No. 859,944. PATENTED JULY 16, 1907.

W. H. HULTGREN.

ELEVATOR CONTROLLING MECHANISM.

APPLICATION FILED SEPT. 13, 1905.

5 SHEETS—SHEET 1.

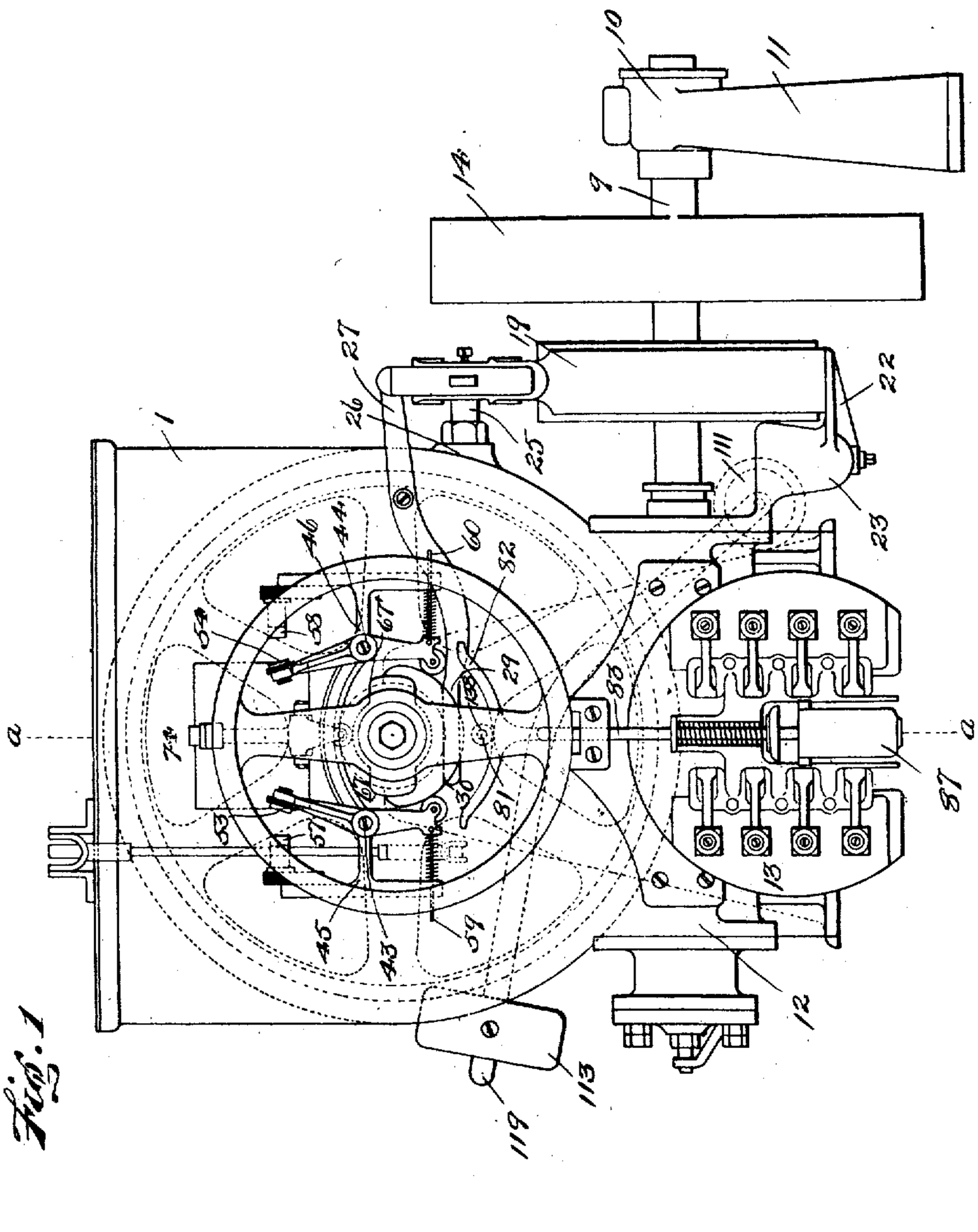

Fig. 1

Witnesses
Walter C. Strang
Henry E. Kirby

Inventor
William H. Hultgren
By Chas. M. Nissen
Attorney

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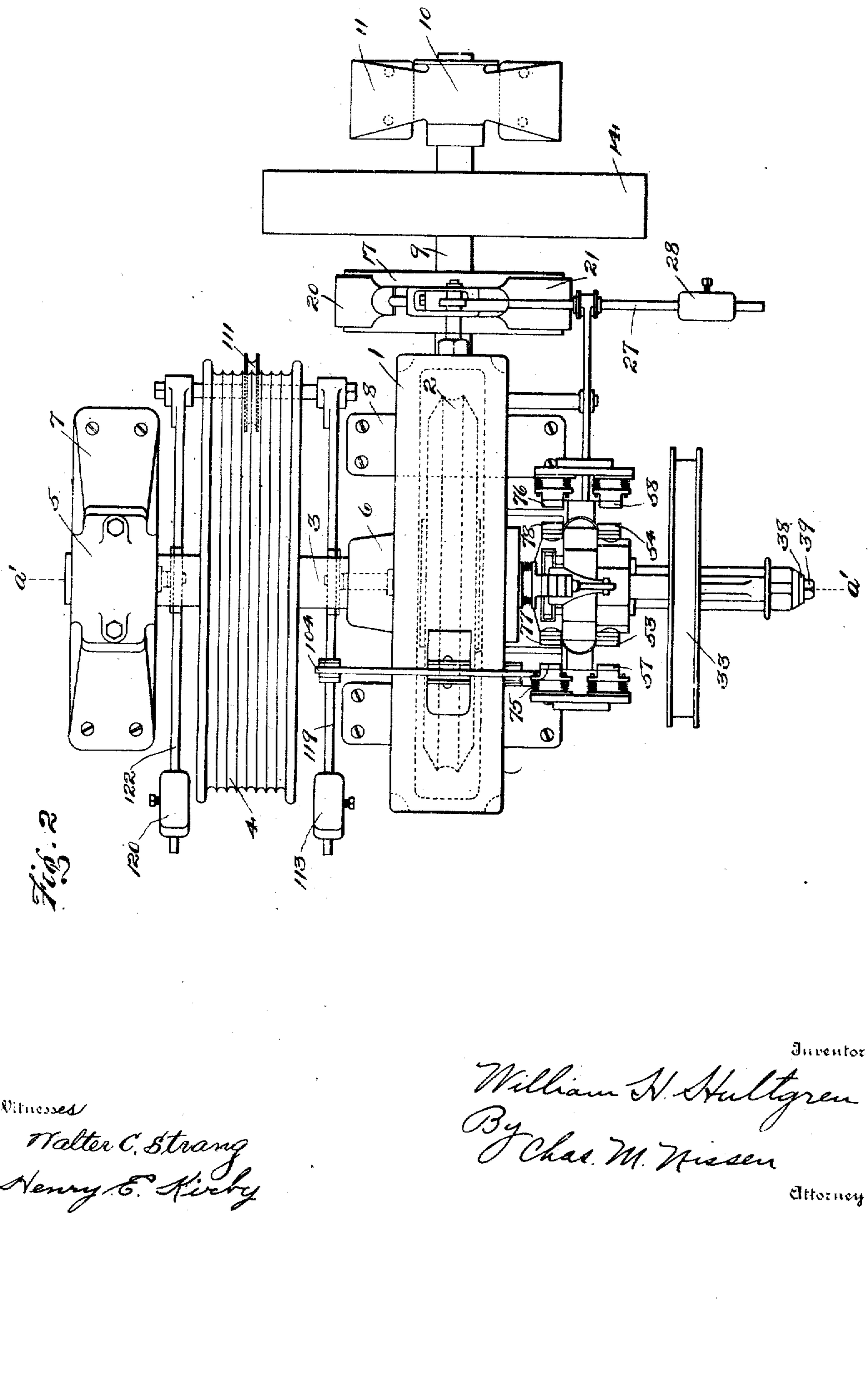

Fig. 2.

Witnesses

Walter C. Strang

Henry E. Kirby

Inventor

William H. Hultgren

By Chas. M. Nissen

Attorney

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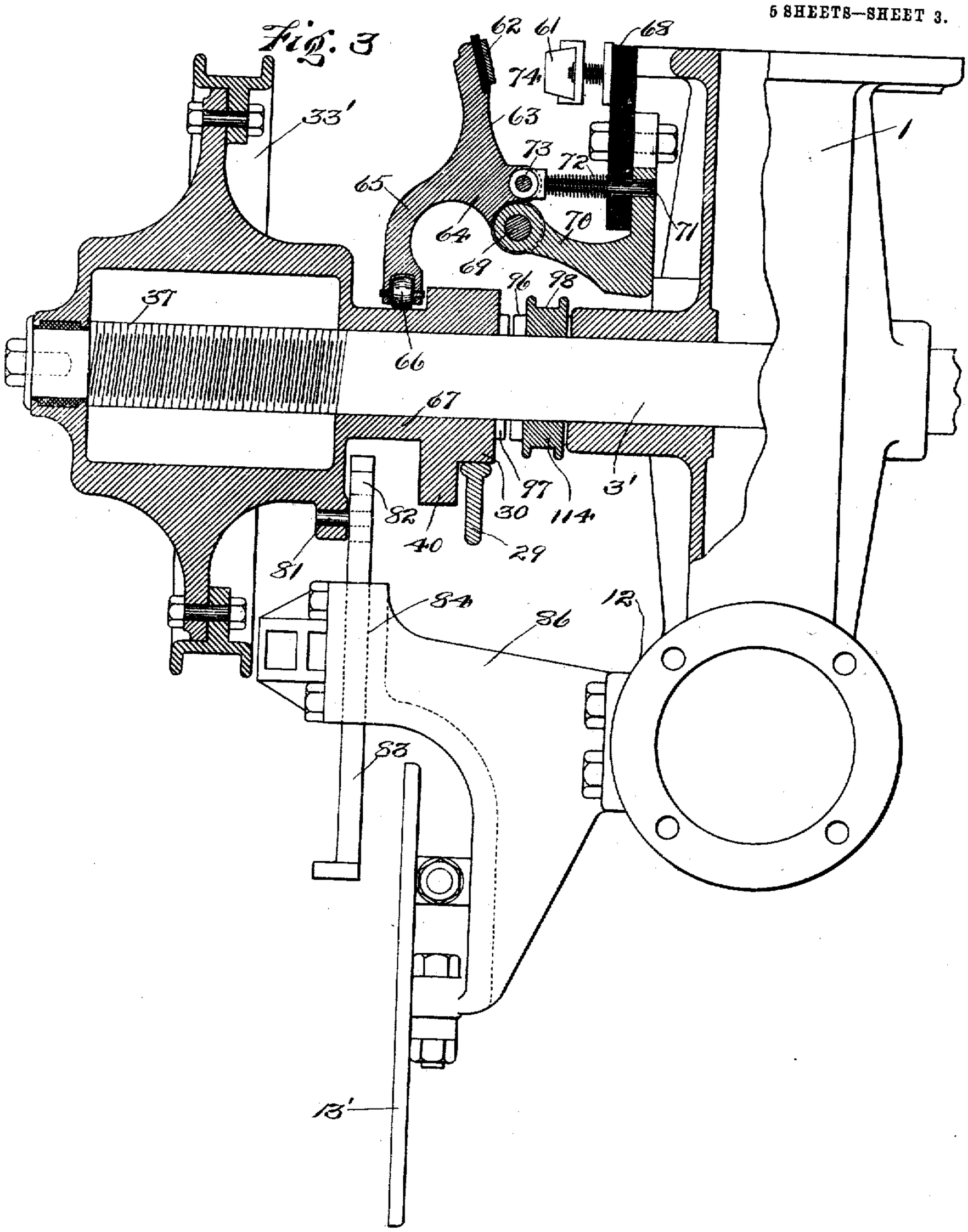
5 SHEETS—SHEET 3.

Fig. 3



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Walter C. Strang

Henry E. Kirby

Inventor

William H. Hultgren

By Chas. M. Higgen

Attorney

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6 SHEETS—SHEET 4.

Fig. 4

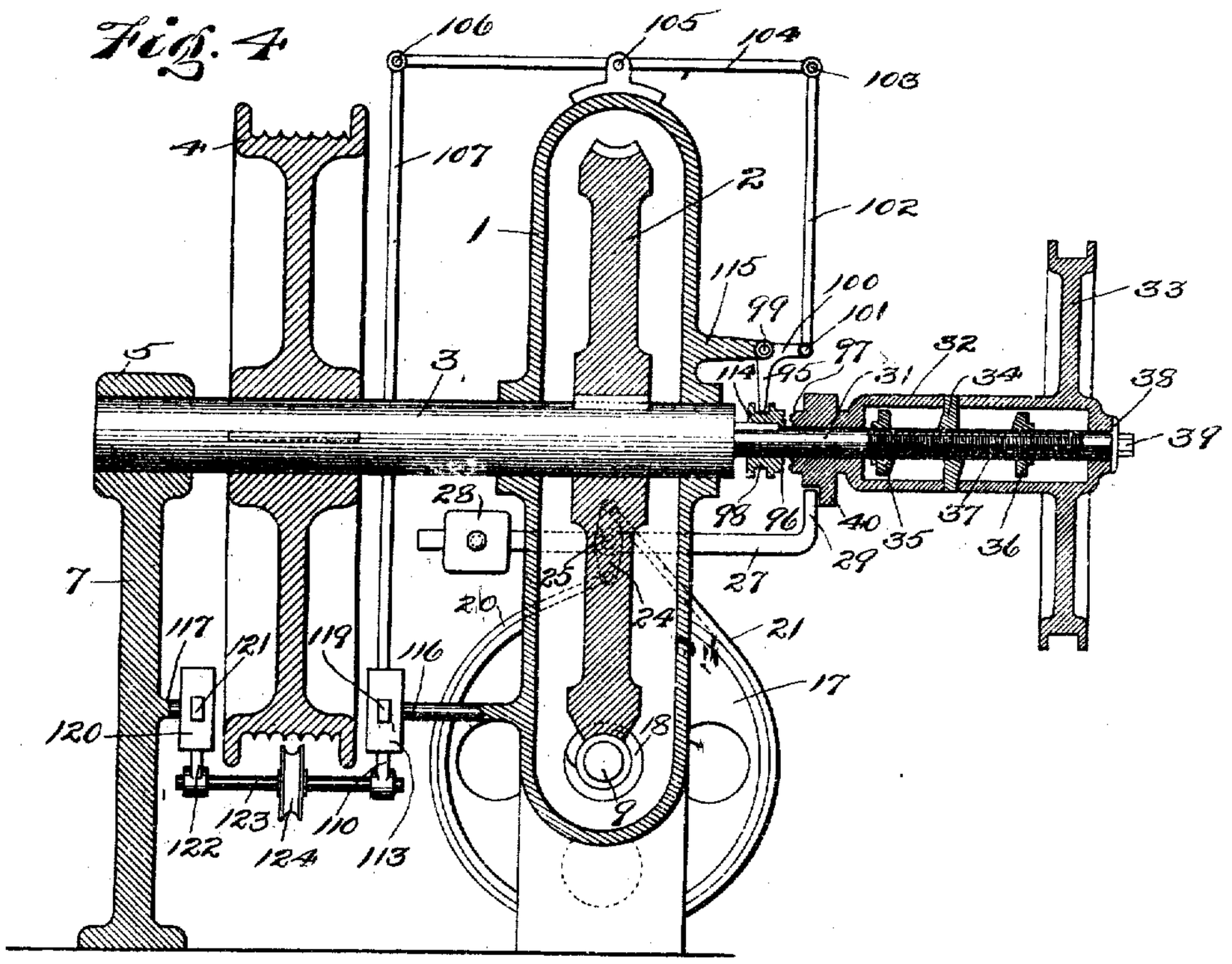


Fig. 5

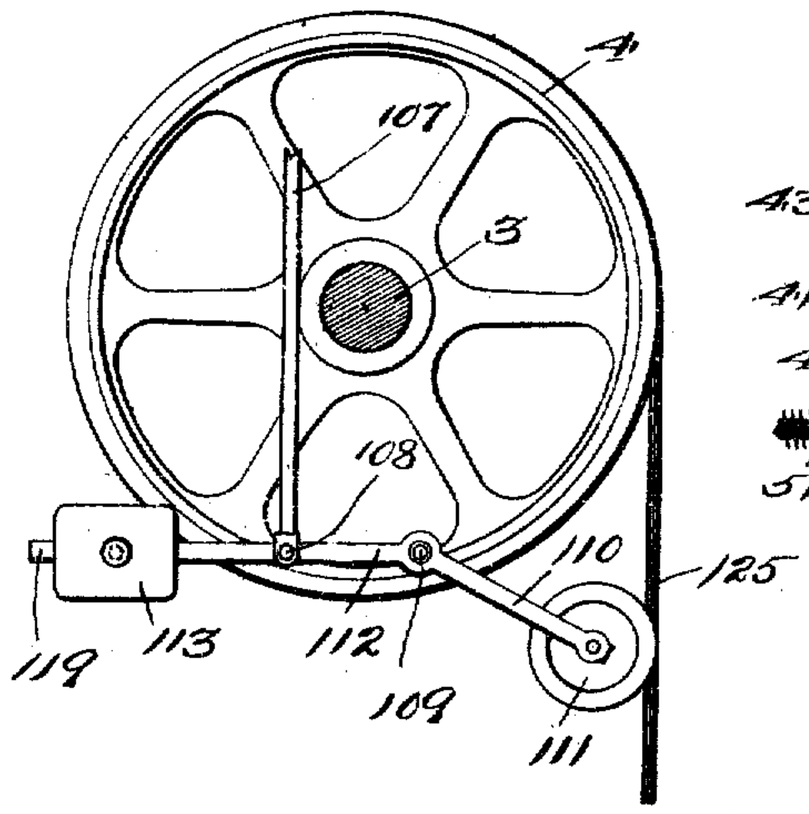
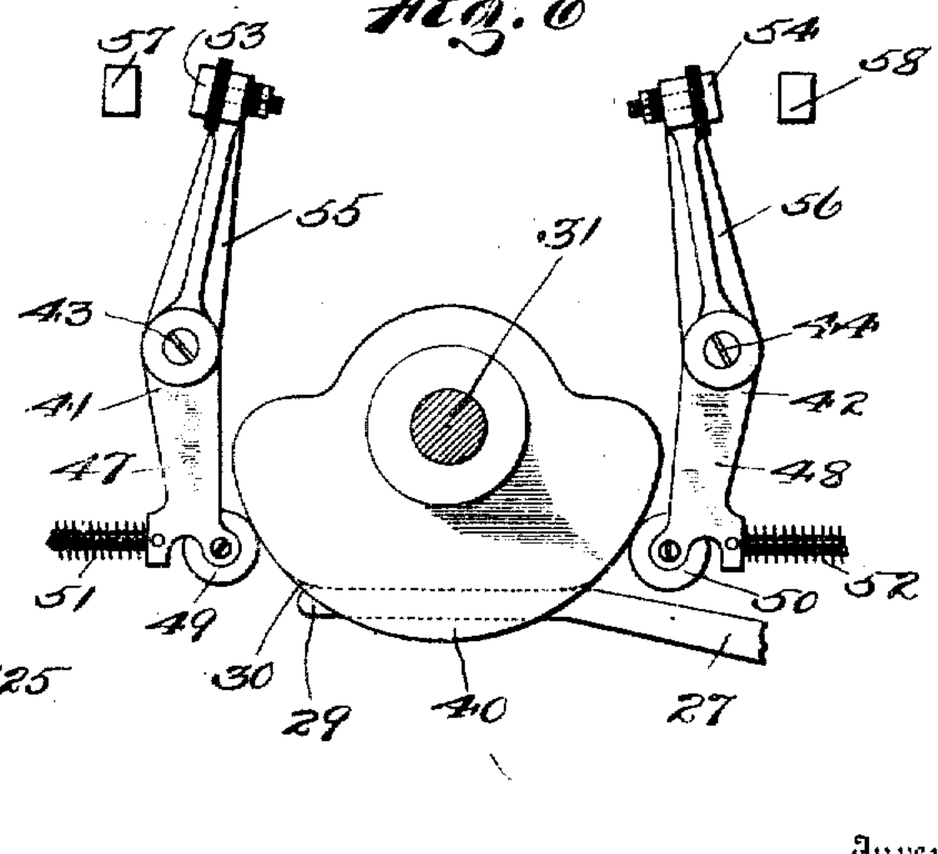


Fig. 6



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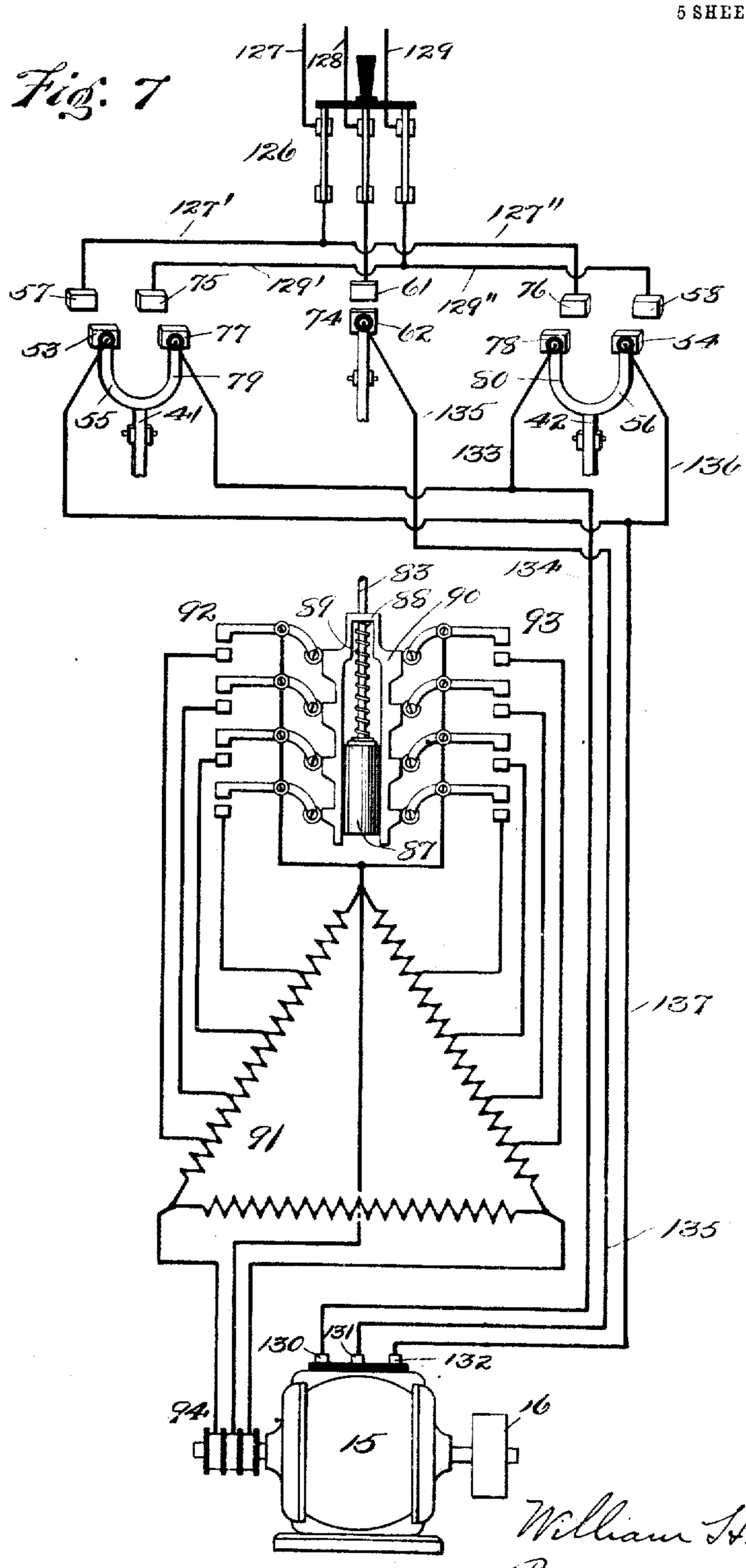
5 SHEETS—SHEET 5.

Fig. 7



Witnesses

Walter C. Strang

Henry C. Kirby

Inventor

William H. Hultgren

By Chas. M. Nissen

Attorney

UNITED STATES PATENT OFFICE.

WILLIAM H. HULTGREN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

ELEVATOR-CONTROLLING MECHANISM.

No. 859,944. Specification of Letters Patent. Patented July 16, 1907.

Application filed September 13, 1905. Serial No. 278,215.

To all whom it may concern:

Be it known that I, WILLIAM H. HULTGREN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Elevator-Controlling Mechanism, of which the following is a specification.

My invention relates to elevators, and one of its objects is the provision of simple and efficient mechanism compactly arranged for controlling the starting, stopping and reversing of electric motors.

More particularly it is the object of my invention to provide compact and improved means for controlling alternating electric motors in connection with hoisting apparatus, so that the main line switch and the reversing switches may be operated and the brake released by actuating the flier sheave from the car or platform.

In the accompanying drawings illustrating my invention, Figure 1 represents an elevation of my novel arrangement of elevator controlling mechanism; Fig. 2 is a plan view of the construction shown in Fig. 1; Fig. 3 is a broken away portion partly in vertical section, the section being taken on the line *a*—*a* of Fig. 1 or on the line *a'*—*a'* of Fig. 2; Fig. 4 is another broken away portion in vertical section to show particularly the slack cable device, the section being taken on *a'*—*a'*, of Fig. 2; Fig. 5 shows a detail of the slack cable device; Fig. 6 shows the reversing switches and the cam for operating the same and for operating also the brake lever; and Fig. 7 is a wiring diagram of the alternating current motor-controlling system.

Similar reference characters are used throughout the drawings to designate similar parts.

Referring to Figs. 1 and 2, the reference number 1 designates a suitable housing for a worm wheel 2 which is fixed to the hoisting drum shaft 3, 4 designating the hoisting drum. The journals of the shaft 3 are mounted in suitable bearings 5, 6 on the standards 7, 8, respectively. The worm-shaft 9 has one of its journals mounted in the bearing 10 on the standard 11, the other end of the shaft carrying the worm 18 (Fig. 4) which meshes with the worm-wheel 2 and is inclosed in the casing 12. The worm casing 12 is secured to the housing 1 and serves to support the electric rheostat controller 13 as shown in Fig. 3. Fixed to the worm shaft 9 is a pulley 14 which may be connected by belt to the pulley 16 of the alternating current motor 15 shown in Fig. 7. Although I have shown a belt elevator, it is obvious that the electric motor may be direct connected or connected through suitable gearing to the worm shaft 9. 17 designates the brake pulley fixed to the shaft 9 and provided with a brake 19 comprising two brake bands 20 and 21 (Fig. 4) which may be pivoted at their lower ends to the bracket 22 which extends from the oil drip cup 23, this cup being secured to the worm casing 12 (Fig. 1). The brake-applying means comprises a double armed lever 24 (Fig. 4) which is pivotally mounted on the bearing 25 which is fixed to and extends from the housing 1. Substantially at right angles to the lever 24 and secured thereto is the brake lever 27 having an adjustable weight 28 and a cam engaging portion 29 at its other end. The weight 28 may be on one side as shown in Fig. 1, or on the other side as indicated by the reference character 28' in Fig. 4, depending upon the connections of the brake bands 20 and 21 with the lever 24. 30 designates a cam mounted loosely on a reduced portion 31 (Fig. 4) of the drum shaft 3. Preferably the toe 29 of this brake lever is normally out of contact with the flat portion of the cam 30 as indicated in Fig. 4. Rigidly connected by means of the yoke 32 with the cam 30 is the flier or shipper sheave 33 on the periphery of which is wound one or more times the operating or shipper rope. The rope may be secured to the sheave in the manner illustrated in my patent, No. 744,346, November 17, 1903, elevator, if desired. A stop motion device is shown in connection with this sheave in that the threaded portion 37 of the shaft 31 has a traveling nut 34 which is restricted to a longitudinal movement by guides on the yoke 32. This traveling nut is arranged to engage the fixed stops 35 and 36 when the drum 4 has made a predetermined number of revolutions and the car has reached the limits of its travel, the result being that the flier 33 is revolved back to stop position. The brake cam being symmetrical it is immaterial in which direction from normal position the flier is moved as in either case the weight 28 will be lifted and the brake released. 38 designates a washer which is held in place by the nut 39 and serves as a thrust bearing for the shipper sheave 33. Motion of the sheave in the opposite direction is prevented by the cam 40 engaging the toe 29 of the brake lever 27. The cam 40 moves with the brake cam and controls the position of the switch levers 41 and 42. These levers are pivoted respectively at 43 and 44 to the brackets 45 and 46 which are carried by the housing 1. The downwardly projecting arms 47 and 48 are respectively provided with antifriction rollers 49 and 50 which are held against the symmetrical cam 40 by means of the springs 51 and 52. That is, the springs 51 and 52 tend to rock the levers 41 and 42 so as to bring the contacts 53 and 54 mounted on but insulated from the switch arms 55 and 56 respectively, into engagement with the fixed contacts 57 and 58. Fig. 1 shows that the contacts 57 and 58 are secured to but insulated from the brackets 45 and 46, respectively, and that pins 59 and 60 pivotally connected to

the lower ends of the arms 47 and 48 and passing through the lower portions of said brackets retain the springs 51 and 52 in place.

In Fig. 3 I have shown the shipper sheave 33′ and parts rigid therewith of different proportions than in Fig. 4 and have omitted the stop motion apparatus, in order to show more clearly the main switch and the means for operating it. The drum shaft 3′ in this case is of the same diameter throughout its length. The main line switch comprises a contact 61 suitably mounted on a base of insulation 68 which is fixed to the housing 1, and a movable contact 62 carried by hut insulated from the switch arm 63 of a lever 64 which is pivoted at 69 to a bracket 70 also fixed to the housing 1. The lever 64 has also a downwardly projecting arm 65 with an anti-friction roller 66 at its end which is adapted to be engaged by the cams 67 and 67′ (Fig. 1) shown in Figs. 1 and 3 integral with the yoke 32 and the cams 40 and 30. The main line switch 74 is held normally in open position by means of the spring 72 which is held in place by the pin 71, this pin being pivoted to the rock lever 64 at 73 and projecting through holes, in the insulation 68 and bracket 70. Although the main line switch comprises only one set of contacts the reversing switches each comprise two sets of contacts, this being clear from an inspection of Figs. 2 and 7. In Fig. 7 it is shown that the levers 41 and 42 have double switch arms 55, 79 and 80, 56, respectively, the movable contacts 53, 77 and 78, 54 being adapted to engage the contacts 57, 75 and 76, 58. Two arms and double sets of contacts are necessary for each reversing switch in this case because of the connections to a polyphase alternating current motor. Only one set of contacts 61, 62 is necessary for the main line switch, however. Fixed to the lower central portion of the yoke 32 is a pin 81 as indicated in Fig. 3. This pin is adapted to engage the arc-shaped movable cam 82 which is fixed to the vertical stem 83 of the rheostat 13. 13′ (Fig. 3) represents the mounting plate for the switches 92, 93 (Fig. 7). The stem 83 is guided in its movement by the guide 84 in the bracket 86 which is secured to the worm casing 12. To the lower end of the stem 83 is connected a dash pot 87, between which and a cap 88 of a cam plate 90 is placed a compression spring 89 to encircle said stem. Normally the cam plate 90 is in such position that the pairs of switches 92 and 93 controlled thereby are held in open position as indicated in Fig. 7 and the entire resistance 91 is in circuit with the rotor of the motor. This resistance is connected to the rotor circuits through the slip rings 94 and when the stem 83 is released the plate 90 is forced upwardly so that the pairs of switches from bottom upward will be operated successively to gradually cut out the resistance 91. This construction is not described in detail as it is *per se* no part of my invention and being fully described in the patent to Ihlder, 726,303, April 28, 1903, motor controlling apparatus. Any other means for suitably starting an alternating current motor may be used if desired.

I will now describe the slack cable device. Referring to Fig. 4 it will be noticed that the left-hand end of the cam 30 is provided with teeth 97 to engage with corresponding teeth 96 to form a clutch. The teeth 96 are on the collar 114 which is loosely feathered to the shaft 31 so as to be free to slide longitudinally but not circumferentially. This collar has a circular groove 98 with which is arranged to engage the fork 95 of a bell-crank lever 100 which is pivoted at 99 on a bracket 115 fixed to the housing 1. The bell-crank lever 100 is pivotally connected at 100′ to the link 102 which in turn is pivotally connected at 103 to the lever 104. This lever is pivoted at 105 on top of the housing 105 and is pivotally connected at 106 to the downwardly extending link 107 which is pivoted at 108 to the lever 112. The lever 112 is pivotally mounted on the bracket 116 which extends from the lower left-hand portion of the housing 1. A lever similar to that designated by the reference number 112 is pivoted on the bracket 117 which extends to the right from the standard 7. These levers are weighted by means of the weights 113 and 120 which are adjustably mounted on the outer ends of the lever arms 119 and 121, respectively. The other lever arms 110 and 122 have their outer ends rigidly connected together by means of the rod 123 which serves as a bearing for the sheave or pulley 124. The elevator machine is shown in Figs. 4 and 5 as a ceiling machine in that the elevator apparatus is placed above the hatchway and the hoisting cable 125 passes downwardly directly to the car or platform. From Fig. 5 it will be seen that when the cable 125 is under sufficient tension it will force the pulley 111 to the left and consequently the link 107 upwardly and the clutch collar 114 to the left; and maintain the latter out of engagement with the teeth 97. When, however, the cable 125 becomes slack, as when the car sticks on the guideways, the weights 120 and 113 will act to move the levers and links in the opposite direction so that the teeth on the collar 114 shall engage those on the cam 30. When this occurs the clutch will be operated by the drum shaft 3 to move the shipper or flier sheave to central or stop position and thus stop the hoisting apparatus.

The operation of my device is as follows: Assuming that the parts are in their central or stop positions as indicated and the main line and reversing switches consequently in open position, let the shipper sheave 33 be rotated in a clock-wise direction. The cam 30 will immediately act on the toe 29 of the brake lever and effect a release of the brake. A short time thereafter the right-hand portion of the cam 40 will release the lever 42 and allow the spring 52 to close the switch contacts 54, 58 and 78, 76 (Fig. 7), the lever 41 being held during this time in normal position by the concentric portion of the cam 40. Substantially at the same time that the right-hand reversing switch is closed the cam 67 strikes the roller 66 and with a sudden or quick movement rocks the lever 64 to effect a closure of the main line switch 174 by bringing the contacts 62 and 61 into engagement. The switch 126 (Fig. 7) being closed, current will now pass from the mains 127, 128 and 129 to the motor terminals 130, 131 and 132, respectively; that from the main 127 passing through the wire 127″, contacts 76, 78, and wires 133, 134 to motor terminal 131; and that from main 129 passing through the wire 129″, contacts 58, 54, and wires 136, 137 to motor terminal 132. By rotating the flier sheave in an anti-clockwise direction the left-hand reversing switch will be closed and the right-hand one held open. In this case two of the phases will be reversed since the

main 127 will be connected to motor terminal 132 and main 129 to motor terminal 130. The motor will therefore rotate in the opposite direction.

Whether the shipper sheave is rotated in one direction or the other it will be seen that it is moved through about 90° and that as it approaches the limit of its motion the roller 138 on the pin 81 will move out of engagement with the arc-shaped cam 82 and allow the spring 89 to move the rod 83 and consequently the plate 90 which is attached to it by means of the cap 88, slowly upward against the action of the dash-pot 87. As the plate moves upwardly the switches 92 and 93 will be closed in pairs one after another to gradually short-circuit the resistance 91. This will allow the motor to start with a strong torque and gradually increase to full speed when all the resistance 91 will be short-circuited.

When it is desired to stop the motor the shipper sheave is simply rotated back to central position, the flat portion on the cam 30 enabling the operator to determine when central position is reached so that the sheave will not be rotated too far. The spring 72 operates to open the main line switch 74 and the cam 40 opens the reversing switch which had been closed. The roller 138 also engages the arc-shaped cam 82 and depresses the same so that the rod 83 and plate 90 will receive a downward movement so as to open the switches 92 and 93. It is therefore seen that it is impossible to reverse the motor without first opening the switch 74 and reinserting the starting resistance 91 in the rotor circuit.

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

1. The combination with a hoisting drum, of a drum shaft, a motor for rotating said drum, a brake, brake applying means, a shipper sheave, and means co-acting with said sheave for operating said motor and said brake-applying means.

2. The combination with hoisting apparatus, of brake mechanism therefor, a motor connected to said hoisting apparatus, a shipper sheave, and means co-acting with said shipper sheave for operating both said motor and said brake mechanism.

3. The combination with hoisting apparatus, of brake mechanism therefor, a motor for driving said hoisting apparatus, a shipper sheave, and means co-acting with said shipper sheave for simultaneously operating said motor and said brake mechanism.

4. The combination with hoisting apparatus, of a brake, brake-applying means, a motor for said hoisting apparatus, a shipper sheave, means operated by said shipper sheave for actuating said brake-applying means to release the same, and means operated also by said shipper sheave for starting the motor.

5. The combination with hoisting mechanism, of brake mechanism therefor, means for operating said brake mechanism, an electric motor for driving the hoisting apparatus, reversing switches for the motor, and means co-acting with said operating means for controlling said reversing switches.

6. The combination with hoisting apparatus, of brake mechanism therefor, an electric motor for driving said hoisting apparatus, and means for operating said brake mechanism and for controlling the circuits to said motor.

7. The combination with hoisting apparatus, of brake mechanism therefor, an electric motor for driving said hoisting apparatus, switches for closing the circuits to said motor, and single mechanism for operating said brake mechanism and said switches.

8. The combination with hoisting apparatus, of brake mechanism therefor, an electric motor for driving said hoisting apparatus, reversing switches for said motor, and a single device for operating said brake mechanism and said switches.

9. The combination with hoisting apparatus, of brake mechanism therefor, an electric motor, reversing switches for said motor, means for closing said reversing switches, means for holding said switches in open position, means for actuating said holding means to release one of said switches, and means co-acting with said actuating-means for releasing said brake mechanism.

10. The combination with hoisting apparatus, of brake mechanism therefor, a cam for operating said brake mechanism, an electric motor, reversing switches for said motor, means for closing said switches, a cam for holding said reversing switches normally in open position, and means for actuating said cams to effect the release of the brake mechanism and the closing of one of said switches.

11. The combination with hoisting apparatus, of brake mechanism therefor, a cam for operating said brake mechanism, an electric motor, switches for said motor, means for closing said switches, a cam for holding said switches in open position, and a flier sheave for actuating said cams for effecting the release of the brake mechanism and the closure of one of said reversing switches.

12. The combination with hoisting apparatus, of brake mechanism therefor, an electric motor for driving said hoisting apparatus, a main line switch and reversing switches for said motor, and a single device for operating said brake mechanism and effecting the closure of one of the reversing switches and of the main line switch.

13. The combination with hoisting apparatus, of brake mechanism therefor, a cam for operating said brake mechanism to release the same, an electric motor, a main line switch and reversing switches for said motor, means for closing said reversing switches, means for opening said main line switch, a cam for holding said reversing switches in open position, a cam for positively actuating said main line switch to close the same, and a shipper sheave for actuating all of said cams.

14. The combination with a hoisting drum, a drum shaft, an electric motor connected to drive said shaft and drum, brake mechanism, a shipper sheave mounted loosely on said drum shaft, a cam connected to said sheave for operating said brake mechanism, motor-controlling means, and additional cams connected to said sheave for operating said motor-controlling means.

15. The combination with hoisting apparatus, of brake mechanism therefor, a shipper sheave, a cam carried by said sheave for operating said brake mechanism, a motor for driving said hoisting apparatus, motor-controlling means, and additional cams carried by said sheave for operating said motor-controlling means.

16. The combination with hoisting apparatus, of brake mechanism therefor, a motor for driving said hoisting apparatus, motor-controlling means, and a single device for operating said brake mechanism and said motor-controlling means substantially at the same time.

17. The combination with hoisting apparatus, of brake mechanism therefor, a motor for driving said hoisting apparatus, motor-controlling means, means for operating said brake mechanism and motor-controlling means, a clutch co-acting with said operating-means, and a slack cable device for actuating said clutch to effect a stopping of the hoisting apparatus.

18. The combination with hoisting apparatus, of brake mechanism therefor, an electric motor, starting resistance for said motor, means for controlling said starting resistance, and a single device for effecting the operation of said brake-mechanism and of said controlling-means.

19. The combination with hoisting apparatus, of brake mechanism therefor, an electric motor, an adjustable rheostat for said motor, switches for closing the circuits to the motor, and a single device for operating said brake mechanism and permitting the closure of said switches and the operation of said rheostat.

20. The combination with hoisting apparatus, of an electric motor for driving the same, a main line switch and reversing switches for said motor, sectional starting resistance for the motor, means for automatically cutting out said resistance, a shipper sheave, and means actuated by said shipper sheave for closing the main line switch, permitting one of the reversing switches to be closed, and permitting the operation of said means for automatically cutting out the resistance.

21. The combination with hoisting apparatus, of brake mechanism therefor, an alternating current motor, starting mechanism therefor, and a single device for operating said brake mechanism and said motor starting mechanism.

22. The combination with hoisting apparatus, brake mechanism therefor, an alternating current motor for driving said hoisting apparatus, a starting device for said motor, a shipper sheave, and means actuated by said shipper sheave for effecting the operation of said brake mechanism and said starting device.

23. The combination with hoisting apparatus, of brake mechanism therefor, an alternating current motor, a main switch and reversing switches for said motor, an adjustable rheostat for controlling the acceleration of said motor, and a single device for effecting the operation of said brake mechanism, the closure of said main switch and one of said reversing switches and the operation of the rheostat.

24. The combination with a hoisting drum, of a drum shaft, a shipper sheave mounted loosely upon an extension of said shaft, brake mechanism, an electric motor for driving said hoisting apparatus, motor-controlling means, and means actuated by said shipper sheave for effecting the operation of said motor-controlling means.

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

WILLIAM H. HULTGREN.

Witnesses:
ISAAC RICHARDS,
WALTER I. COOPER.