig. 3 forms the subject matter of my copending application, Serial No. 271,777, filed July 29, 1905, in which is a full disclosure of the system and its operation.

Referring to Fig. 3, the main line switch 32 connects the apparatus to the source of current supply designated by the characters + and −. A manually operable switch 33 is adapted to be placed in any convenient position, and as shown in Fig. 1 is located near the gun 15. The motor M has its armature connected in series with the main lines 34 and 35 through the brushes 36 and 37. The field 38 of the motor is connected in shunt to the constant potential mains by means of the wire 39. The armature circuit is normally open at the contacts 40, but may be closed by means of the magnet 41 through the starting resistances 42, 43, 44, 45, 46, 47. The accelerating magnet 48 is arranged to operate the contacts 49, 50, 51, 52 to successively short-circuit the resistances 43, 44, 45, 46. The slow speed magnet 53 operates the contacts 54 to control the resistance 42, while the fast speed magnet 55 with the contacts 56 control the resistance 47.

A load magnet 58 operates the contacts 59, 60 and 61 to short-circuit the load resistances 62, 63, 64. The contacts 59, 60, 61 are connected by wire 65 with the resistances 42 and 43, and the resistances 62, 63 and 64 are connected to the contact 66 of the manual switch 33 by wire 67, and by wire 68 to the lower one of the contacts 40.

An automatic stop motion switch or controller 69 comprises a number of circularly-shaped contact strips such as 74, 75, 76, 77, 78, with insulating sections 79, 80, 81, 82, 83, 84, 85. The circular strips or conductors may be arranged concentrically as shown in Fig. 3 and mounted on a plate or disk of insulating material, the whole being connected for rotation in conjunction with other moving parts of the hoisting mechanism. But I prefer to mount these conductors on the peripheral surface of a drum 86 as shown in Fig. 2, the operation in this case being the same, the arrangement shown in Fig. 3 being chosen to simplify the illustration and enable the operation to be more readily understood.

The automatic controller 69 as shown in Fig. 2 embodies the drum 86, having its surface covered with insulating material 87 on which are mounted the contact strips 74, 75, 76, 77, 78, these strips being arranged spirally, as indicated. The controller is mounted in a bracket or frame 89 which is secured to the frame of the motor. This bracket carries a worm shaft 88 on which the drum 86 is mounted for rotation. The drum is rotated by means of a cross-head 90 secured to a shaft 91 which is journaled in the bracket 89. Keyed to the shaft 91 is a sprocket wheel 92 which is driven by a sprocket chain 93 from a sprocket wheel 94 secured to the shaft of the hoisting drum D. An extension of the

shaft 88 is fixed to the left-hand arm of the bracket 89 and the shaft 88 itself extends loosely into the cross-head 90. The drum 86 is connected for adjustment in unison with the adjustment of the gun by means of a sprocket chain 96 uniting the sprocket wheels 95 and 97, the latter being secured to one of the trunnions of the gun. Mounted loosely on the extension of the shaft 88 is a disk 98 which carries an arm 99 provided with insulated brushes 100, 101, 102 and 103 bearing against the contact-strips 74, 75, 76 and 77 respectively. A similar arm 104 is secured to a disk 105 and is provided with a brush 150 engaging the strip 74. Other arms are also fixed to the disk 105 to carry the brushes 125, 126, 127, 128, 129 and brushes 153 and 154 shown in Fig. 3 diagrammatically. Also mounted loosely on the extension of the shaft 88 is a sprocket wheel 95 which is geared by means of the chain 96 to the sprocket wheel 97 moving with the gun.

An electro-magnetic brake K of any approved form is used in connection with the motor. As here shown a brake pulley 107 is keyed to the motor shaft, and the brake arms 108 are normally held against the brake pulley by a coil spring 109. The brake arms 108 are released by means of an electro-magnet 110 whose armature is connected to the toggle links 111.

The function and operation of the various parts of the motor-controlling devices shown in Fig. 3 will now be described.

Assuming the main switch 32 to be closed, as shown, let the lever 112 of the manual switch 33 be moved to the left to cause the carrier C to move upwardly. The contact strip 113 is connected to the negative main 35 and is always in contact with the segment 114 of the switch. The segment 114 is rigidly connected to the lever 112 which is pivoted at 115 to the insulating base and provided with a handle 116. In addition to the contact strip 113 on the base are fixed contacts 117, 118, 119, 120 at the right and the contacts 66, 121 and 122 at the left.

The contacts 117, 118 are connected by means of the wires 123, 124 to the contact brushes 100, 101, which engage the circular conductors 74 and 75, respectively. The brushes 100, 101 are respectively in electrical connection with the brushes 125, 126, which in turn are connected by the wires 130, 131 to the brake magnet 110 and the main line magnet 41. Therefore when the lever 112 is moved toward the left to elevate the carrier C as indicated, the segment 114 will first electrically connect the contacts 117 and 118, whereupon the magnet 41 and brake magnet will be operated, the one to close the motor armature circuit through the contacts 40 and resistances 42, 43, etc., and the other to release the brake against the action of the spring 109. The circuit for the main line magnet 41 may be traced from the positive main through the wire 34, magnet coil 41, wire 131, brush 126, contact strip 75, brush 101, wire 124, contact 118, segment 114, contact strip 113, and wire 133 to the negative main. The circuit through the brake magnet coil is parallel to the coil of magnet 41 from the wire 34, through the wire 134, magnet coil 110, brush 125, strip 74, brush 100, wire 123, contact 117 and segment 114. The circuit through the motor armature is from the wire 34 to and through the contacts 40, wire 135, starting resistances 42, 43, 44, 45, 46, 47, wire 136, motor armature brush 36, motor armature, brush 37, wire 35, to the negative main. The shunt field circuit is also completed when the main line switch 32 is closed, so that now the motor can start and attain a predetermined slow speed.

On moving the handle 116 of a switch 33 farther toward the left the contact 119 is engaged by the segment 114. This completes a circuit from the positive main through wire 34, to and through the contacts 40, wire 135, coil of slow speed magnet 53, wire 138, brush 127, strip 76, brush 102, wire 139, contact 119, segment 114, contact 113 and wire 133 to the negative main. The magnet 53 is therefore connected across the constant potential mains, as is magnet 41, and operates to close the contacts 54 and short-circuit the resistance 42. The motor will thereupon receive more current and run at full slow speed.

The next operation is the moving of the handle 116 to its extreme left-hand position so that the segment 114 will engage the fixed contact 120 in addition to the contacts 117, 118, 119. A circuit will now be completed from the positive main to and through the wire 34, contacts 40, wire 135, contacts 54, wire 55, resistances 43, 44, 45, 46, 47, wire 140, coil of accelerating magnet 48, wire 141, brush 128, strip 77, segment 114, strip 113, wire 133 to the negative main. Thus the accelerating magnet 48 is connected directly across the motor armature and will operate automatically to cut out or short-circuit the starting resistances 43, 44, 45, 46 successively in a well known manner, depending upon the load on the motor. The contacts 49, 50, 51 and 52 are closed successively, but when the last is closed the wire 137 is connected through contact 144 to and through the fast speed magnet 55 to the wire 141. Upon the energization of this magnet 55 the contacts 56 are connected and the resistance 47 short-circuited. The current can now flow directly from wire 137 through wire 136 to the motor armature. The motor armature is therefore connected directly across the mains and will run up to fast speed.

The stop motion switch 69 being positively connected to rotate in harmony with the motor, will move in a clockwise direction as soon as the carrier C starts upwardly. As

the carrier approaches its upper limit of travel, the first operation of the switch 69 will be to break the circuits of the fast speed magnet 55 and the accelerating magnet 48. This is caused by the insulating section 84 running under the brush 103. This will operate to place the resistances 43, 44, 45, 46, 47 in the motor armature circuit and therefore slow down the motor. Very shortly after this operation, the insulating section 83 runs under the brush 102 to break the circuit including the magnet 53. The contacts 54 therefore become separated and the resistance 42 reinserted to still further reduce the speed of the motor.

All the starting resistances having been replaced in the armature circuit, the motor will run at a very slow speed. By this time the carrier C has almost reached its upper limit of travel and operates the upper limit stop L in the manner before explained. The carrier is held at its extreme upper limit of travel by the action of the motor, and when in such position the stop motion switch 29 is at rest with the brushes 102, 103 on the insulation sections 83, 84, respectively, and the brushes 100, 101 in contact with the strips 74, 75, respectively. The brake magnet 110 and the main line magnet 41 are therefore kept energized, but since the current must traverse the starting resistances it will be insufficient to injure the armature by heating but will produce sufficient torque to hold the carrier at its upper limit of travel. If desired, however, the automatic stop motion switch may be adjusted to rotate a little farther so that the insulating sections 81 and 82 will run under the brushes 100 and 101, respectively, to automatically deënergize the brake magnet 110 and the main line magnet 41. The current will then be entirely cut off from the motor armature and the brake applied to hold it against rotation, in which case the upper limit stop L may be dispensed with.

When it is desired to lower the carrier C the switch handle 116 is brought back to its central position as shown in the drawing. This will cause the brake to be applied as the circuit to the magnet 110 is broken at the contact 117. Furthermore, the circuit of magnet 41 is broken at the contact 118 and therefore the contacts 40 are separated. The current to the motor is thus cut off, but the car is kept from descending by means of the brake which is now applied, since the magnet 110 is deënergized.

I will now describe my automatic means for slowing down the movement of the carrier and stopping it at its lower limit of travel. On moving the handle 116 to the right the contact segment 114 will engage the fixed contacts 66, 121, 122. When the segment 114 is brought into connection with the contact 66, a local circuit including the motor armature, the starting resistances and the additional resistances 62, 63, 64 is closed. This local circuit will be established before the segment 114 engages the contacts 121 and 122. When the segment 114 engages contact 122 the brake magnet 110 is energized and the brake released. The circuit thus established is as follows: from the positive main through wire 34, to and through wire 134, magnet 110, brush 125, strip 74, brush 150, wire 151, contact 122, segment 114, strip 113, and wire 133 to the negative main.

The contact 121, however, temporarily remains deënergized, since it is connected to the brushes 154 and 153 which are in contact with the strips 156 and 155 insulated by the insulation sections 80, 83 and 79, 85, respectively.

The brake having been released, the carrier can descend by reason of its own weight, and in so doing drives the motor armature backwards. Since the field is connected across the main lines by wire 39, it will be fully excited, and the armature being driven by the carrier will generate a current through the various resistances forming a closed circuit with it. This arrangement constitutes an electro-dynamic brake and prevents excessive speed of the carrier as it descends.

As the car descends the automatic stop motion switch 69 will be slowly turned in an anti-clockwise direction through nearly 180°. As the carrier approaches its lower limit of travel the slow down operation is automatically controlled by means of said stop motion switch. The first change will take place when the insulation section 83 runs under and past the brush 154 so that the brushes 154 and 127 are electrically connected by the strip 76. The slow speed magnet 53 will then be connected in shunt to the load resistances 62, 63, 64, the circuit being as follows: from wires 68 and 135 to and through magnet 53, wire 138, brush 127, strip 76, brush 154, brush 153, wire 160, contact 121, segment 114, contact 66, and wire 67 to the other side of the load resistances 62, 63, 64.

The energization of the magnet 53 depends on the potential across the load magnet resistances 62, 63, 64. This potential varies directly as the speed of the motor armature and consequently of the carrier C. If the speed rises above a predetermined point the magnet 53 will operate to short-circuit the resistance 42 by the closure of the contacts 54. The resistance in the armature circuit being thus decreased, more current can flow and the electro-dynamic braking action will be increased. The carrier will therefore run at a reduced speed.

The automatic stop motion switch in revolving still farther brings the insulation section 85 under and past the brush 153, so that the latter will be in contact with the

strip 78. This occurs when the carrier is a short distance from its lower limit of travel. The load magnet 58 is now connected directly across the motor armature from the brush 36 and wires 136, 140 and 161 to the coil of magnet 58, through wire 162, brush 129, strip 78, brush 153, wire 160, contact 121, segment 114, strip 113, wires 133 and 35 to the other motor armature brush 37. The load magnet 58 will be energized to a degree depending upon the speed of the motor, to close one or more of the contacts 59, 60, 61 which will operate to cut out one or more of the load resistances 62, 63, 64.

The next operation is the application of the brake to stop the carrier. This occurs when the insulation section 81 runs under the brush 150 to interrupt the circuit of the brake magnet, and therefore allowing the brake to be applied. It should be noted that the brake magnet can again be energized as another brush 100 is still in electrical connection with the brake magnet so that the latter may be energized by moving the handle 116 to the left to bring the segment 114 and contact 117 into engagement.

The brushes 100, 101, 102, 103 which control the circuits affected in the operation of the stop motion switch 69 as the carrier moves upwardly, are carried by the arm 99 (Fig. 2) secured to the disk 98. As the disk 98 is connected for rotation about its axis in unison with any adjustment of the gun to different elevations, the positions of the brushes will be correspondingly changed, resulting in a change in the time at which the stop motion switch operates in the upward movement of the carrier. For example, if the gun is inclined to a higher elevation the disk 98, as viewed in Fig. 1, will be rotated backwardly or in a counter-clockwise direction. This will shift the position of the brushes on the drum 86, being equivalent to a forward movement of the drum. The distance through which the drum rotates before it operates to stop the motor will therefore be reduced and the carrier brought to rest in a lower position corresponding to the lowered position of the breech of the gun.

As the position in which the carrier stops at its lower limit of travel is always the same, the brushes 150, 153, etc., are mounted on the stationary disk 105, only the brush 150 being shown in Fig. 2 for the sake of clearness.

Although the upper limit stop and the stop motion switch are both adjusted entirely automatically in unison with adjustment of the gun, either or both of them may be adjusted manually if desired. Also, either one is adapted to be used alone as varying conditions may require. It is obvious also that various forms of connections between the gun and the part adjusted thereby might be adopted, and that various other changes in details of construction and arrangement of parts might be made without departing from the spirit or scope of my invention. I wish, therefore, not to be limited to the precise construction disclosed.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. In an ammunition hoist, the combination with a carrier, a motor and driving connections therebetween, of a gun, and means for stopping the carrier automatically at different positions varying with the gun elevation.

2. In an ammunition hoist, the combination with a carrier, and driving mechanism therefor, of a gun, and means for stopping the carrier automatically at different positions varying in proportion to variations in the gun elevation.

3. In an ammunition hoist, the combination with a carrier, and means for raising and lowering the carrier, of a gun, and means for stopping the carrier automatically at different elevations corresponding to different gun elevations.

4. In an ammunition hoist, the combination with a carrier, means for elevating the carrier, and means for stopping the carrier in an elevated position, of a gun adjustable to different elevations, and connections between the gun and said stopping means operable to change the position in which the carrier is stopped to correspond with changes in the gun elevation.

5. In an ammunition hoist, the combination with a carrier, means for elevating the carrier, and an upper limit stop, of a gun adjustable to different elevations, and means for adjusting the limit stop to positions corresponding with the gun elevation.

6. In an ammunition hoist, the combination with a carrier, means for elevating the carrier, and an upper limit stop, of a gun adjustable to different elevations, and connections between the gun and limit stop for automatically varying the position of the limit stop when the gun is adjusted.

7. In an ammunition hoist, the combination with a carrier, and means for elevating the carrier, of a gun located near the path of travel of the carrier and adjustable to different elevations, an upper limit stop for the carrier, and automatic means to adjust the position of the limit stop when the gun is adjusted.

8. In an ammunition hoist, the combination of a gun adjustable to different elevations, a carrier, means for elevating the carrier to a position opposite the gun, an upper limit stop for the carrier, and connections between the gun and limit stop for automatically varying the position of the limit stop when the gun is adjusted.

9. In an ammunition hoist, the combination with a carrier, a motor, and driving con-

nections between the carrier and motor, of a gun, means for stopping the carrier opposite the gun, and connections between said means and the gun for varying the position at which the carrier stops as the gun elevation is varied.

10. In a hoisting device, the combination with a carrier and means for elevating the carrier, of an upper limit stop, means for moving the stop up or down, and means for locking to stop against such movement when it is engaged by the carrier.

11. In a hoisting device, the combination with a carrier, means for raising and lowering the carrier, an upper limit stop movable to different heights, a stationary ratchet bar, and a pawl carried by the limit stop and movable into engagement with the ratchet bar when the carrier engages the limit stop.

12. In an ammunition hoist, the combination with a carrier and means for raising and lowering the carrier, of an upper limit stop, a gun adjustable to different elevations, connections between the gun and limit stop for moving the limit stop when the gun is adjusted, and means for locking the limit stop against movement when it is engaged by the carrier.

13. In an ammunition hoist, the combination with a carrier, a motor, and driving connections between the carrier and motor, of a gun adjustable to different elevations, and means for stopping the carrier at different elevations governed by the position of the gun.

14. In an ammunition hoist, the combination with a carrier, a motor, and driving connections between the carrier and motor, of a gun adjustable to different elevations, and means for automatically stopping the motor with the carrier in a position depending upon the gun elevation.

15. In an ammunition hoist, the combination with a carrier, a motor, and driving connections between the carrier and motor, of a gun adjustable to different elevations, means for stopping the motor when the carrier has reached a predetermined position, and means for automatically varying such position as the gun is adjusted.

16. In an ammunition hoist, the combination with a carrier, a motor, and driving connections between the carrier and motor, of a gun adjustable to different elevations, means for stopping the motor with the carrier in different positions depending upon the adjustment of said means, and connections between the gun and said stopping means for automatically adjusting said means as the gun is adjusted.

17. In an ammunition hoist, the combination with a carrier, an electric motor, and driving connections between the carrier and motor, of a gun adjustable to different elevations, a stop motion switch automatically operable when the carrier reaches a predetermined position, and means for automatically varying such position as the gun is adjusted.

18. In an ammunition hoist, the combination with a carrier, an electric motor, and driving connections between the carrier and motor, of a gun adjustable to different elevations, an adjustable stop motion switch operable to stop the carrier at predetermined positions depending on the adjustment of the stop motion switch, and connections between the gun and switch for automatically adjusting the switch when the gun is adjusted.

19. In an ammunition hoist, the combination with a carrier, an electric motor, and driving connections between the motor and carrier, of a gun adjustable to different elevations, a brake for the motor, a stop motion switch automatically operable to cut off the current and apply the brake when the carrier reaches a position opposite the gun, and means to automatically vary the operation of the stop motion when the gun is adjusted to correspond with such adjustment.

20. In an ammunition hoist, the combination with a carrier, an electric motor and driving connections therebetween, of a gun adjustable to different elevations, a stop motion switch comprising a rotatable member and a stationary member, electrical connections between said members and a motor controlling the current supply to the motor, driving connections between the motor and said rotatable member, and connections between said stationary member and a gun for automatically adjusting said stationary member as the gun is adjusted.

21. In an elevating device, the combination with a load carrying member, a motor, and driving connections between said parts, of a limit stop adjustable to different heights, means for reducing the speed of the motor as the load carrying member approaches the limit stop, and means to vary the time at which the motor speed is reduced to correspond to the position of the limit stop.

22. In an elevating mechanism, the combination with a load carrying device, an electric motor and driving connections between the motor and said device, of a limit stop adjustable to different heights, means for automatically reducing the current supply to the motor as the load carrying device approaches the limit stop, and means for automatically varying the time at which the current is reduced to correspond with the position of the limit stop.

23. In an ammunition hoist, the combination with a carrier, an electric motor, and driving connections between the carrier and motor, of a gun adjustable to different elevations, an upper limit stop for the carrier, connections between the gun and limit stop for

varying the position of the stop when the gun is adjusted, means for reducing the supply of current to the motor as the carrier approaches the limit stop, and means to automatically vary the time at which the current supply is reduced to correspond with the position of the limit stop.

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

JOHN D. IHLDER.

Witnesses:
T. W. ALGAN GOLDY,
W. H. BRADY.