E. L. DUNN.

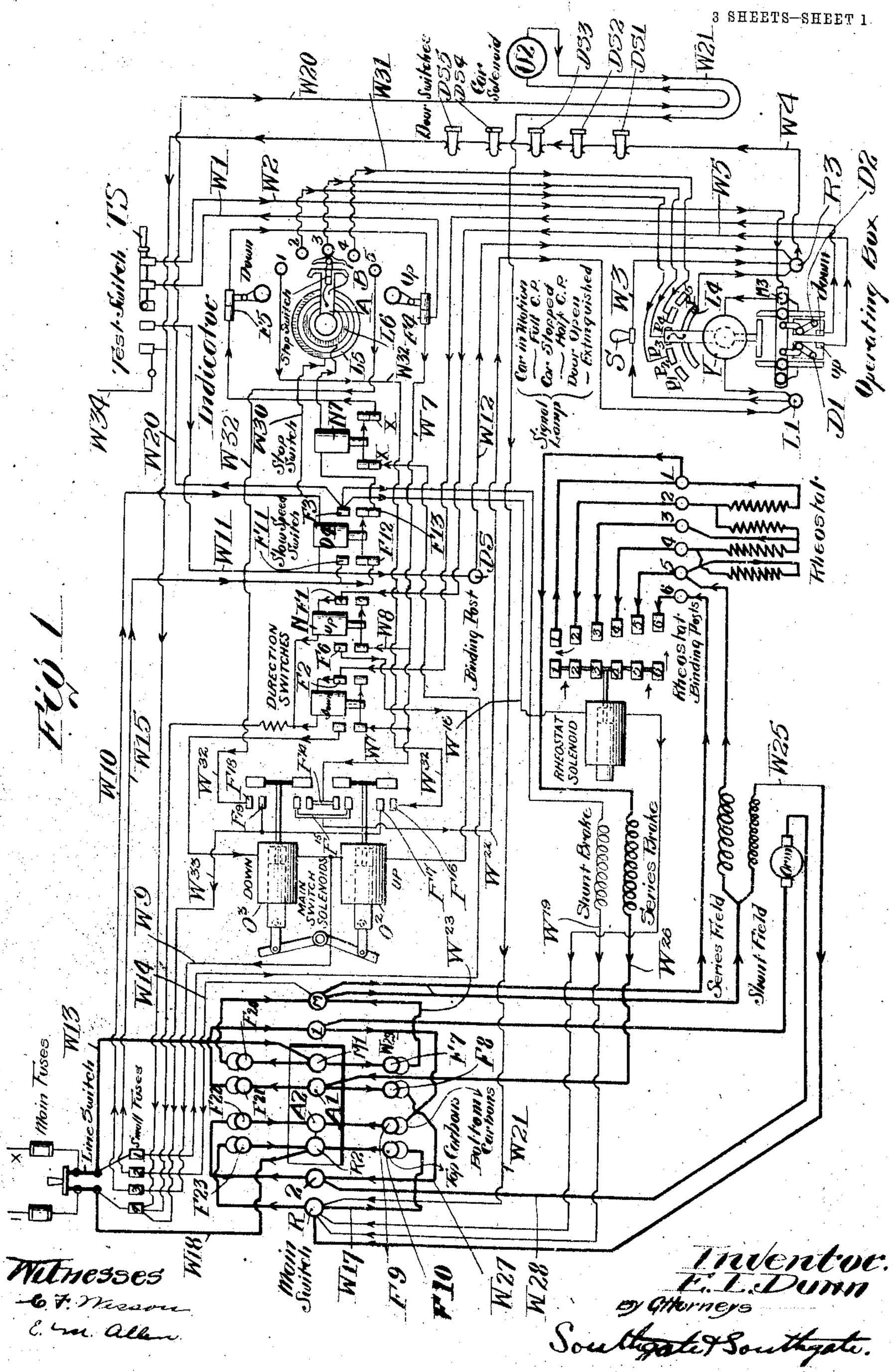
ELECTRIC CONTROL FOR ELEVATORS.

APPLICATION FILED JUNE 5, 1908.

989,584.

Patented Apr. 18, 1911.

3 SHEETS—SHEET 1.



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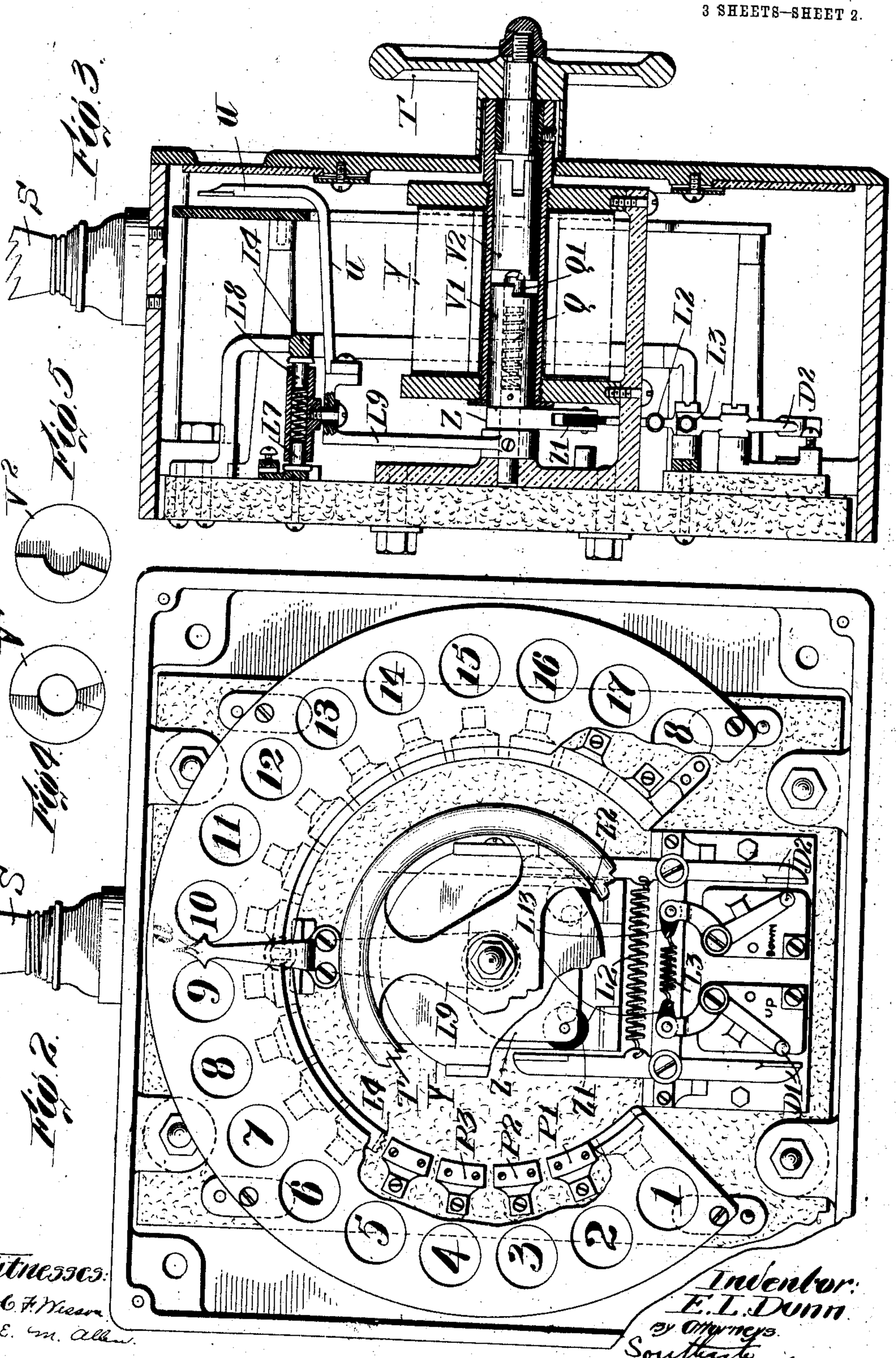

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3 SHEETS—SHEET 3.

Fig. 7.

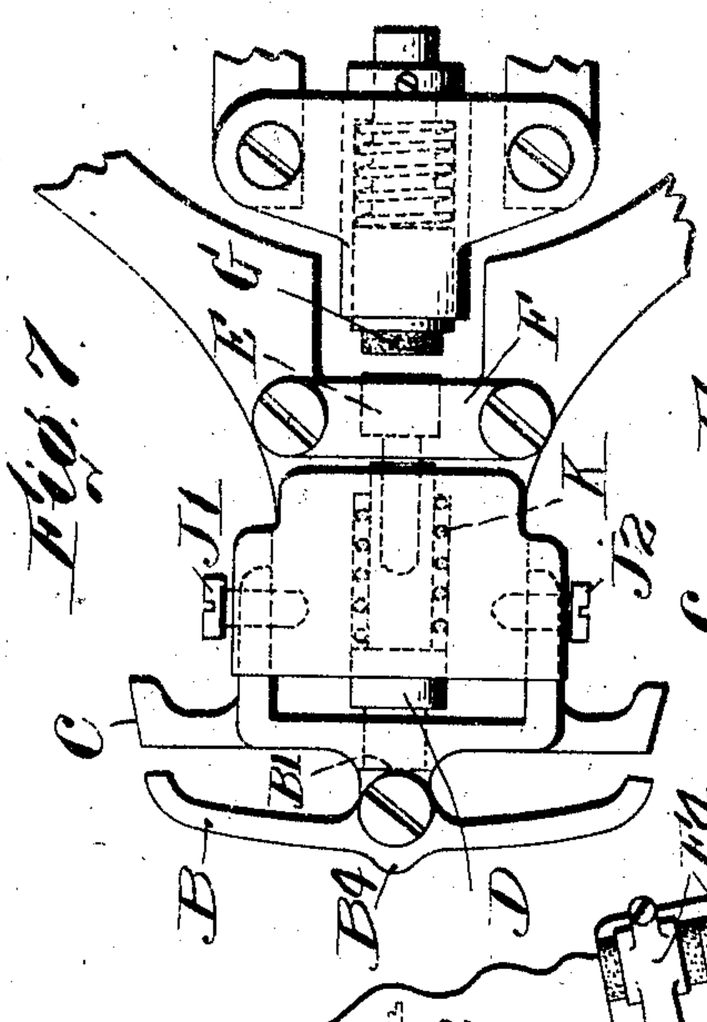


Fig. 8.

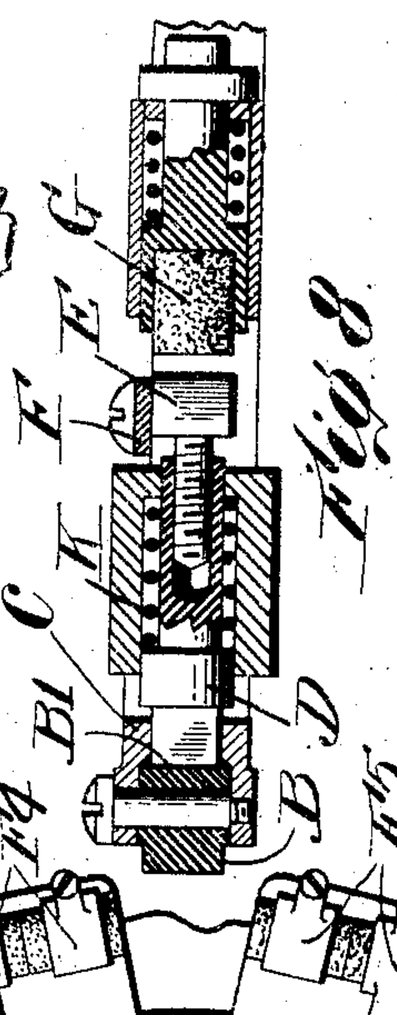


Fig. 9.

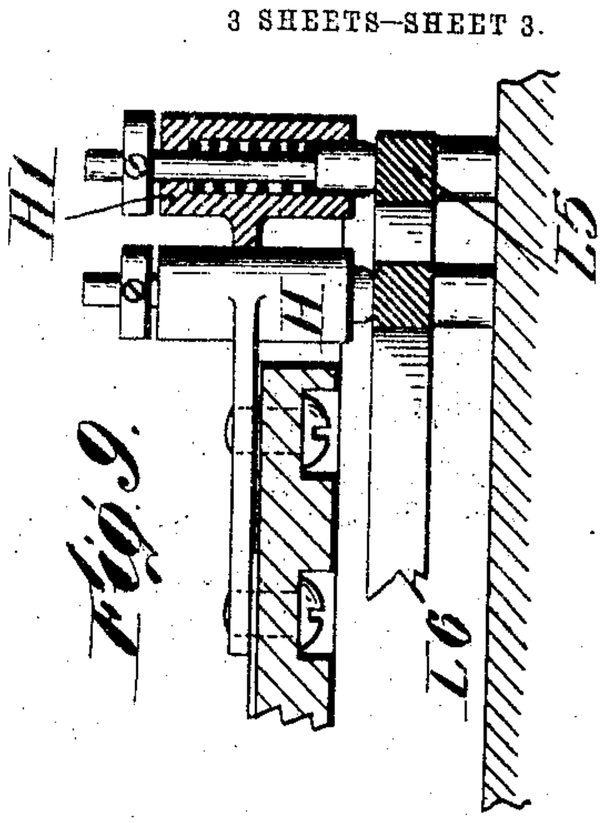
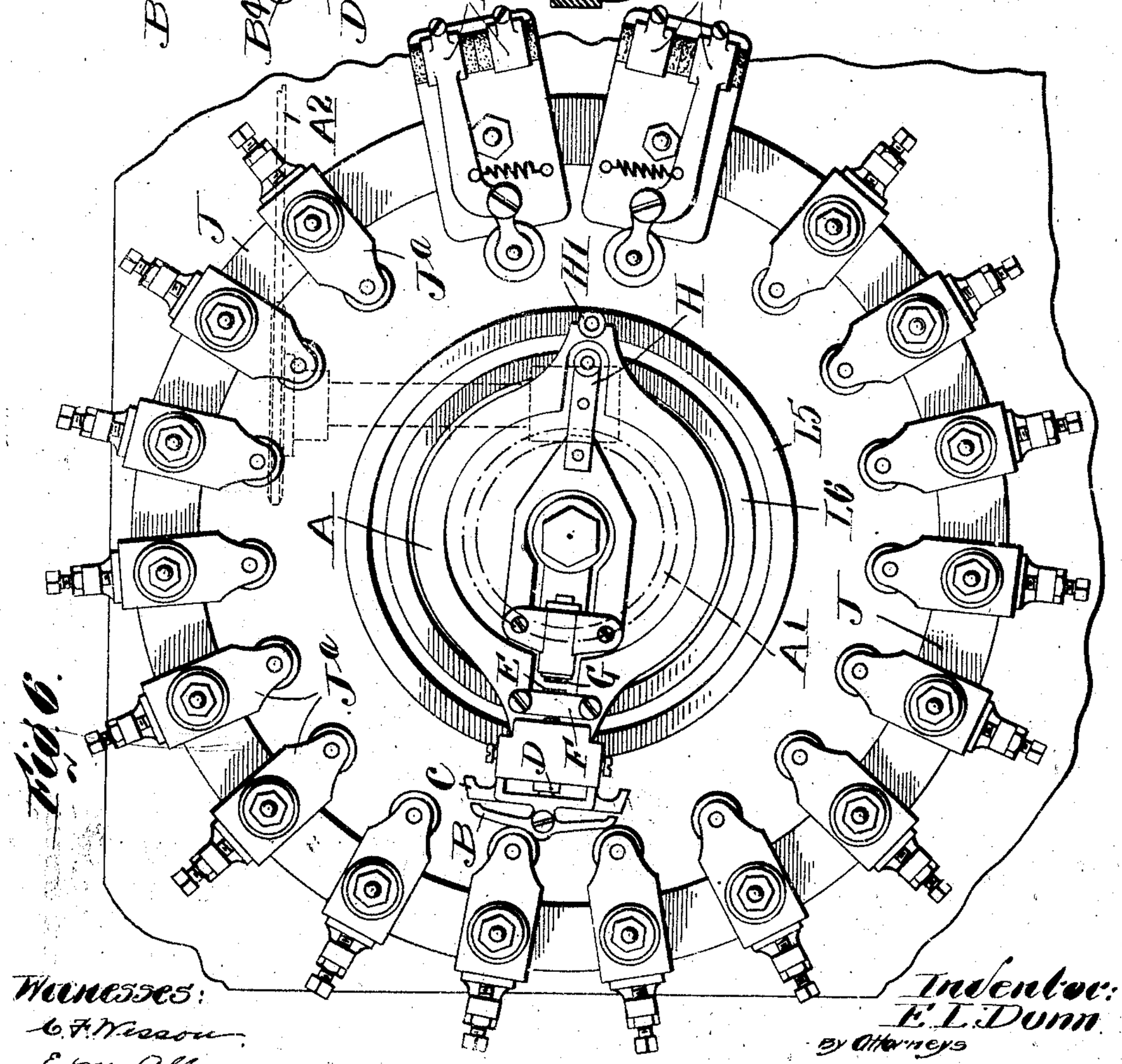


Fig. 6.



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UNITED STATES PATENT OFFICE.

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ELECTRIC CONTROL FOR ELEVATORS.

989,584. Specification of Letters Patent. Patented Apr. 18, 1911.

Application filed June 5, 1908. Serial No. 436,831.

To all whom it may concern:

Be it known that I, EDWARD L. DUNN, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Electric Control for Elevators, of which the following is a specification.

This invention relates to an elevator system and while capable of use for passenger elevators is particularly adapted to freight elevators and dumb waiters.

The invention is described herein chiefly as an improvement on my prior application for patent filed July 2, 1906, Serial No. 324,384, but certain features are capable of use independently of that type of elevator system.

The principal objects of this invention are to provide an improved operating box; an improved indicator, independent limit circuits closed by the main switch, a stop solenoid switch, a test switch, improved slow speed connections, etc. all so arranged and constructed that the operating box is safe in the hands of the most inexperienced operator, being inoperative at all times when it should be, so the car cannot permanently get out of position with the pointer; that the entire mechanism is magnetically automatic, *i. e.*, two clutches operate the two direction switches and release an operating box hand wheel by means of magnetism, so ignorant operators cannot break the apparatus as they have been known to do with a locked mechanism; that the signal lamp is an element of the mechanism, as it acts as protective resistance to keep the solenoid from heating and also takes the shunt circuit as the solenoid is deënergized, and the solenoid acts as resistance to dim the light; that the V-shaped contacting point or wedge of the indicator is used to force the stop switch to close; the shape being changed as the wedge is used in combination with a circular surface which causes the slow speed effect; that when the machine is running in either direction the slow speed and stop circuits are set regardless of the operating box, and in addition to the up and down automatics; that the shunt circuit passes through the stop solenoid, and is a very small fraction of what was formerly required to pass through the resistance; that the test switch will permit the machine to be operated independently of the operating box and the door switches can be short circuited by it; and that the operation and construction shall be improved and simplified.

Further objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings in which,

Figure 1 is a wiring diagram of the system in a practicable form. Fig. 2 is a front view of the operating box partly broken away to show interior construction. Fig. 3 is a transverse sectional view of the same. Figs. 4 and 5 are views of details thereof. Fig. 6 is a front view of the indicator. Fig. 7 is a fragmentary enlarged front view of the contacting point and associated mechanism. Fig. 8 is a central longitudinal sectional view thereof, and Fig. 9 is a sectional view of a detail of the indicator.

The invention is illustrated in the form of an automatic freight elevator, usually known as a dumb waiter machine. Automatic dumb waiter machines have usually been designed to operate from all floors at which the car stops. This machine is intended to be operated from one floor only, and as a consequence is made simpler than other machines which have full automatic features. The machine is run by a single operator in response to annunciator or other suitable signals.

While the invention is illustrated as a drum type of machine having an electric motor, the controlling apparatus is applicable in every way to plunger or other forms of hydraulic elevators, the main difference being that where a main reversing switch is used for the purpose of controlling an electric motor, a pilot valve can be used in a similar way for controlling a hydraulic motor valve. (See drawing of pilot valve in my application filed Feb. 14, 1908, Serial No. 415,801).

The following description of the wiring diagram relates to a drum type electric machine, the motor being compound wound, series and shunt, and reversible. This motor is direct connected to worm gearing in the usual manner, for the purpose of revolving the drum. (The same as fully described and illustrated in my co-pending application Ser. No. 324,384). All circuits and controlling apparatus are shown in wiring diagram Fig. 1. The complete apparatus, as shown, comprises a main reversing switch

actuated by solenoids for operating the motor in both directions, two direction solenoid switches for operating the main reversing switch solenoids; a rheostat actuated by a solenoid for accelerating and retarding the motor speed; a slow speed solenoid switch, for controlling the rheostat, car attachment and shunt brake solenoids, and incidentally for opening and closing the stop circuit; also a compound wound brake solenoid, a car attachment for operating the door locks, a stop solenoid switch for causing the machine to stop, a floor indicator, consisting of a revolving contactor, a stationary contact for each floor, and two automatics, or limit stops, a complete operating box, a signal lamp, resistance for the direction solenoids, a line switch, a test switch, fuses, door switches, and a compound wound electric motor.

I will first describe all circuits shown in the wiring diagram Fig. 1 and later on will describe fully the complete operation of the apparatus.

The diagram (Fig. 1) is arranged for five floors. It shows the parts in the position occupied when the machine is at rest with the car at the 3rd floor and everything ready to start. With the parts in this position the circuit can be traced as follows: starting at plus side of line switch through #1 fuse to stop switch contacts X—X, through limit switches F^5—F^4, and wire W^1 to test switch TS, through wire W^2 to operating box binding post M^3, through operating box solenoid Y to binding post L^1, through signal lamp S and wire W^3 to binding post R^3, through wire W^4 and door switches DS^1—DS^2—DS^3—DS^4 and DS^5 to #4 fuse and minus side of line. The above described circuit passing through the operating box solenoid serves three purposes, *i. e.*, it causes the signal lamp S to give a dim light and at the same time locks an operating box pointer U to a hand wheel T by means of a clutch arrangement at solenoid plungers V^1—V^2, (see Figs. 2 and 3) and in addition to this an armature Z is attracted to the solenoid plunger V^1, so that when the plunger V^1 is turned the armature Z will move with it and will close one of the operating box direction switches D^1 or D^2, the details of the operation of all of which will be described hereinafter.

Assuming that it is desired to run the car up to the 4th floor, the operating box pointer U is accordingly moved, clock wise, to the right, by means of the hand wheel T. When the pointer moves one space on the dial there will be several results; *i. e.*, 1st:—A new stop circuit will be made, or in other words one opening in the 4th floor stop circuit will be closed. 2nd:—The up direction switch D^1 will close and open. 3rd:—The up direction solenoid switch N will be energized and will maintain its circuit. 4th:—The main reversing switch will operate and consequently all apparatus will be active.

The circuit through the up direction solenoid is as follows:—from plus side of line switch through #1 fuse, stop switch contacts X—X, limit switches F^5—F^4, and wire W^1 to test switch, through wire W^2 to operating box binding post M^2, through up direction switch D^1, and wire W^5 to direction solenoid switch contact F^1, through solenoid N, resistance O, and wire W^6 to #4 fuse and minus side of line. The energizing of the solenoid N operates to make the contacts F^1 and F^6. The up direction solenoid switch when operating maintains its circuit independently of the operating box direction switch and also feeds the up main switch solenoid circuit as follows:—from plus side of line switch through #1 fuse, stop switch contacts X—X, limit switches F^5—F^4, wires W^7 and W^8, contacts F^6—F^1, through solenoid N, resistance O, and #4 fuse to minus side of line. The up direction solenoid switch N when operating feeds the up main switch solenoid. The circuit is as follows:—from the upper limit switch F^4 as before described, through wires W^7 and W^8, through contacts F^6, and main switch up solenoid O^2, wire W^9, #3 fuse, wire W^{10}, through slow speed switch solenoid O^4, to binding post D. S., through wire W^{12} to operating box binding post R^3, and door switches DS^1—DS^2—DS^3—DS^4 and DS^5 to one side of test switch, through #4 fuse to minus side of line. From this it can be seen that the up direction solenoid switch N is supplying its own current, is in series with resistance O, and is in parallel with the main switch solenoid O^2. It can be seen further that the up direction solenoid switch N is supplying current to the up main switch solenoid O^2 and that the latter is in series circuit with the slow speed switch solenoid O^4, and door switches, also if a door switch were now opened, the main switch solenoid would be deënergized, but not the direction switch solenoid N as its circuit does not pass through the door switches. The main switch solenoid O^2 has now closed contacts F^7—F^8—F^9—F^{10}, preferably in the manner set forth in my above identified co-pending application Ser. No. 324,384. The main switch circuits will now be traced.

Starting at plus side of line switch the current path is through wire W^{13} to main switch binding post M^1, through wire to contacts F^7, through wire W^{23} to binding post M. From this point the controlling circuit will first be followed and later the motor circuits will be traced: from binding post M, through wire W^{14} and #2 fuse, through wire W^{15}, and slow speed switch contact F^{11} to F^3, which are now bridged as above described. From contact F^3 three circuits are

made, *i. e.*, the rheostat solenoid circuit, the shunt brake solenoid circuit, and the car attachment solenoid circuit. It can be further noted that the circuit through the slow speed switch lower contacts F^{12}—F^{13} to stop switch solenoid N^7 is now open. The rheostat solenoid circuit can be traced from contact F^3, through wire W^{16}, and solenoid to main switch binding post R, through wire W^{17}, and contacts F^{10}, to binding post R^2, through wire W^{18} to minus side of line switch. The shunt brake solenoid circuit can be traced from slow speed switch contact F^3, through wire W^{19}, and shunt winding of brake solenoid to main switch binding post R, through wire W^{17}, main switch contacts F^{10}, and binding post R^2, wire W^{18} to minus side of line switch as before. The circuit to the car attachment solenoid U^2 is from contact F^3, through wire W^{20}, through the solenoid U^2, back through the car cable wire W^{21}, to main switch binding post R and to minus side of line switch as before, through wire W^{17}, contacts F^{10} and wire W^{18}. It is to be noted at this point that the rheostat is operating, closing the rheostat contacts 1—2—3—4—5 and 6 and accelerating the motor speed, as will be described later. Also that the brake solenoid is energized and holding the brake open regardless of the series winding, and that the car attachment solenoid U^2 is energized and holding a cam out of the path of the door lock rollers according to my co-pending application Serial No. 324,384, in which case, as in this the car attachment can be omitted without materially affecting the rest of the system.

Auxiliary switches F^{14}, F^{15}, F^{16}, F^{17}, F^{18}, F^{19} are really a part of the main switch as they operate in conjunction with it, *i. e.*, when the up main switch solenoid O^2 operates, it closes the up side of main switch, and also the up auxiliary switch F^{18}, F^{19} and vice versa when the down solenoid O^3 operates. The auxiliary switch circuits will now be described. Auxiliary switch contacts F^{14}—F^{15} govern the signal lamp S and consequently these contacts are bridged every time the main switch operates regardless of direction, but the other auxiliary switch contacts F^{16}—F^{17}—F^{18} and F^{19} are bridged alternately as the main switch operates in alternate directions. As the machine is now being described as running in an up direction, auxiliary switch contacts F^{14}—F^{15} also (F^{18}—F^{19}) are bridged. The contacts F^{16}—F^{17}—F^{18} and F^{19} are for the purpose of establishing limit stop circuits regardless of the operating box circuits and reference will be made to these later. When the main reversing switch operates in either direction the contacts F^{14}—F^{15} are bridged, this deenergizes the operating box solenoid Y, rendering the operating box mechanism irresponsive to any movement of the hand wheel, and at the same time causes the signal lamp S to burn at full candle power as follows: The current starting from plus side of line switch passes through #1 fuse, and stop switch contacts X—X, through limit switches F^5—F^4, and wire W^7, through auxiliary switch contacts F^{14}—F^{15}, and wire W^{22} to operating box binding post L^1, through signal lamp S and wire W^3 to binding post R^3, through wire W^4 and door switches DS^1—DS^2—DS^3—DS^4 and DS^5 to #4 fuse and minus side of line. It can be noted here that opening one of the door switches would not only stop the machine, as before mentioned, but would also extinguish the signal lamp, which would notify the operator that the machine was stopped. It can be further noted that the operating box solenoid Y is now deënergized as it was originally, in series circuit with the signal lamp which is now across the line. The operating box solenoid is consequently shunted out of circuit and the clutch released. If the hand wheel were now turned the pointer would not move with it as the solenoid plungers V^1—V^2 are apart and the clutches open.

Another point to take note of is that the armature Z, (see Figs. 2 and 3) is now in a normal central position and the operating box direction switches D^1 and D^2 are open. It can be further explained here that when the operating box hand wheel was turned the solenoid plungers V^1—V^2 turned with it as they were locked together by means of the magnetism holding the clutch in contact, (details of clutch are shown in Figs. 4 and 5). Also the armature Z being magnetically attracted to the plunger V^1 moved with the plunger. As the armature Z moved the armature roller Z^1 engaged the direction switch lever D^1 causing the switch to close, but as the solenoid is deënergized the spring L^2 snaps the direction switch lever D^1 and the armature Z back to the normal central position. The armature rollers Z^1—Z^2 are of insulating material, like-wise the spring L^3 is insulated at each end, (see Fig. 2) by insulators L^{13}.

The main switch and motor circuits will now be described. The main switch, as in my co-pending application Ser. No. 324,384, is provided with a lever (not shown herein) pivoted in the center which oscillates in see saw fashion in response to the solenoids which are connected to this lever at either side of the center. At the ends of the lever are arranged the four contacts F^7—F^8—F^9—F^{10} and F^{20}—F^{21}—F^{22}—F^{23}. These contacts are preferably carbon faced, insulated from each other and connected with the binding posts M^1—A^1—A^2—R^2. As the lever is moved down by one of the solenoids one set of carbon contacts F^7—F^8—F^9—F^{10} or F^{20}—F^{21}—F^{22}—F^{23} is made to contact

with a duplicate set of carbon faced spring contacts which are stationary. It can therefore be readily understood that the switch is interlocking, *i. e.*, that there is no possibility of both sides acting at once. It can be further seen that either set of main switch contacts are fed from the binding posts M^1—A^1—A^2—R^2.

To trace motor circuits start at plus side of line switch through wire W^{13} to main switch binding post M^1, through main switch contacts F^7, and wire W^{23} to binding post M, through wire W^{24} to the series and shunt fields. The shunt field circuit is completed through wire W^{25} to main switch binding post R, and wire W^{17}, through contacts F^{10} to binding post R^2 and wire W^{18} to minus side of line switch. Starting again at main switch binding post M, through wire W^{24}, through series field to rheostat binding post #5, through all resistance in series to rheostat binding post #1, through wire W^{26}, and series brake winding to main switch post A^1, through main switch contacts F^8, and wire W^{27} to binding post 2, through wire W^{28}, through armature and back to main switch binding post 1, through wire W^{29} and contacts F^9, to binding post A^2 and wire W^{18} to minus side of line switch. It can be seen from the above described circuits that the shunt field is directly across the line, that the series field is in series circuit with the rheostat resistance, series brake winding, and armature.

A rheostat is indicated diagrammatically similar in construction to the main switch and like the one shown in my co-pending application Ser. No. 324,384, *i. e.*, there is an upper and lower set of carbon contacts, the lower contacts 1—2—3—4—5 and 6 are insulated from each other. The upper contacts which are not insulated from each other are fastened to the rheostat lever, which is moved by means of the rheostat solenoid and retarded when opening or closing by means of dash pots. As the rheostat lever moves, the contacts 1—1, 2—2, 3—3, 4—4, 5—5, 6—6, are made in consecutive order, with the result that the armature resistance is short circulted in regular order, and finally the series field is short circuited by means of the contacts 6—6. Thus it can be seen that after the rheostat has operated, the motor runs at full speed as a shunt motor, the series field and armature resistance being shunted out of circuit. When making a normal stop the rheostat solenoid circuit is broken before the main switch opens and the rheostat is caused to operate in a reverse manner to that described. This may be done by a spring in tension not shown herein as it is fully illustrated in my prior application Ser. No. 324,384. The result of the reverse movement is to reëstablish the starting circuit, or in other words to put the series field and armature resistance back into circuit with the armature, and thereby cause the motor speed to be reduced before the machine stops. The manner in which the rheostat solenoid circuit is broken will be explained in detail later. From the foregoing it will be understood that the operating box pointer was moved to the 4th floor indication, that this movement caused the up direction switch D^1 to be automatically closed and opened, that the up direction solenoid switch N operated causing the main switch to operate correctly, that the slow speed solenoid switch operated causing the rheostat, car attachment and shunt brake solenoids all to receive current and perform their various functions, that the auxiliary switch F^{14}, F^{15} caused the signal lamp to change from a dim light to a bright light, and has rendered the operating box mechanism irresponsive to movement of the hand wheel, that the machine is running at full speed in an up direction and consequently that the indicator A is revolving slowly toward the 4th floor contact. (Details of the indicator contactor appear in Figs. 7—8 and 9). As the machine is now described as running at full speed, reference will be made to the fact that it would stop instantly if the circuit was opened at any one of the door switches DS^1—DS^2—DS^3 etc., at either limit switch F^5—F^4, or at the stop switch contacts X—X.

The improved method by which the motor speed is reduced and finally stopped will now be explained. It is understood that the operating box segment P^4 is in circuit with the long segment L^4 and that the indicator A is slowly approaching the floor stop contact 4. When the contactor B engages the floor stop contact a circuit is made which shunts the slow speed switch solenoid O^4 out of circuit. The path of this shunt circuit is as follows: The slow speed switch solenoid O^4 has been shown to be in series circuit with the main switch solenoids O^2, O^3, through wire W^{10}. When circuit is made by the indicator at the floor stop, the current instead of passing through the slow speed solenoid takes the path of least resistance, through wire W^{30} to contact member or shunt ring L^5, which being in circuit with movable arm A allows the current to pass through contactor B to floor stop contact J^4 through wire W^{31} to operating box segments P^4 and L^4, to binding post R^3, through wire W^4, door switches DS^1—DS^2 etc. to one side of the test switch, through #4 fuse to minus side of line switch. This circuit shunts out the slow speed switch solenoid thus deënergizing it and causing the contacts F^3—F^{11} to be open circuited with the result that circuits to rheostat, shunt brake and car attachment solenoids U^2 are broken. If the motor is taking current the

rheostat retards the current causing the speed to be reduced. If the motor is not taking current there will be no current passing through the series brake winding and as the shunt brake circuit is broken the brake will be applied. In one case the flow of current is retarded, in the other the brake is applied, in either case the speed is reduced, and the indicator contactor B continues moving to a central position with the 4th floor contact.

It will be noticed that the contactor B is provided with a V shaped point, (see Fig. 7). As this point comes near to a central position with the floor stop contact roller the frame C is forced back, (see Figs. 6, 7 and 8). The contactor B is pivoted to the frame C which is arranged to slide in and out. As the frame C moves it carries the plunger D with it. The plunger D is held out by a coil spring and is provided with an adjustable screw contact E, which is prevented from turning by a guide plate F. When the screw contact E engages the switch contact G a circuit is made through a stop switch solenoid N^7 causing it to operate and break all controlling circuits through contacts X—X, thus causing the main switch to open and the machine to stop. The path through this stop switch solenoid can be traced from plus side of line switch, through wire W^{13} to main switch binding post M^1, through contact F^7 and wire W^{23} to binding post M, through wire W^{14} to #2 fuse, through wire W^{15}, lower slow speed switch contacts F^{12}—F^{13}, which are now bridged, and stop switch solenoid N^7 to a contact member or stop ring L^6, through sliding contact H (which is insulated from indicator A,) (see Figs. 6 and 9), through contacts G—E—B and #4 floor stop contact, through wire W^{31} to operating box segments P^4 and L^4, through binding post R^3, and wire W^4 to door switches DS^1 DS^2—etc., through #4 fuse to minus side of line. The stop switch when operating breaks all controller circuits at X—X as above explained, the main switch as a consequence opens and breaks the shunt circuit which is passing through the stop switch solenoid. The machine has therefore come to a full stop and cannot start again except by a further movement of the operating box pointer, which would close one of the direction switches.

The limit circuits passing through the auxiliary switches will now be explained. When the machine is running in an up direction the auxiliary switch contacts F^{18}—F^{19} are bridged. Suppose, for instance that the machine failed to stop at the #4 floor stop contact, as above described, through accident or some other cause, the indicator contactor A would continue its movement to floor stop contact #5, where the slow speed effect and stop would take place exactly as described and independently of the operating box circuits, as follows: from floor stop contact #5, through wire W^{32}, and auxiliary switch contacts F^{18}—F^{19}, through wire W^{33} and #4 fuse to minus side of line switch. In such a case as this if an attempt were made to start the machine again in an up direction, by moving the pointer toward the 5th. floor indication, the machine would not respond, as the stop switch circuit would be made through the auxiliary switch contacts F^{18}—F^{19} and this would cause the stop switch solenoid N^7 to open the controlling circuits and prevent the machine from starting However, if the pointer were moved toward the 1st. floor indication the machine would start in the direction indicated by the pointer and would stop correctly with the pointer. There is another independent limit circuit W^{32} connected with the first floor contact. As explained at the start, if a door is opened while the machine is in motion, the machine will stop instantly, as the main switch solenoids would be open circuited by the door switch, but the direction solenoid N would remain in circuit as its circuit does not pass through the door switches. The operating box mean time would remain inoperative, as the opertaing box solenoid circuit would also be broken by the door switch. By closing the door again the car would resume its travel to the floor indicated by the pointer. From this it can be seen that the car must follow the pointer and that the two cannot get permanently out of position with each other. In the event of the machine failing to stop at the limit floor, a continued movement of the indicator would open the limit switch F^4 or F^5, which would open the controlling circuits and make it necessary for the attendant to get the machine back into proper position.

The test which TS serves a useful purpose when the machine is being installed or when it is desired to run the machine independently of the operating box, *i. e.*, by opening the test switch the circuit to the operating box solenoid is broken and the mechanism would not respond to movement of the hand wheel. However, the attendant at the machine could operate it by manipulating either direction solenoid switch and cause it to stop in the regular manner at any desired floor by holding the wire W^{34} from the test switch to the floor stop contact J^a at which it is desired the machine should stop. This would permit the current to flow directly from said contact J^a to the fuse 4 instead of passing through the parts P^1 or P^2, etc., L^4, R^3, W^4, DS^1, DS^2, etc. to fuse 4. This temporary circuit causes the machine to stop in the regular manner and independently of the operating box circuits. By reversing the test switch the door switches are short circuited, because R^3 is connected

with the line on the other side of them through W^{11}, DS and W^{12}.

I will not describe the operation of the machine in the down direction as the circuits are identical with those described, except that they pass through the down direction switch, down solenoids, down side of main switch, etc.

As the various circuits have been fully described, I will now describe more in detail the construction and operation of the controlling apparatus, and show wherein it differs from that shown in my other application Ser. No. 324,384. The operating mechanism used by the operator may be contained in a metal box, (see Figs. 2 and 3), which can be located in any convenient place as it is electrically connected to the machine.

The box is shown arranged for 18 floors and is provided with a dial and pointer U, a hand wheel T and signal lamp S. The box cover has a circular opening, glass covered, through which the floor indications and pointer are visible.

To start the machine the pointer U is moved by means of the hand wheel T. When the pointer has moved one space on the dial the machine starts. If the operator releases the hand wheel T or attempts to reverse its movement, the pointer U is released from the hand wheel and the operator cannot again move the pointer until the machine stops, thus the operator cannot reverse the movement of the pointer after starting the machine, nor change its position after it has been set, neither can the pointer be moved while a door is open, or in other words when there is no circuit. (In my above mentioned application No. 324,384, the pointer could be moved while a door was open and could also be moved in one direction after it had been set, but in neither case could it be reversed.)

The signal lamp S shown at top of the operating box gives three distinct signals in the same manner as in my above mentioned application, except that there is no special resistance required, as the solenoid Y acts as resistance to the signal lamp, and the signal lamp acts as resistance to the solenoid, each being accessory to the other. The signal lamp signals are:—

1st. Door open_____Light extinguished.
2nd. Door closed_____Light burns dimly.
3rd. Machine running_Light burns brightly.

These signals make it possible for the operator to know the conditions at all times practically as well as if the machine and doors were visible to him.

The operating box mechanism is contained upon a single slab of slate or other suitable insulator, and comprises the solenoid Y with interlocking undercut plungers V^1—V^2 and armature Z, two direction switches D^1—D^2, a short segment for each floor P^1—P^2—P^3, etc., and a long segment L^4 for all floors, a movable arm L^9 to which is attached the pointer U and sliding contacts L^7—L^8, which are insulated from the arm L^9. The segments P^1—P^2—P^3—P^4—etc., represent the stop circuits, as one of them is always in circuit with the long segment L^4 by means of the sliding spring contacts L^7—L^8, thus insuring that the machine will stop at the floor indicated by the pointer.

The solenoid plungers are arranged to lock together when the solenoid Y is energized. (See details Figs. 4 and 5.)

The plunger V^1 is hollow and contains a coil spring Q and brass plunger Q^1 upon which the spring acts when there is no circuit, thus opening the clutch. When there is a circuit the plungers V^1—V^2 are locked together to form a clutch, and move with the hand wheel T. The armature Z swings loosely upon the shaft to which the arm L^9 is attached, but when the solenoid Y is energized the armature Z is magnetically attracted to the plunger V^1, therefore as the plunger V^1 moves the armature Z moves with it until it engages one of the direction switches D^1 or D^2 according to the direction of rotation. When the direction switch D^1 or D^2 closes, the main reversing switch at the machine acts, shunting the operating box solenoid Y out of circuit, the shunt circuit passing through the signal lamp causing it to flash to full C. P. When the solenoid Y is deënergized the armature Z is instantly released from the plunger V^1 and snapped to a central position by the spring L^2, which also opens the direction switch. The clutch is prevented from releasing with the armature because of the friction between the jaws which are slightly undercut for this purpose, but when the hand wheel is released or reversed the spring Q is free to act and force the clutches apart. The arm L^9, which carries the pointer U, is fastened securely to the plunger V^1 and must always move with it.

From the foregoing it can be seen that the operating box solenoid performs a number of duties, *i. e.*, 1st. Acts as a resistance to the signal lamp. 2nd. Locks and unlocks the pointer from hand wheel. 3rd. Closes and opens the direction switches.

The improved indicator (see Fig. 6) comprises a metal ring J to which are fastened the floor stop contacts J^8 and the two automatics, or limit stops F^4, F^5, also a rotatable member A, which is indicated as connected with a worm gear A^1 and driven by means of a sprocket chain A^2 from the drum shaft. The member A, which is insulated from the worm gear is limited to slightly less than a complete revolution as can be seen from Fig. 6. As the car makes a full trip the member A revolves slowly from one auto-

matic to the other, the contactor B contacting at each floor stop when passing it, which incidentally closes the stop switch contacts EG. The contactor B is shown as formed on the arc of a circle and having at the center of its two arms a projection B^4. It is pivoted at the center behind the projection and held in correct position by a plunger D, which presses against a flat surface B^1 of the contactor. A coil spring K brings the two flat surfaces together with the result that when the contactor B is moved the plunger D is cammed back. This construction makes the contactor B very flexible and prevents any possibility of an open circuit taking place at the floor stop contacts when they are set close together. The frame C to which B is pivoted and which acts as a stop to limit the swinging thereof, is arranged to slide on two retaining screws J^1—J^2, having corresponding slots (not shown). At the back end of plunger D is the screw contact E, the threaded portion being for the purpose of adjusting the space between the contacts E and G. A guide plate F allows the contact E to slide but prevents it from turning. The carbon faced spring contact G is connected electrically with a sliding contact H. Another sliding contact H^1 is electrically connected with the parts A, B, C, D, E and F. Therefore the two stationary contact members or rings L^5—L^6 on which the contacts H^1 and H bear are electrically connected when the stop switch contacts E and G are together. The floor stop contacts and automatics are of course all insulated from each other. The floor stop contacts are adjustable laterally in both directions and are provided with brass rollers which contact with the contactor B. The slow speed effect takes place when the contactor B touches the floor stop contact at which it is to stop. The contactor B adjusts itself to the roller and the contact becomes greater as the former nears a central position with the roller. When the protecting or V-shaped point B^4 engages the roller, the frame C is quickly forced back closing the stop switch contacts E G (Figs. 7 and 8) and causing the machine to stop. When the floor stop contacts are in correct position on the ring and are all exactly on the same radius from the center it is a very simple matter to adjust the automatic stopping of the car in both directions by removing the guide plate F and adjusting the screw contact E.

The stop switch contacts E—G close sooner or later according to the space between them and thereby effect the stopping of the machine. The limit switches F^5—F^4 are adjustable limit stop switches, set to open immediately when the car fails to stop at either limit.

It will be seen that all the above mentioned objects and advantages are attained in a very efficient manner with the employment of comparatively simple and inexpensive mechanism and without unnecessary complications in the wiring system.

While I have illustrated and described only one form of the invention and shown its application to only one form of electric dumb-waiters, I am aware that many modifications may be made therein and that it may be applied to other forms of electric as well as hydraulic and other elevator systems without departing from the scope of this invention as expressed in the claims, therefore I do not wish to be limited to all the details and forms shown, but

What I do claim is:—

1. In an elevator system, the combination of a car, a controlling mechanism, a main switch having solenoids for controlling the direction of motion of the car, means for connecting said solenoids with a source of electrical energy comprising a pair of direction solenoid switches, and means for preventing the operation of the controlling mechanism keeping the direction solenoid switches in the circuit independent of the main switch solenoids after they have connected one of the main switch solenoids with the source of energy, whereby if the main switch circuit is opened the direction solenoid switches will remain in the circuit.

2. In an elevator system, the combination of a controlling mechanism independent of the elevator car, a pair of direction solenoid switches, electrical connections from the controlling mechanism to said switches, a main switch having two solenoids, connections from each of said direction solenoid switches to one of said main switch solenoids, said direction solenoid switches each having means for keeping closed the last named connections when a solenoid of the main switch is deënergized and for preventing the operation of the controlling mechanism.

3. In an elevator system, the combination of a car, a controlling mechanism, a main solenoid switch, a direction solenoid switch for connecting the solenoid of the main switch with a source of electrical energy, means for keeping the direction solenoid switch in circuit independently of the main switch solenoid after the former has connected the main switch solenoid with the source of energy, and a plurality of door switches in series with the main switch solenoid and with the controlling mechanism, whereby if one of said door switches is opened, the main switch will be thrown out of the circuit, the direction solenoid switch will remain in the circuit and the controlling mechanism cannot be operated.

4. In an elevator system, the combination of a controlling mechanism, a main switch having a pair of solenoids, connections for

supplying current to said solenoids, a direction solenoid switch, a plurality of door switches, said door switches being arranged in a series circuit with the main switch solenoids and controlling the mechanism, said series circuit being in parallel with the direction switch solenoids, and means operated by opening said door switches to break the series circuit, thereby leaving said parallel circuit undisturbed and the controlling mechanism inoperative.

5. In an elevator system, the combination with upper and lower limit switches connected in series with each other and connected with the main for supplying current, said limit switches being adapted to break the circuit, of a main switch having two solenoids, each adapted to be connected in series with said limit switches, said solenoids also being connected with the other supply main, a pair of direction switches, and a pair of direction switch solenoids in parallel with the main switch solenoids, and in series with said limit switches, and means for operating said limit switches.

6. In an elevator system, the combination with limit switches, of a main switch having two solenoids, each adapted to be connected in series with said limit switches, said solenoids also being connected with the supply main, a pair of direction switches, a pair of direction switch-solenoids in parallel with the main switch solenoids, and in series with said limit switches, and means for operating said limit switches.

7. In an elevator system, the combination of a controlling mechanism, a pair of direction solenoid switches, electrical connections from the controlling mechanism to said switches, a main switch having two solenoids, connections from each of said direction solenoid switches to one of said main switch solenoids, said direction solenoid switches each adapted to remain energized to keep closed the last named connections when a solenoid of the main switch is deenergized, and the main switch having means for supplying a shunt current through a path for causing the machine to stop.

8. In an elevator system, the combination of a car, a controlling mechanism, a main switch having solenoids for controlling the direction of motion of the car, a stop-switch solenoid and a circuit for said stop switch solenoid said main switch constituting means for establishing a shunt current through said circuit and means for breaking the stop switch solenoid circuit after one of the main switch solenoids has been connected with a source of power.

9. In an elevator system, the combination of a car, a main switch having solenoids for controlling the direction of motion of the car, a stop switch solenoid, a circuit for said stop switch solenoid, said main switch having means for establishing a shunt current through said circuit, and means for thereafter breaking the stop switch solenoid circuit.

10. In an elevator system, the combination of a car, a controlling mechanism, a main switch having solenoids for controlling the direction of motion of the car, a stop switch solenoid, said controlling mechanism having means for establishing a shunt current through said stop switch solenoid to deënergize the main switch solenoids, said main switch constituting means for breaking the stop switch solenoid circuit after one of the main switch solenoids has been deënergized.

11. In an elevator system, the combination of a car, a controlling mechanism, a main switch having solenoids for controlling the direction of motion of the car, and a stop switch solenoid, said controlling mechanism having means for establishing a shunt current through said stop switch solenoid to deenergize the main switch solenoid.

12. In an elevator system, the combination of a car, a main solenoid switch having connections for operating the car, a stop switch having a solenoid, and contacts in the main solenoid switch circuit adapted to be opened by the stop switch, said main switch constituting means for breaking the stop switch solenoid circuit, whereby when a shunt current is sent through said stop switch solenoid the controlling circuits will be broken and the shunt circuit through the stop switch solenoid will be broken by the main switch.

13. In an elevator system, the combination of a car, a main solenoid switch having connections for operating the car, a stop switch having a solenoid, and contacts in the main solenoid switch circuit adapted to be opened by the stop switch, said main solenoid switch constituting means for breaking the stop switch solenoid circuit, and an indicator comprising means for closing a break in a shunt circuit through the stop switch solenoid as the car passes each floor.

14. In an elevator system, the combination of an operating mechanism, a motor, means connected with the operating mechanism for directly controlling the operation of the motor, a plurality of motor stopping circuits in parallel with each other, having means for reducing the speed of the motor before stopping it, and a floor indicator connected with said operating mechanism and constituting means for closing the motor stopping circuits at the several floors.

15. In an elevator system, the combination of an operating mechanism, a motor, means connected with the operating mechanism for directly controlling the operation of the

motor, and a plurality of motor stopping circuits in parallel with each other, having means for reducing the speed of the motor.

16. In an elevator system, the combination of a car, a motor, a controlling mechanism comprising a movable member which by its position determines the floor at which the car is to stop, means connected with the controlling mechanism for directly controlling the operation of the motor with a floor indicator having a movable member, a plurality of motor stopping circuits in parallel with each other for controlling the stopping of the car and for reducing the speed of the car before stopping, and means for causing the last named movable member to travel proportionately to the travel of the car.

17. In an elevator system, the combination of a car, a main switch, a controlling mechanism comprising a movable member which by its position determines the floor at which the car is to stop, a floor indicator having a movable member adapted to travel proportionately to the travel of the car, means controlled by said floor indicator and controlling mechanism for stopping the car and for reducing the speed of the car before stopping, and limit circuits independent of said controlling mechanism controlled by the main switch for stopping the car at another floor if it passes the floor determined by the controlling mechanism.

18. In an elevator system, the combination of a car, a main switch, a controlling mechanism, a stopping device, a floor indicator having a plurality of floor stops, connections from said floor stops through the controlling mechanism for establishing a current to operate said stopping device, and limit circuits independent of said controlling mechanism adapted to be closed by the main switch, for operating said stopping device.

19. An elevator system, comprising a floor indicator having floor stops, a stopping device, a main switch, a controlling mechanism, and two sets of circuits adapted to be closed respectively by the main switch and by the controlling mechanism, and both connected with said floor indicator for operating said stopping device.

20. In an elevator system, the combination of a floor indicator, a stop switch having a solenoid, a main switch, a controlling mechanism, and two sets of circuits connected with said stop switch solenoid and adapted to be closed respectively by the main switch and by the controlling mechanism.

21. In an elevator system, the combination of a car, a stop switch provided with a solenoid and having means for stopping the car at a predetermined floor, circuits for operating said solenoid when the car reaches said floor, and independent limit circuits adapted to energize said stop switch solenoid at another floor if it passes the said predetermined floor.

22. In an elevator system, the combination with a main switch having an up solenoid and a down solenoid, and auxiliary switches, of a stopping device, a floor indicator, and means whereby while the floor indicator is moving in either direction the operating solenoid of the main switch will cause a circuit to be made for operating the stopping device ready to be completed when the floor indicator indicates that the elevator car has reached the last floor.

23. In an elevator system, the combination of a slow speed solenoid switch, a stop solenoid switch, a conductor from the solenoid of each of said switches, a floor indicator having two contact members, one connected with each of said conductors, a plurality of floor stops, a movable member adapted to engage said stops and having means for connecting said contact members when it engages any one of the stops, and for connecting that stop with both of said contact members, and means connected with said floor stops for completing the circuits through said solenoids.

24. In an elevator system, the combination of a slow speed solenoid switch, a stop solenoid switch, a conductor from the solenoid of each of said switches, a floor indicator having two contact members, one connected with each of said conductors, a plurality of floor stops, a movable member adapted to engage said stops and having means for connecting said contact members when it engages any one of the stops and for connecting that stop with both of said contact members, a controlling device, means connected with said floor stops and with said controlling device for completing the circuits from said solenoids, and independent limit circuits connected with said floor indicator for completing said circuits independently of the controlling device.

25. In an elevator system, the combination of a slow speed solenoid switch, a stop solenoid switch, a conductor from the solenoid of each of said switches, a floor indicator having two contact members, one connected with each of said conductors, a plurality of floor stops, a movable member adapted to engage said stops and having means for connecting said contact members with any one of the stops when it engages it, a controlling device, means connected with each floor stop and with said controlling device for completing the circuits from both of said solenoids, independent limit circuits connected with said floor indicator for completing said circuits independently of the controlling device, and a mai switch having auxiliary switches adapted to close the last named circuits when the main switch is in the circuit.

26. In an elevator system, the combination of a car, a floor indicator having two contact members, a plurality of floor stops, a movable member adapted to engage said floor stops in succession and having means for connecting said contact members with each other when it engages any one of the floor stops and for connecting both of them with the floor stop engaged, and operating circuits connected with said floor stops and adapted to be closed by the movable member.

27. A floor indicator for an electric system, comprising two contact members, operating circuits connected with said members, a plurality of floor stops, a movable member adapted to engage said floor stops in succession and having means for automatically making an electric connection between said contact members and any one of the floor stops when said movable member engages the floor stop.

28. In an indicator for an electric system, the combination of a pair of contact members, a plurality of floor stops, a movable member adapted to engage said floor stops in succession and having means whereby upon engaging a floor stop it first connects said floor stop electrically with one of said contact members and thereafter connects said contact members with each other so that both of them are connected with the floor stop.

29. In an indicator of the class described, the combination of two circular contact members insulated from each other, a movable member adapted to turn on an axis passing through the center of said contact members, a plurality of floor stops arranged in position to be engaged by said movable member, and means on the movable member for first electrically connecting a floor stop with one of said contact members and thereafter closing a contact, during the continued travel of a movable member, for connecting the other of said contact members with the first one and with the floor stop.

30. In an electrical controlling system, the combination of a hoisting machine, an indicator comprising a pair of stationary rings, a series of floor stop contacts, a rotary contactor having means thereon for electrically connecting said rings whenever said contactor comes fully into engagement with any one of said floor stop contacts, a circuit for controlling the operation of the machine connected with one of said rings, a circuit connected with the other of said rings, and a stop switch solenoid located in said second circuit.

31. In an electrical controlling system, the combination of a hoisting machine, an indicator comprising a pair of stationary rings, a series of floor stop contacts, a rotary contactor having means thereon for electrically connecting said rings whenever said contactor comes fully into engagement with any one of said floor-stop contacts, a circuit for controlling the operation of the machine connected with one of said rings, a motor, and a circuit connected with said motor and with the other of said rings.

32. In an electrical controlling system, the combination of an indicator comprising a pair of stationary rings, a series of floor stop contacts, and a rotary contactor having means thereon for electrically connecting said rings whenever said contactor comes into engagement with any one of said floor stop contacts.

33. An indicator for an electrical controlling system comprising a series of contacts, and a movable member having a contactor pivoted thereon adapted to engage said series of contacts in succession during the motion of said member, and having a contact surface projecting therefrom at a slight angle to the direction of motion of the movable member.

34. An indicator for an electrical controlling system comprising a series of floor stop contacts arranged in a circle, and a rotary member having a contactor pivoted thereon and having a central projection and oppositely extending arm, all adapted to engage said series of contacts in succession during the rotation of said member.

35. A contactor for an indicator comprising a pivoted bar having a central projection opposite the pivotal point, and arms extending outwardly therefrom between said projection and the pivot and movable in the path of the end of said projection.

36. A contactor for an indicator comprising a pivoted bar having a central projection opposite the pivotal point, arms extending rearwardly therefrom, and resilient means for normally holding said contactor against turning on its pivot.

37. An indicator comprising a moving member having a frame slidingly mounted thereon, a contact movable with said frame, a second contact adapted to be engaged thereby when the frame moves, and a contactor on the outer end of the frame mounted to swing thereon on a pivot.

38. In an indicator for an electrical controlling system, the combination of a rotatable member, a frame arranged to slide thereon, a contactor pivoted on said frame and having a surface extending behind the pivot on which it is mounted, a plunger located in position to engage said surface and normally hold said contactor against turning on its pivot, and a spring for holding said plunger yieldingly against the contact.

39. A contactor for an electric controlling system having a contacting member provided with a curved surface and a wedge-shaped projection between the ends thereof, a pair of stop switch contacts, a screw

plunger adjustable to regulate the space between the stop switch contacts, whereby the time required for closing said contacts can be adjusted to regulate the stopping of the car:

40. An indicator for an electric system comprising a contacting device provided with a movable member having a curved surface having a projection between the ends thereof, a pair of stop switch contacts, and adjustable means whereby when said projection meets an obstruction the contact will be moved into engagement with each other and whereby the time required for closing said contacts can be adjusted.

41. An electric indicator comprising a contacting device having a movable member provided with a projection between the ends thereof, a pair of contacts connected with said movable member whereby when said projection meets an obstruction, one of said contacts will be caused to move against the other, and means for adjusting one of said contacts whereby the time required for closing them can be regulated.

42. In an indicator for an electrical controlling system, the combination of a rotatable member, a frame arranged to slide thereon, a contactor pivoted on said frame and having a surface extending behind the pivot on which it is mounted, a plunger located in position to engage said surface and normally hold said contactor against turning on its pivot, a contact adjustably mounted on said plunger, and yielding means for forcing said plunger toward the contactor to hold the latter yieldingly against turning.

43. In an indicator for an electrical controlling system, the combination of a rotatable member, a frame arranged to move thereon, a contactor pivoted on said frame, a plunger located in position to engage said contactor and normally hold it against turning on its pivot, a pair of spring-pressed contacts connected with said plunger, said rotatable member having a pair of spring-pressed contacts thereon, insulated from each other, each of said contacts being connected with one of said first named spring-pressed contacts, and a controlling system connected with the first named pair of spring pressed contacts.

44. In an elevator system, the combination of a car, a floor indicator having two contact members, a plurality of floor stops, a movable member adapted to engage said floor stops in succession and having means for connecting said contact members with each other when it engages any one of the floor stops and for connecting both of them with the floor stop engaged, operating circuits connected with said floor stops and adapted to be closed by the movable member, automatic limit stops connected with the indicator, and means for stopping the car if the movable member engages either of said stops.

45. In an elevator system, the combination of a direction switch, a magnetically controlled clutch therefor, and automatic limit stops in series with each other and with said switch and clutch, whereby said switch and clutch are rendered inoperative when either of said stops is open.

46. In an elevator system, the combination of a car, direction switches, a magnetically controlled clutch for operating the direction switches, a pair of limit stops, both in series with each other, and with said switches, whereby when one of said limit stops is open, the switch will be rendered inoperative by the deënergizing of the clutch.

47. In an elevator system, the combination of a car, a controlling device comprising a solenoid, connections from said controlling device for controlling the operation of the elevator car, a test switch in series with said solenoid, whereby when the test switch is open the solenoid circuit is broken, direction switches, each having a solenoid and capable of being operated by hand, an indicator having floor stop contacts, and a conductor connected with one pole of said switch and adapted to be held against any one of said floor stop contacts.

48. In an elevator system, the combination of a car, a controlling device comprising a solenoid, connections from said controlling device for controlling the operation of the elevator car, a test switch in series with said solenoid, whereby when the test switch is open the solenoid circuit is broken, direction switches, each having a solenoid and capable of being operated by hand, an indicator having floor stop contacts, a conductor connected with one pole of said switch and adapted to be held against any one of said floor stop contacts, and connections from said floor stop contacts adapted to be completed by said wire for stopping the car.

49. In an elevator system, the combination of a car, a controlling device, comprising a solenoid, connections from said controlling device for controlling the operation of the elevator car, a test switch in series with said solenoid, whereby when the test switch is open the solenoid circuit is broken, direction switches, each having a solenoid and capable of being operated by hand, an indicator having floor stop contacts, a conductor connected with one pole of said switch and adapted to be held against any one of said floor stop contacts, and a series of door switches adapted to be short circuited by reversing the test-switch.

50. In an elevator system, the combination of a controlling device, a test switch having two pairs of poles, one pole of one pair connected with the line, a series of door switches connected with both poles of the

same pair, the other two poles being connected with the controlling device, whereby when the first two poles of the test switch are connected the door switches will be short circuited and the circuit to the controlling device broken.

51. In an elevator system, the combination of a car, direction switches, a plurality of door switches, a magnetically controlled clutch in series with said door switches for operating the direction switches, and a pair of limit stops in series with each other and with said direction switches, whereby when one of said limit stops or door switches is open the clutch will be deënergized.

52. In an elevator system, the combination of a plurality of door switches, a car, means for controlling the operation of the car comprising a handle, a pointer controlled by the handle, a pair of direction switches, means for connecting the pointer with the handle so that the pointer can be moved thereby, and means whereby if the handle is released or reversed, the pointer is automatically released from the handle.

53. In an elevator system, the combination of a series of door switches, a car, means for controlling the operation of the car comprising a handle, a pointer controlled by the handle, a magnetically controlled clutch for connecting the pointer and handle, whereby the pointer can be moved, and means whereby the reverse motion or the releasing of the handle will render said magnetically controlled clutch inoperative.

54. In an elevator system, the combination of a movable controlling member, direction switches, means magnetically connected with said controlling member for closing said switches, and a series of door switches, said member and door switches being electrically connected in series, whereby when one of said door switches is open all of said mechanism will be rendered inoperative.

55. In an elevator system, the combination of a movable controlling member, direction switches, means for magnetically operating said member, and a series of door switches connected in series with said magnetic means, whereby the magnetic means will be deënergized when any one of said door switches is open.

56. In an electric system, the combination of a car, a door switch, operating mechanism, said operating mechanism having a pointer provided with connections for controlling the destination and direction of motion of the car, a pair of direction solenoid switches, said door switch and direction switches being connected with the same main, one of the direction switches being in circuit when the machine is inoperative from the opening of the door switch, whereby the pointer cannot get permanently out of position with respect to the car.

57. In an electric system, the combination of a door switch, operating mechanism in series therewith, a direction solenoid switch having a circuit adapted to remain closed when the door switch is open, whereby under all conditions the opening of the door switch will cause the operating mechanism to remain inoperative, and the direction solenoid switch to remain in condition for immediate action.

58. In an electric system, the combination of door switches, hand-operated operating mechanism in series therewith, and a direction solenoid switch in a circuit independent of said door switches and operating mechanism, whereby it will remain in circuit when one of said door switches is open and the operating mechanism is inoperative.

59. In an elevator system, the combination of direction switches, means for closing said switches, direction solenoid switches connected with the direction switches so as to be supplied with current therethrough when the direction switches are closed, a main switch, a signal, door switches in series with the signal and connected with the same main as the direction solenoid switches, and means controlled by the main switch for sending a current through said signal, whereby when a door switch is open the signal will be deenergized and one of the direction solenoid switches will remain in circuit.

60. In an elevator system, the combination of a car, a controlling device comprising a solenoid, connections adapted to be operated and controlled by said solenoid for controlling the operation of the car, a signal in series with said solenoid when the latter is energized, and means whereby said solenoid may be short-circuited.

61. In an electrical elevator system, the combination of a controlling device comprising a solenoid, a signal lamp normally in series with said solenoid, whereby said solenoid acts as a resistance to dim the light when the solenoid is in circuit and the light acts as a protective resistance to the solenoid, and means whereby the current is caused to pass through the signal lamp to light it to the full candle power and the solenoid is deënergized, when the machine is running.

62. In an electric elevator system, the combination of a controlling device comprising a solenoid, a signal lamp normally in series with said solenoid, whereby the solenoid acts as a resistance to dim the light and thus show the condition of the solenoid, and means whereby the current is caused to pass through the signal lamp to light it to full candle power.

63. In an electric elevator system, the combination of a door switch, an electric signal device adapted to indicate when the door switch is open, and a direction solenoid

switch arranged and adapted to remain in circuit when the door switch is open.

64. In an electric elevator system, the combination with a car, of a series of door switches, an electric signal device arranged to indicate when a door switch is open, and a direction solenoid switch arranged to remain in circuit when a door switch is open ready to act to control the direction of the car upon the reëstablishment of circuit through the door switches.

65. In an electric elevator system, the combination of a door, an electric signal device, direction solenoid switches, and means whereby when a door is open the signal device indicates the same and one of the direction solenoid switches remains in circuit.

66. In an electric elevator system, the combination with a car, of a series of doors, an electric signal device, direction solenoid switches, and means whereby when a door is open, the signal device indicates the same and one of the direction solenoid switches remains in circuit ready to act to control the direction of the car upon the reëstablishment of a circuit.

67. In an electric elevator system, the combination of a hoisting machine, door switches, an electric signal device, direction solenoid switches, a solenoid clutch, and means whereby when the machine starts the signal device is caused to act at full power.

68. In an electric controlling system for elevators, the combination with a car, of an operating mechanism adapted to control the destination of the car and to be thereafter automatically rendered inoperative, door switches so arranged that when one of the door switches is open the operating mechanism is thrown entirely out of circuit, and a signal device arranged to be thrown out of circuit when one of the door switches is open to show that the machine is stopped and to be thrown into circuit at full power when the machine is running.

69. In an electric controlling system for elevators, the combination of a car, a series of well-room doors, a switch for each door adapted to open when the door is opened, an operating box for controlling the system, direction solenoid switches having means for controlling the direction in which the car shall start, said operating mechanism comprising a pointer indicating the destination of the car, and having connections for stopping the car at the destination indicated, connections controlled by said pointer for stopping the car at the proper floor, and means whereby if one of said doors is opened while the machine is running, the operating mechanism will be entirely thrown out of circuit, and one of the direction solenoid switches will remain in circuit thus insuring that the car will start in the right direction when the door is again closed, but the pointer will be left set insuring the stopping of the car at the proper floor.

70. In an electric elevator system, the combination with a car, of a series of well-room doors, a switch connected with each door to be closed when the door is closed, a signal lamp connected and arranged to burn dimly when all the doors are closed, a plunger clutch, an armature for said clutch, means connected with said clutch for controlling the destination of the car, and means controlled by said armature for controlling the direction of motion of the car, and means whereby when all the doors are closed, the plunger clutch is closed, and the armature is caused to move with the plunger.

71. In an electric elevator system, the combination with a car, of a controlling handle, a pointer for indicating the destination of the car, a normally open two part plunger clutch one part of which is connected with the handle and the other with the pointer, an armature adapted to be controlled by the clutch, direction switches controlled by said armature, a main solenoid switch, a signal lamp, means whereby when the machine is ready to start and the handle is moved the plunger clutch is caused to close and move the pointer, the armature being arranged to operate one of the direction switches, the direction switch to close the main switch solenoid circuit, and the main switch to operate the signal lamp to burn brightly and to release the armature while the two parts of the plunger clutch hang together mechanically, and means whereby the machine is caused to run.

72. In an electric elevator system, the combination with a car, of a controlling handle, a pointer for indicating the destination of the car, a plunger clutch connected with the handle for moving the pointer, an armature adapted to be controlled by the clutch, direction switches controlled by said armature, a main solenoid switch, a signal lamp, a plunger clutch solenoid for causing the clutch to close, whereby the handle is caused to move the pointer, the armature being constructed and arranged to operate one of the direction switches, the direction switch to close the main switch solenoid circuit, and the main switch to operate the signal lamp to burn brightly and to short circuit the plunger clutch solenoid so as to release the armature, means whereby the machine is caused to run, and means whereby if the handle is released or reversed, the sections of the plunger clutch are caused to separate whereby the handle has no further control of the pointer.

73. In an elevator system, the combination of a car, a dial indicating the floors, a pointer adapted to coöperate with the dial to show the destination of the car, magnetic means connected with the pointer for con-

trolling the destination of the car, and a signal for indicating when the car is moving, when it is at rest but ready to move, and when the system is in inoperative condition.

74. An operating mechanism for an elevator car, comprising a dial indicating floors, a pointer adapted to coöperate with the dial to show the destination of the car, magnetic means connected with the pointer for controlling the operation of the car, and a signal comprising means for indicating when the car is moving, when it is at rest but ready to move, and when the system is inoperative.

75. The combination with a hoisting machine, a car, and a controlling device therefor, of magnetic operating means for the controlling device electrically connected therewith, a pointer connected with said operating means for indicating the destination of the car, and a signal constructed and adapted to indicate more than two different conditions of the apparatus.

76. The combination with a hoisting machine, a car, and a controlling device therefor, of magnetic operating means for the controlling device electrically connected therewith, means for operating the machine, and means for indicating the destination of the car.

77. In an elevator system, the combination of a car, a pointer for controlling the destination of the car, a handle for operating the pointer, means controlled by the handle for starting the car, and means for releasing the pointer from the handle, so that the pointer cannot be turned thereby.

78. In an elevator system, the combination of a car, a pointer for controlling the destination of the car, a handle for operating the pointer, means controlled by the handle for starting the car, and a magnetic device connected with said means for starting the car for releasing the pointer from the handle so that the handle may be turned freely in either direction without moving the pointer.

79. In an elevator system, the combination of a car, a pointer for controlling the destination of the car, means for starting the car controlled by the handle, means for stopping the car at the floor indicated by the pointer, a handle for operating the pointer, and means for automatically releasing the pointer from the control of the handle adapted to operate whenever the handle is once turned in either direction and then released from the control of the hand.

80. In an elevator system, the combination of a hoisting machine, an operating box having a movable pointer, a handle for moving the pointer, means whereby when the handle is started in either direction and then released the pointer will be released from all further control of the handle until the machine stops, and electrical means for controlling the operation of the hoisting machine directly from said handle.

81. In an elevator system, the combination of a hoisting machine, a movable pointer, an operating handle for moving the pointer, means whereby when the machine is at rest the turning of the handle in either direction will turn the pointer, means whereby if the handle is released after being started, the pointer cannot again be moved by it until the machine comes to rest, means controlled by said handle for starting the hoisting machine in either direction and for stopping it, and an operating box inclosing said means.

82. In an elevator system, the combination of a car, a handle for controlling the operation of the car, means controlled by the handle for starting the car, and magnetic means for controlling the operation of the handle, said magnetic means being rendered inoperative whenever the handle is once turned backward or released after being started.

83. A controlling mechanism for an elevator system, comprising a controlling arm, a series of contacts with which said arm is adapted to engage, each contact representing a floor in the elevator well, means for moving said arm along said contacts, and means for releasing said arm and preventing the movement thereof in either direction after it is once started, and then reversed or released, until the elevator car has moved to and stopped at the floor indicated by the position of the arm when so reversed or released.

84. A controlling mechanism for an elevator system, comprising a handle, a movable controlling member, direction switches, and a magnetically controlled clutch having connections for releasing said member from the handle.

85. In an operating box for an electrical controlling system, the combination of a handle adapted to turn on an axis, a controlling device, and a clutch between the controlling device and the handle having means for disengaging the controlling device from the handle if the handle is reversed, or released during its motion in either direction.

86. In a controlling device for an electrical controlling system, the combination of a handle adapted to turn on an axis, a pointer, and a clutch between the handle and pointer, whereby the pointer may be moved by the handle, said clutch having means for disengaging it from the handle whenever the latter is released or reversed.

87. In a controlling device for an electrical controlling system, the combination of a handle adapted to turn on an axis, a pointer, and a clutch between the handle and pointer, whereby the pointer may be moved by the

handle, said clutch having means for disengaging it from the handle whenever the latter is released or reversed, whereby the handle may then be turned in either direction without moving the pointer, and means for moving the clutch back into position to be reëngaged by the handle.

88. In an electrical controlling system, the combination of a handle adapted to turn on an axis, a pointer adapted to be moved by the handle, connections from the pointer for controlling the operation of the machine in accordance with the position of the pointer, means between the handle and pointer whereby after the handle is started in either direction, the releasing or reversing thereof will release the pointer from the handle, and means connected with said controlling system for restoring the parts to a position in which the handle can again engage the pointer when the machine to be controlled is at rest.

89. In a controlling device for an electric controlling system, the combination of a movable handle, a pointer, direction switches, and a double clutch controlled by the handle for connecting the pointer and the direction switches therewith so as to move with the handle.

90. In a controlling device for an electric controlling system, the combination of a handle, a pointer, direction switches, a double clutch for connecting the handle with the pointer and direction switches, said clutch having means for disengaging it from the handle whenever the latter is released or reversed, whereby the handle may then be turned in either direction without moving the pointer or closing the direction switches.

91. In an operating box for an electrical controlling system, the combination of a handle adapted to rotate on an axis, a solenoid, a plunger within said solenoid having a clutch section adapted to receive motion from the handle, a spring connected with the plunger for normally forcing the clutch section into inoperative position, an armature normally in central position adapted to rotate with the plunger when the solenoid is energized, and a pointer connected with said armature to rotate therewith.

In testimony whereof I have hereunto set my hand, in the presence of two subscribing witnesses.

EDWARD L. DUNN.

Witnesses:
ALBERT E. FAY,
C. FORREST WESSON.