G. C. GRABLE.

AUTOMATIC HOIST.

APPLICATION FILED APR. 18, 1907.

982,809.

Patented Jan. 31, 1911.

2 SHEETS—SHEET 1.

Fig. 1

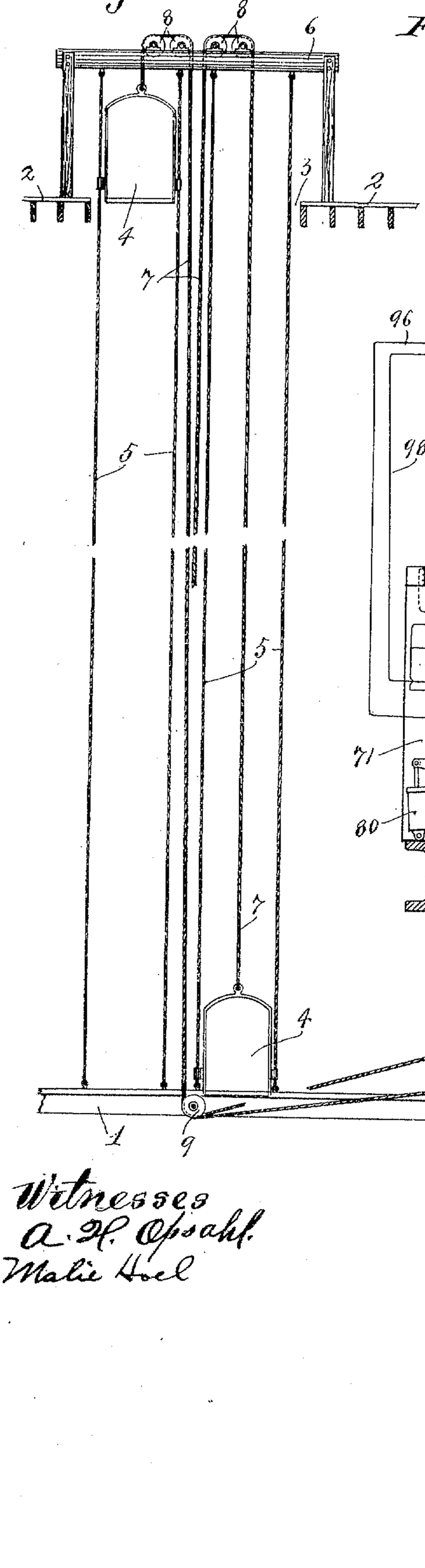

Fig. 2

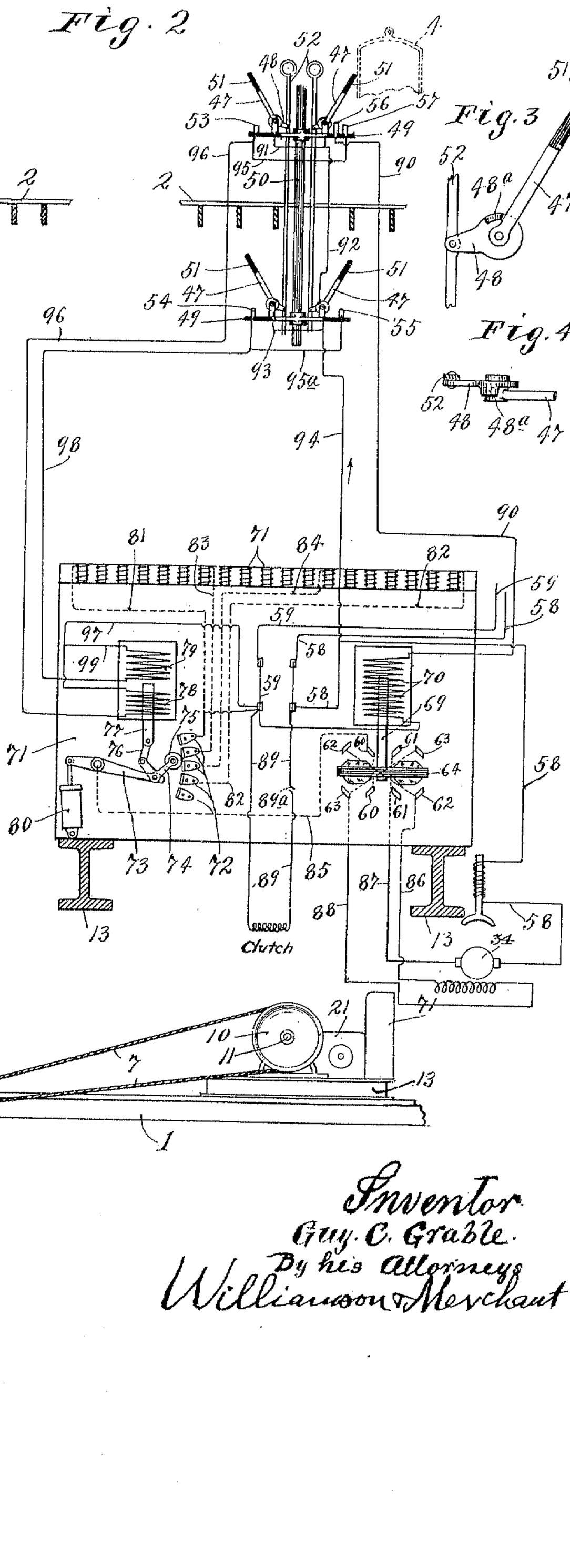

Fig. 3

Fig. 4.

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2 SHEETS—SHEET 2.

Fig. 5

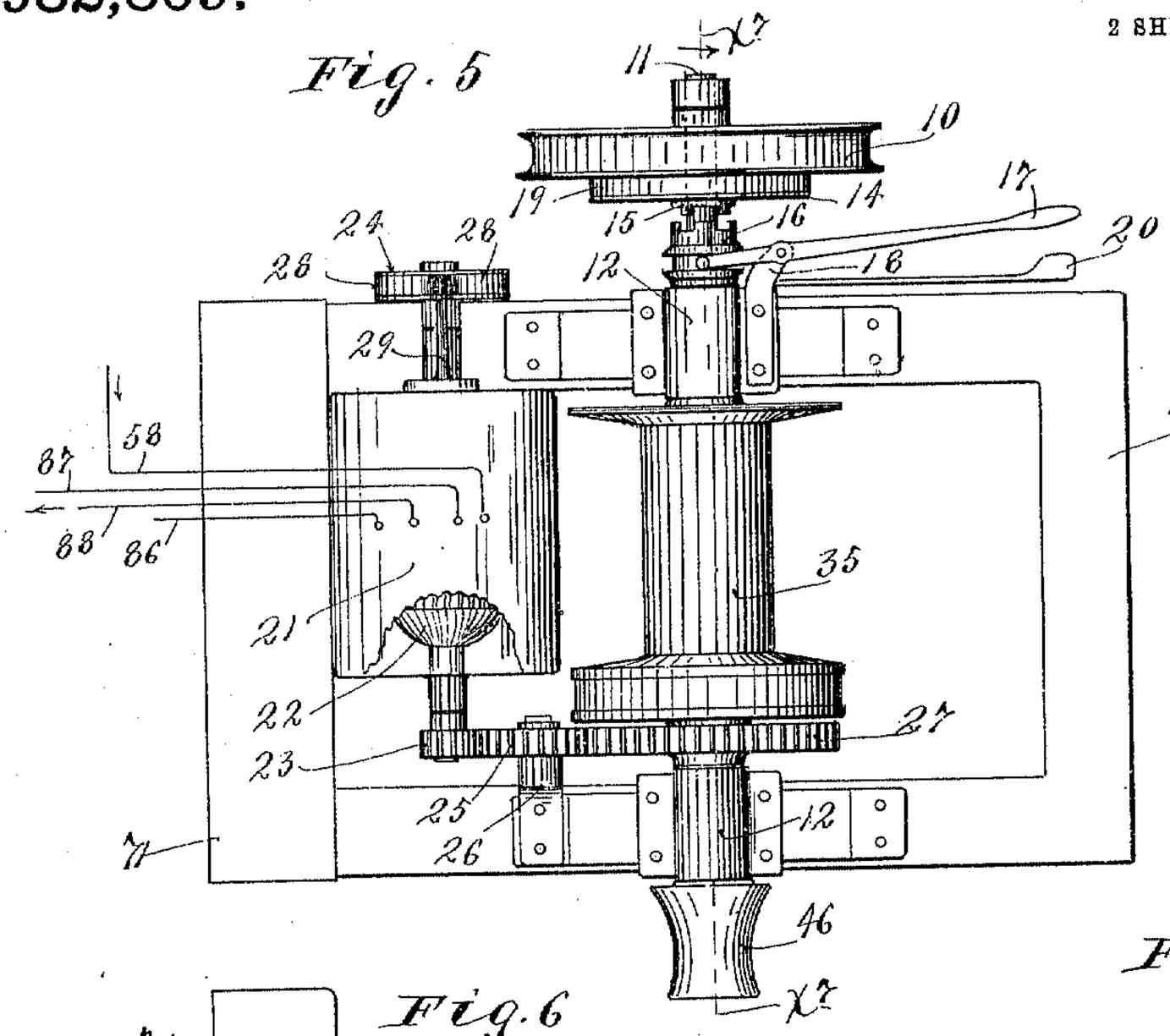


Fig. 6

Fig. 6.

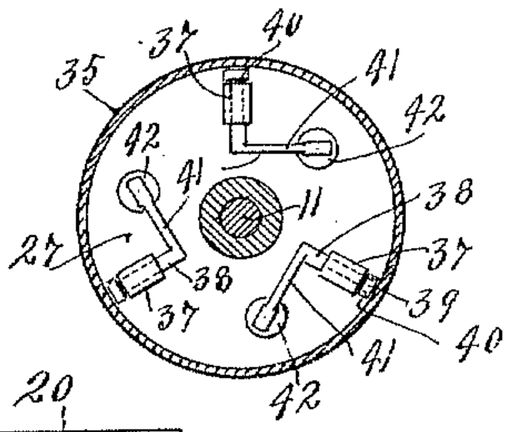


Fig. 9.

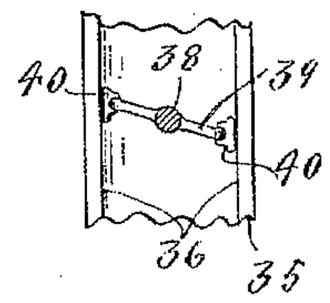
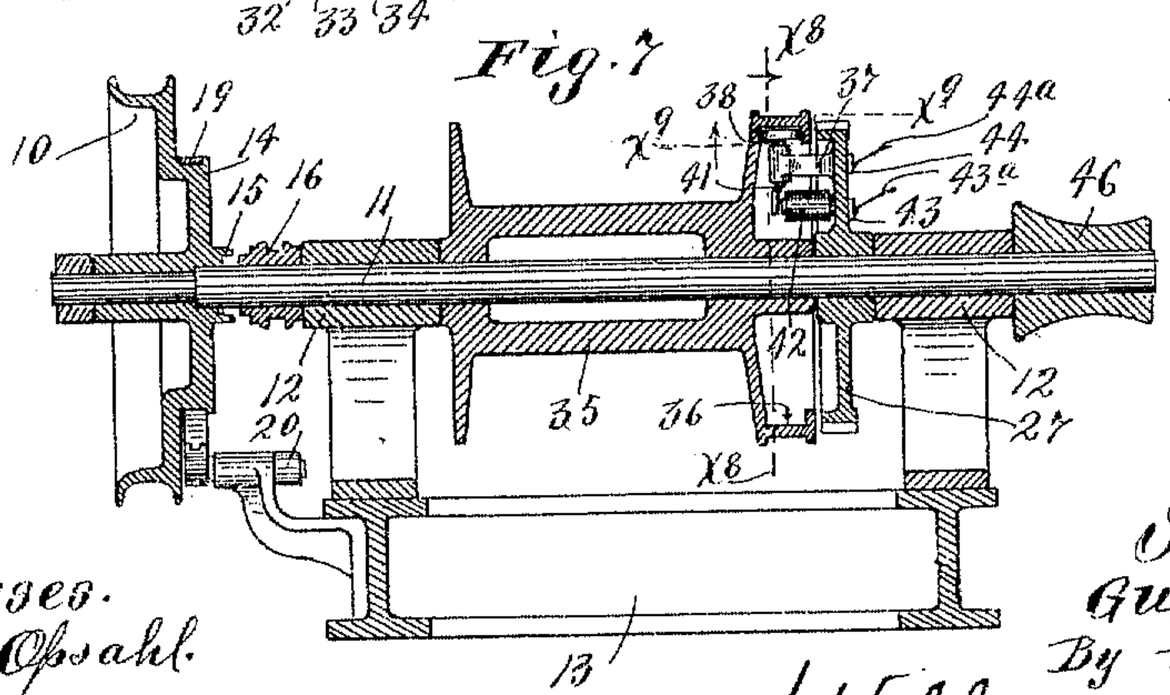


Fig. 7



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UNITED STATES PATENT OFFICE.

GUY C. GRABLE, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO NELSON F. DUNN, OF MINNEAPOLIS, MINNESOTA.

AUTOMATIC HOIST.

982,809. Specification of Letters Patent. **Patented Jan. 31, 1911.**

Application filed April 18, 1907. Serial No. 368,876.

To all whom it may concern:

Be it known that I, GUY C. GRABLE, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Automatic Hoists; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object to provide an improved automatic hoist especially adapted for use in the erection of buildings for elevating the building material from the ground to one of the upper stories.

More particularly stated, this invention relates to hoists of this character which employ reversely movable cars, frequently designated as scales, which are arranged the one to approximately counter balance the other, and the one to move upward while the other is moving downward.

The chief feature of my present invention is directed to an electrical controlling mechanism for controlling and regulating the movements of the cars or scales.

This improved mechanism, as well as other minor but novel features of this invention are illustrated in the drawings and will be hereinafter described and defined in the claims.

In the drawings like characters indicate like parts throughout the several views.

Referring to the drawings, Figure 1 is a view partly in elevation and partly in section and with some parts shown in diagram only, showing a hoisting mechanism to which my invention is applied. Fig. 2 is a view partly in elevation, but principally in diagram, illustrating the construction and arrangement of the automatic electrical controlling mechanism. Fig. 3 is a detail in elevation, showing one of the stop switches. Fig. 4 is a plan view of the parts shown in Fig. 3, some parts being broken away. Fig. 5 is a plan view, showing the windlass mechanism and motor for driving the same. Fig. 6 is a side elevation of the parts shown in Fig. 5. Fig. 7 is a vertical section taken on the line x^7 x^7 of Fig. 5. Fig. 8 is a section taken approximately on the line x^8 x^8 of Fig. 7; and Fig. 9 is a detail in section on the irregular line x^9 x^9 of Fig. 7, some parts being broken away.

The numeral 1 indicates what may be designated as the floor of the first story, and the numeral 2 the floor of one of the upper stories, the latter having an opening 3 through which the cars or so-called scales are adapted to pass. These cars or scales 4, as shown, are guided for vertical movements by vertical guide cables 5 attached to the floor 1, and at their upper ends to a framework 6 which is supported by the floor 2 and is frequently designated as the horse. The two cars 4 are attached one to each end of a hoisting cable 7, which cable is passed over guide sheaves 8 on the horse 6, under guide sheaves 9 journaled to the floor 1 and around a driving sheave 10, around which latter the cable is given several turns so as to give the proper friction between the said cable and driving sheave. This driving sheave 10 is loosely journaled on a shaft 11 of the windlass mechanism which shaft, as shown, is mounted in suitable bearings 12 on a suitable supporting base or frame 13. The sheave 10 is shown as provided with a brake drum 14 and with a half-clutch 15 with which half-clutch coöperates a sliding half-clutch 16 located on but carried by the shaft 11. The half-clutch 16 is adapted to be thrown into and out of engagement with the half-clutch 15, at will, by means of a shipper lever 17, shown as pivoted to a lug 18 on one of the bearings 12. A brake strap 19 of the usual construction coöperates with the brake drum 14 and is adapted to be operated in the usual way by a lever 20, to which the ends of said strap are eccentrically pivoted.

The motor is of the usual construction, and of the parts thereof it is only desirable for the purposes of this case to note the combined case and supporting frame 21, which is shown as secured to the base frame 13, and the armature 22, the shaft of which at one end carries a spur pinion 23, and at its other end a brake drum 24. In the arrangement shown, the pinion 23 meshes with an intermediate gear 25, journaled on a bearing 26 secured to the base frame 13, and this intermediate gear 25 meshes with a large spur gear 27 secured to the windlass shaft 11.

For coöperation with the brake drum 24 of the armature shaft, a pair of metallic brake straps 28 are provided, and these, as shown, are pivotally supported at their upper ends by a bracket 29 rigidly secured to

the motor case or frame 21. A nutted bolt 30 is passed through the depending ends of the brake straps 28, and a coiled spring 31 is compressed between the end of said bolt and the depending end of the adjacent strap 28. The force of this spring 31 will clamp the brake straps 28 onto the drum 24 with sufficient force to stop the motor and prevent rotation of the armature thereof, both under the magnetic driving force and the reverse force imparted thereto by the weight of the load. The brake straps 28 are adapted to be forced apart and away from the drum 24, against the tension of the spring 31, by the cam acting head 32 of a pivoted armature equipped lever 33, shown in Fig. 6, when the armature of said lever is drawn toward the right with respect to Fig. 6 by a magnet 34, which magnet, as will presently be noted, is connected in series with the armature of the motor.

On the intermediate portion of the windlass shaft 11 is a loosely journaled windlass drum 35, one rim of which is formed with an internal groove 36, the purpose of which will presently appear. The driving gear 27 is provided with one or more, as shown with three, rigidly secured bearing brackets 37 that project into the concave flange of the windlass drum 35. Journaled in the projecting end of each bracket 37 is a short rock shaft 38 disposed radially with respect to the axis of the windlass shaft 11. At their outer ends, the rock shafts 38 are provided with T-heads or diametrically extended arms 39, on both ends of which are mounted small clutch shoes 40 that are adapted to bear against the opposite sides of the annular channel 36, as best shown in Figs. 7 and 9. At their inner ends the said rock shafts 38 are provided with armature equipped arms 41 that are subject to magnet coils 42 located adjacent thereto and carried by the driving gear 27. The terminals of the magnet coils 42 are connected to contact rings 43 and 44 carried by the gear 27, and these contact rings are in constant engagement, respectively, with relatively fixed brushes 43[a] and 44[a]. As is evident, when the coils 42 are magnetized the rock shafts 38 and 39 will be oscillated and the clutch shoes 40 will be pressed against the opposite sides of the channel 36, thereby frictionally coupling the windlass drum 35 to the driving gear 27. The manner in which this is accomplished will hereinafter more clearly appear. As shown, the windlass shaft 11 is provided at one end with a capstan 46 of the usual construction.

The so-called tripping contacts are preferably arranged in upper and lower pairs there being two such contacts in each car or scale 4. As shown in the drawings, each of these tripping contacts comprises a lever 47 and coöperating rocker arm 48 pivotally supported by a cross bar 49 of the vertical supporting rod 50. This supporting rod 50 may be rigidly supported in any suitable way from the floor 2 with one pair of tripping contacts above the floor and one pair below the same although, of course, this arrangement may be varied. The levers 47 are shown as provided with insulated free ends 51 that are adapted to be engaged by the corresponding car or scale 4 under upward movements of the latter, and to be thereby forced into inoperative positions shown in Figs. 2 and 3. On the rocker arms 48 are push lugs 48[a] which when moved upward are adapted to force the coöperating levers 47 downward into operative positions. The vertically alined rocker arms 48 are connected for common movements by operating rods 52. When the upper left hand contact lever 47 is moved downward into an operative position it engages with the contact 53; when the lower left hand contact lever 47 is thus moved into an operative position it engages a contact 54; when the lower right hand contact 47 is moved into an operative position it engages with a contact 55, and when the upper right hand contact lever 47 is moved into operative position it engages with two contacts 56 and 57.

The current which supplies the motive force is conveyed by supply leads 58 and 59. The lead 58, as shown, includes the coil of the brake magnet 34 (see Fig. 2) and extends to one terminal of the motor armature 22 through the usual commutator connection.

The numerals 60, 61, 62 and 63 indicate fixed contacts of the motor reversing switch, which contacts are arranged in pairs constituting upper and a lower series.

The numeral 64 indicates the movable contact of the said switch. This movable contact 64 is carried by a core 69, which latter is arranged to be moved vertically by a solenoid 70 (see Fig. 2).

In Fig. 2 the numeral 71 indicates a rheostat of standard construction, and the numeral 72 indicates a series of relatively fixed rheostat controlling contacts.

The numeral 73 indicates the rheostat controlling lever, to the end of which, as shown, is pivoted a small bell crank 74 carrying a contact wheel 75 at the free end of its arms. This contact wheel 75 moves over the fixed contact 72. The other arm of said bell crank 74 is, as shown, connected by a short link 76 to a core 77 which is arranged to be actuated by a pair of solenoids 78 and 79. The movements of the controlling lever 73 are preferably retarded by an ordinary cylinder and piston dash pot 80.

The wire 59 which constitutes one of the supply leads extends to the upper member of the fixed rheostat controlling contact 72, and from this upper fixed contact or from

the said lead 59 a contact wire 81 extends to one terminal of the series of coils which make up the rheostat 71. From the other terminal of the rheostat a tap wire 82 leads to the ends of the lowest member of the said fixed contact 72. Other tap wires 83 and 84 lead from the intermediate portions of the rheostat to the second and third contacts 72, counted downward with respect to Fig. 2. The controlling lever 73 is connected by a lead wire 85 to the upper and lower contact 60 of the reversing switch. A lead wire 86 connects the upper and lower contacts 62 of the reversing switch. Another lead wire 87 connects the upper and lower contacts 61 of the reversing switch to the other terminal of the motor armature 22 through the usual commutator connection. The other terminal of the field of said motor is connected by a lead wire 88 to the upper and lower contacts 63 of the reversing switch.

The contact brushes 43ª and 44ª which are in electrical connection with the coils of the clutch magnets 42 are in a shunt from the supply circuit through wires 89 (see Figs. 2 and 7).

The solenoid 70 which actuates the reversing switch is interposed in a shunt from the supply circuit, which shunt includes a wire 90 extended from the main lead 59 to the upper right hand contact 56 of the automatic tripping mechanism. The two upper contact levers 47 are connected by a short wire 91, and this wire 91 is connected by a wire 92 to the lower right hand contact lever 47. The two lower contact levers 47 are connected by a short wire 93, and this wire 93 is connected by a short wire 94 which connects with the supply lead 58. The upper contacts 53 and 57 are connected by a short wire 95, and the two lower contacts 54 and 55 are connected by a short wire 95ª. The said wire 95 is connected by a wire 96 to one terminal of the solenoid 78, and the other terminal of said solenoid is connected by a wire 97 to the supply lead 59. The said connecting wire 95ª is connected by a wire 98 to one terminal of the upper solenoid 79, and the other terminal of said solenoid is connected by a wire 99 to the said wire 97 and through the latter to the supply lead 59.

Operation: It should be here stated that normally, or when the circuit is broken at the contact levers 47, the movable reversing contact 64 which in Fig. 2 is shown in an intermediate position will, however, be in a lowered position and in engagement with the lower reversing contacts 60, 61, 62 and 63; and also at such time the contact wheel 75 which in Fig. 2 is shown in an intermediate position will, nevertheless, be lowered and in engagement with the lowermost of the fixed contacts 72, which latter is a dead contact, and serves simply to keep the wheel in proper alinement with the other contacts 72. As is evident, when the wheel 75 is in engagement with the lowermost or dead contact 72, the supply circuit to the motor is broken and the motor is then dead. We will assume that the right hand car 4, as shown in Fig. 1, is down and that the left hand car is up, and that it is desired to cause the said right hand car to move to the upper floor 2 and, of course, the left hand car to move to the ground floor. To do this, all that is necessary is to raise the right hand operating rods 52, thereby simultaneously rocking the upper and lower right hand rockers 48 and causing the push lugs 48ª thereof to move the upper and lower right hand contact levers 47 into engagement with their cooperating contacts 55, 56 and 57. When the said right hand levers 47 are moved into operative positions just stated, the circuit is closed through the motor reversing solenoid 70 and through the resistance regulating solenoids 78 and 79. The solenoid 70 upon being energized acts upon the core 69 and raises the movable reversing contact 64 into engagement with the upper fixed contacts 60, 61, 62 and 63, thereby reversing the direction of the current through the motor; and the solenoids 78 and 79 being energized raises the core 77, lever 73, and wheel 75, moving the said wheel to its extreme uppermost position and into engagement with the uppermost fixed contact 72, thereby closing the circuit through the motor and causing a maximum flow of current through the same. This will, as is evident, throw the motor into action in a direction to cause the right hand car 4 to travel upward and the left hand car 4 to travel downward. It will be noted that when the contact wheel 75 is in engagement with the said uppermost contact 72, the current from the supply line will pass directly through the motor and will not pass through the rheostat 71, while when the said wheel 75 is in engagement with any one of the intermediate contacts 72, the current to the motor will be caused to pass through more or less of the rheostat. In this way, a variable resistance is interposed in the supply circuit to the motor, thereby making it possible to vary or control the speed of the motor. When the said right hand car, in its upward movement, closely approaches the upper floor 2, a suitable portion of the car or part carried by the car comes first into engagement with the free end of the lower right hand contact lever 47 and moves the latter into its raised or inoperative position, thereby breaking the circuit of the upper solenoid 79. When the solenoid 79 is thus deënergized the core 77 is by the lower solenoid 78 moved downward so as to cause the contact wheel 75 to move into engagement with one or the other of the intermediate contacts 72, and this has the effect

of throwing more of the coils of the rheostat 71 into circuit with the motor, thereby increasing the resistance of the motor circuit and causing the motor to materially slow down. When the said right hand car, under continued upward movement, very closely approaches the limits of its extreme upward movement, it comes into contact with the upper right hand contact lever 47 and thereby moves the same into its raised or inoperative position, thus moving the same out of engagement with the contacts 56 and 57, thereby simultaneously breaking the circuit to the reversing solenoid 70 and to the lower regulating solenoid 78. When the said lower solenoid 70 is thus deënergized the core 77, lever 73 and contact wheel 75 drop by gravity to their lowermost positions, and the said contact wheel again remains in engagement with the dead contact 72; and when the said reversing solenoid 77 is deenergized as just stated, the movable reversing contact 64 drops by gravity into engagement with the lowermost contacts 60, 61, 62 and 63, thus assuming a position for reversing the current through the motor as soon as the motor circuit is again closed by an upward movement of the contact wheel 75 into engagement with the live members of the contacts 72. It is here also important to note that the variable resistance device above described also affords means for gradually decreasing the resistance and, hence, gradually increasing the current supply to the motor, so that the said motor will be started gradually. It is, of course, clear that a decreasing resistance in the motor circuit takes place when the contact wheel 75 moves upward, and that conversely, an increasing resistance in the motor circuit takes place when the said contact wheel 75 moves downward. It will also be understood that the dash pot 82 assists in prolonging or retarding the movements of the contact wheel 75 from one position to another. When the left hand car 4 is in a lowered position and the right hand car 4 is in an elevated position, and it is desired to cause the said left hand car to travel upward and the right hand car to travel downward, this may be accomplished by raising the left hand controlling rod 52 so as to thereby move the left hand contacts 47 downward into engagement with the coöperating contacts 53 and 54. When the left hand contact levers 47 are thus moved into operative positions, the same action takes place as when the said right hand contacts 47 are moved into operative positions, except that the circuit through the motor reversing solenoid 70 remains open and the movable reversing contact 64 remains in its lower position in engagement with the lower contacts 60, 61, 62 and 63, in which position the current through the motor is in a proper direction to cause the motor to raise the left hand car 4 and lower the right hand car.

The windlass drum 35 may be coupled to the windlass shaft 11 at any time, either while the driving sheave 10 is or is not coupled to the said shaft, simply by closing the circuit 89 which supplies the clutch magnets 42. Said circuit 89 is normally broken, but is adapted to be closed by means of any suitable device, such as a push button 89ª shown diagrammatically in Fig. 2. When the said magnets 42 are energized, they rock the armature equipped shafts 38 and thereby cause the head 39 of said shaft to press the clutch shoes 40 tightly into frictional engagement with the opposite sides of the annular channel 36 which is in the hollow drum of the windlass drum 35.

The term "switch levers" as applied to the levers 47 is herein used in a broad sense to include any kind of means for making and breaking the controlling circuits. The term "rheostat" is used in a broad enough sense to include any kind of a device for varying the resistance of the electric circuit. The term "car" is also herein used in a broad sense to include any kind of a carrier.

What I claim is:

1. In an electrical hoist, the combination with a pair of cars and a motor having connections for reversely moving the same upward and downward, of electrical connections to said motor including a reversing switch, a rheostat, a series of fixed contacts and a coöperating movable contact having connections for cutting into and out of the motor circuit more or less of said rheostat, a magnetic controller for said reversing switch, a magnetic controller for said movable contact, and a switch lever for each car having connections to said two magnetic controllers and arranged to be moved into an inoperative position when one of the cars approaches a limit of its upward movement, and the other to be moved into an inoperative position when the other car approaches a limit of its upward movement, substantially as described.

2. In an electrical hoist, the combination with a pair of cars and a motor having connections for moving the same reversely upward and downward, of electrical connections to said motor including a reversing switch, rheostat, fixed contacts and a cooperating movable contact with connections for cutting into and out of the motor circuit more or less of said rheostat, a magnetic controller for said reversing switch, a magnetic controller for said movable contact, upper and lower pairs of switch levers with electrical connections to said two magnetic controllers, and means for moving said switch levers into inoperative positions, to thereby demagnetize the said two magnetic controllers when the said cars approach

limits of their upward movements, substantially as described.

3. In an electrical hoist, the combination with a pair of cars and a motor having connections for reversely moving the same upward and downward, of electrical connections to said motor including a rheostat, fixed contacts and a coöperating movable contact with connections for cutting into and out of circuit more or less of the rheostat, a magnetic controller for said movable contact, and switch levers having connections to said magnetic controller, the one switch lever being arranged to be moved into an open position when one of the cars approaches the limit of its upward movement, and the other to be moved into an inoperative position when the other car approaches the limit of its upward movement, substantially as described.

4. In an electrical hoist, the combination with a pair of cars and a motor with connections for reversely moving the same upward and downward, of electrical connections to said motor including a rheostat, fixed contacts and a coöperating movable contact, a magnetic controller for said movable contact including a core and two solenoids cooperating with said core, switch levers arranged in upper and lower pairs and having electrical connections to said two solenoids, one upper and one lower switch lever being arranged to be moved into inoperative positions when one of the cars approaches the limit of its upward movement, and the other upper and lower contact switch levers being arranged to be moved into inoperative position when the other car approaches the limit of its upward movement, whereby the said two solenoids will be deënergized one after the other, substantially as described.

5. In an electrical hoist, the combination with a pair of cars and a motor having connections for reversely moving the same upward and downward, of electrical connections to said motor including a rheostat and a motor reversing switch, fixed contacts and a coöperating movable contact having connections for cutting into and out of circuit more or less of said rheostat, a magnetic controller for said movable contact, a magnetic controller for said reversing switch, a pair of contact levers, one thereof having an electrical connection to the magnetic controller of said reversing switch, and both thereof having electrical connection to the controller of said movable contact, and one of which switch levers is arranged to be moved into inoperative position when one of the cars approaches the limit of its upward movement, and the other of which levers is adapted to be moved into an inoperative position when the other car approaches the limit of its upward movement, substantially as described.

6. In an electrical hoist, the combination with a pair of cars and a motor having connections for reversely moving the same upward and downward, of electrical connections to said motor including a reversing switch and a rheostat, fixed contacts and a coöperating movable contact having connections for cutting into and out of circuit more or less of the rheostat, a magnetic controller for said reversing switch, upper and lower solenoids and coöperating core constituting a controller for said movable contact, upper and lower pairs of switch levers, one of said upper levers having an electrical connection to the magnetic controller of said reversing switch, the two upper switch levers having electrical connection to the lower solenoid, and the two lower switch levers having electrical connection to the upper solenoid of said contact controller, and one of which upper and one of which lower switch levers is arranged to be moved into an inoperative position when one of the cars approaches the limit of its upward movement, and the other upper and lower of which switch levers are adapted to be moved into inoperative position when the other car approaches the limit of its upward movement, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

GUY C. GRABLE.

Witnesses:
MALIE HOEL,
F. D. MERCHANT.