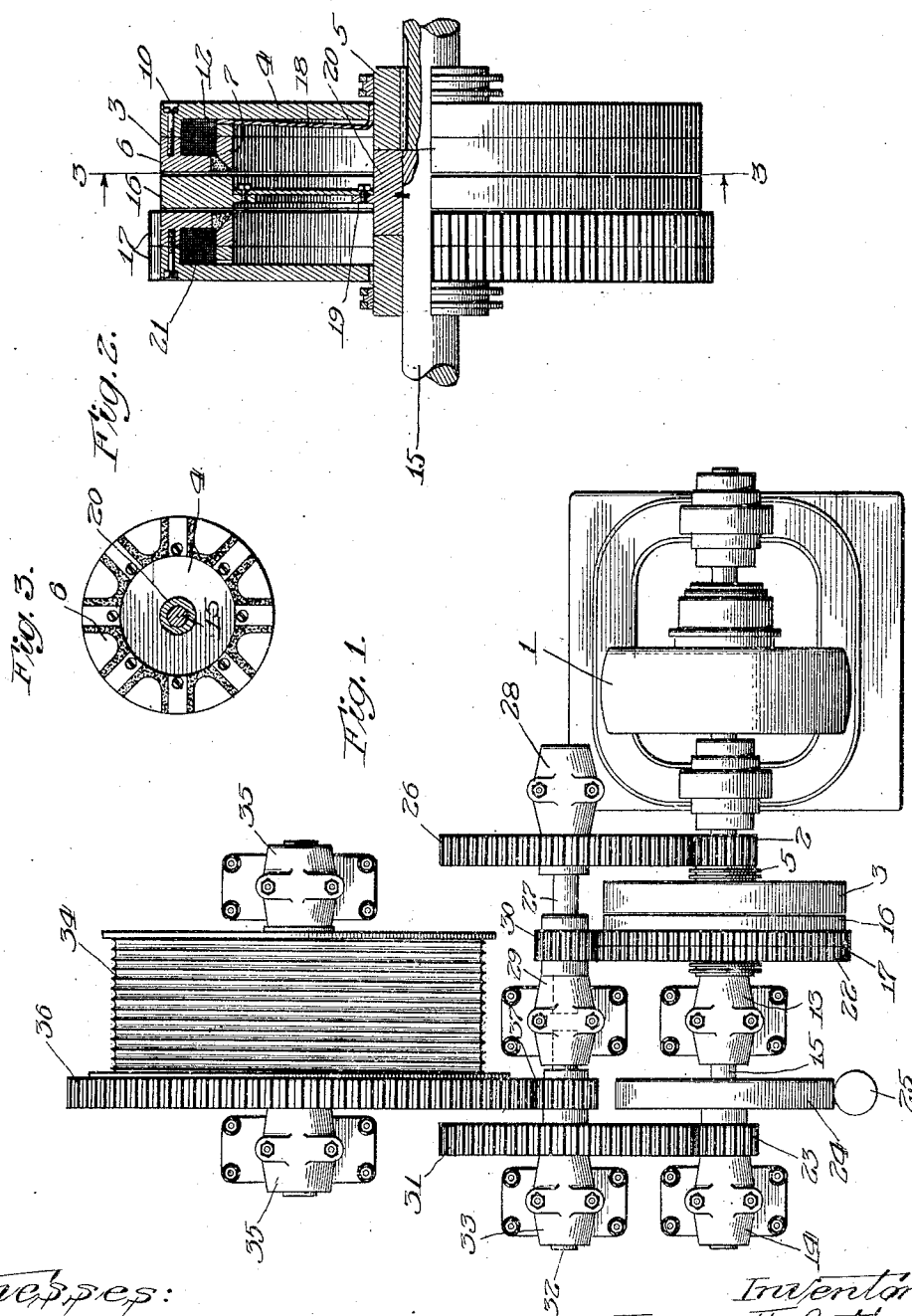


H. H. CUTLER.
ELECTRICALLY CONTROLLED SKIP HOIST.

APPLICATION FILED JULY 20, 1904.

2 SHEETS—SHEET 1.



Witnesses:
Robert H. Weir
M. Perry Hahn

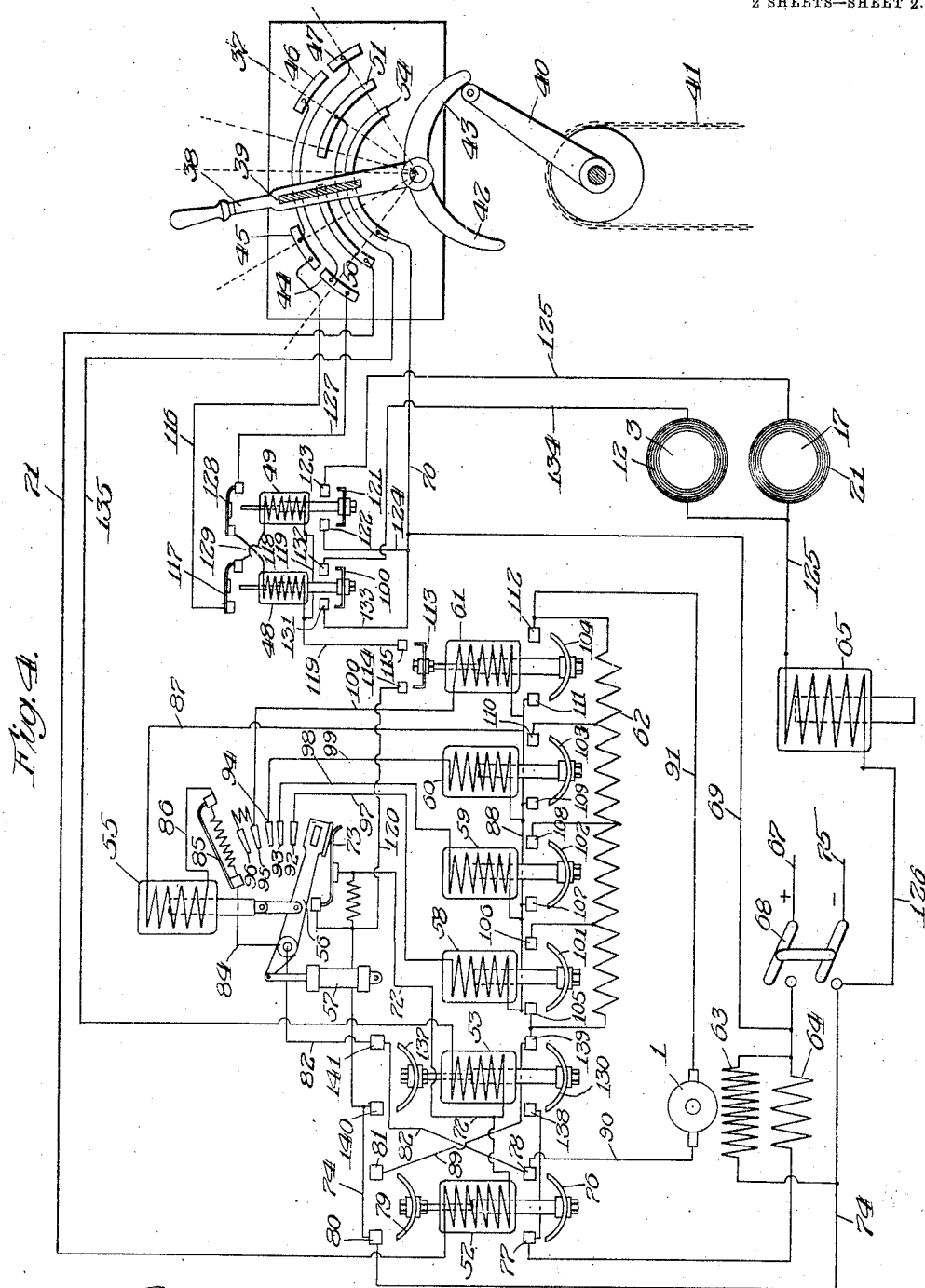
Inventor:
Henry H. Cutler
By: Jones & Asaington
Attorneys:

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UNITED STATES PATENT OFFICE.

HENRY H. CUTLER, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE CUTLER-HAMMER MANUFACTURING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

ELECTRICALLY-CONTROLLED SKIP-HOIST.

No. 844,662.

Specification of Letters Patent.

Patented Feb. 19, 1907.

Application filed July 20, 1904. Serial No. 217,418.

To all whom it may concern:

Be it known that I, HENRY H. CUTLER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Electrically-Controlled Skip-Hoists, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to means for automatically stopping load-carrying devices in approximately the same position irrespective of the load which the machine may be carrying at the time.

It is particularly applicable to skip-hoists, ingot-buggies, traveling cranes, &c.

For the purpose of illustration I have shown my invention as applied to the operating machinery of a skip-hoist, preferably driven by an electric motor. In using a skip-hoist in rolling-mills for carrying ore, coke, and other material to the top of the cupola or steel-converters if the skip runs over, it will fall into the hopper of the furnace and cause considerable damage. On the other hand, if it stops too soon it cannot dump its load. It is of great importance, therefore, to stop the same at exactly the same spot at every trip, irrespective of the weight of the load being carried. The variation on the load of a skip-hoist, as the skip-hoist is adapted to carry coke, which is extremely light, or iron ore, which is extremely heavy, makes it impracticable to rely upon any friction devices for accurately stopping the skip at the proper point.

To accomplish the object of my invention, I automatically slow down the speed of the skip before the same reaches its final stopping place, thereby destroying the momentum of the skip and permitting the same to be stopped by means of the ordinary type of friction-brake.

In the drawings showing the application of my invention to a skip-hoist, Figure 1 is a plan view of my device. Fig. 2 is a partial sectional view of the magnetic clutch employed in connection with my device. Fig. 3 is a face view thereof, and Fig. 4 is a diagrammatic view of the circuits employed.

In the drawings I have shown a motor 1 for driving a skip-hoist, having keyed to the

shaft thereof a small pinion 2. Also secured upon the shaft of the motor is the field of a single magnetic clutch 3, comprising a back plate 4, integrally formed with a hub 5, suitably keyed upon the shaft of the armature member of the motor. To the back plate 4 are secured a pair of rings 6 and 7, the ring 6 carrying inwardly-extending polar projections 8 and the ring 7 carrying outwardly-extending polar projections 9, the two sets of poles being arranged in overlapping positions and held in position against the back plate 4 by bolts or screws 10. The spaces between the pole-pieces are filled with non-magnetic material 11, which may be Babbitt metal or other equivalent material.

An annular channel is provided in the face of the back plate 4, and the rings 6 and 7 when placed together form in conjunction therewith an annular channel for the reception of the annular winding 12 of the clutch.

Suitably journaled in the independent bearings 13 and 14 is an independent shaft 15 in alinement with the shaft of the motor, and keyed upon said shaft 15 is an annular armature member 16. The armature member 16 is of annular form and secured to the outer periphery of a spring-disk 18, the inner face of which is secured to a flange 19 upon the hub 20, keyed to the shaft 15. A magnet member 17 is loosely mounted upon the shaft 15 and has formed on the outer periphery thereof gear-teeth 22. The magnet member 17 is of the same general construction as the magnet member 3 and is provided with an energizing-winding 21. Upon the opposite end of the shaft 15 is keyed a pinion 23 and a brake-wheel 24, which is adapted to be engaged by an electrically-controlled friction-brake 25. A gear-wheel 26, keyed upon a jack-shaft 27, suitably mounted in journals 28 and 29, is adapted to mesh with the pinion 2. A pinion 30, also keyed upon the jack-shaft 27, meshes with the gear-teeth 22, formed on the outer periphery of the magnet member 17, and a gear-wheel 31, mounted upon a shaft 32, journaled in the bearings 29 and 33, meshes with the pinion 23. The winding-drum 34 is mounted upon a shaft suitably journaled in the journals 35 and 36, which is adapted to mesh with a pinion 37, mounted upon the shaft 32.

In operating the device it will be seen that if current be admitted to the energizing-winding 21 the magnet member 17 will be attracted to the armature 16 and motion will be transmitted from the motor through the pinion 2 and gear 26, driving the shaft 27, which in turn will operate the shaft 15 through the pinion 30 meshing with the gear-teeth 22. The pinion 23 will thus be caused to operate, and through it the shaft 32, driving the winding-drum 34 through the pinion 37 and gear 36 at a greatly-reduced speed. On the other hand, if the magnet member 12 be energized the shaft 15 will be driven without the intervention of the gear 26 and pinion 30 at a much higher speed, thereby increasing the speed of the winding-drum.

In Fig. 4 I have illustrated the electric circuits and apparatus for controlling my device. A hand-operated switch having the lever 38, which carries a brush 39, is provided for controlling the motor and the respective clutches. The operator's switch is so designed that when the skip approaches the limit of its travel the traveling nut mechanism 40, which is connected by a chain 41 with the winding-drum, engages with one of the adjusting-dogs 42 or 43, so as to deenergize the high-speed clutch and energize the slow-speed clutch. The further operation of these operating-dogs will appear hereinafter. Contacts 44, 45, 46, and 47 control the circuit to the solenoid-switches 48 and 49, which control the operation of the high-speed and slow-speed clutches, respectively. The contacts 50 and 51 control the circuits through the solenoid-switches 52 and 53, which control the operation of the motor. A contact 54 is connected directly with one side of the circuit, whereby the circuit may be closed through the respective parts by the brush 39 making contact with the several contacts on the switch. A solenoid-magnet 55 operates a pivoted lever 56, whose operation is controlled by the dash-pot 57 to close the circuit to the several solenoid-switches 58, 59, 60, and 61, which cut in and out the resistance 62 in the circuit of the motor 1, which is of the usual type, having a shunt field-winding 63 and a series field 64. A brake-solenoid 65 is connected in series with the windings 12 and 21 of the magnetic clutches 3 and 17.

In operation let it be assumed that the lever 38 has been moved to the position shown in the drawings, in which case the traveling nut 40 will engage the dog 43 and prevent the lever from being moved to the right, permitting the same, however, to be moved farther to the left. With the lever 38 in the position shown circuit will be closed through the solenoid-switch 52, the circuit being traced from the main 67 across the switch 68, through conductors 69 and 70 to the contact 54, across the brush 39 to contact 50, conductor 71, through the winding of the solenoid-switch 52, conductor 72, across the switch 73, which is held normally closed by the lever 56, and through conductor 74 to the main 75. This energizes the winding of the solenoid-switch 52 and causes the plate 76, carried on the core thereof, to bridge the contacts 77 and 78 and the plate 79, carried on the upper end of the core of the solenoid, to bridge the contacts 80 and 81. The circuit is then closed through the solenoid-winding 55 and may be traced over conductors 82 and 83 to the hub of the lever 56, thence by conductor 84, across the switch 85, conductor 86, through the solenoid-winding, thence by conductors 87, 88, and 89 to the contact 81, across the contact-plate 79 to contact 80, and thence by conductor 74 to the opposite main 75. A second circuit may also be traced from the contact 78 through conductor 90 to the armature of the motor and thence by conductor 91, through the resistance 62, conductor 89, to contact 81, across the contact-plate 79, to contact 80, and thence to the opposite main 75 by conductor 74. This starts the motor to operate with all resistance in circuit; but the solenoid 55 being energized its core will move the switch-arm over a series of contacts 92, 93, 94, 95, and 96 to close the circuit through the energizing-windings 58, 59, 60, and 61, respectively, which have one terminal of their windings respectively connected with the contacts 92, 93, 94, and 95 by conductors 97, 98, 99, and 100, their opposite terminals being connected with the conductor 88. The solenoid-switches 58, 59, 60, and 61 are provided with contact-plates 101, 102, 103, and 104 to bridge the contacts 105 106 107 108 109 110 111 112. The contact 112 is connected with one end of the resistance 62, and the contact 111 is connected with the conductor 88. The contact 110 is connected with a section of the resistance 62, while the contact 109 is connected with the conductor 88. The contacts 108 and 106 are respectively connected with sections of resistance, while the contacts 107 and 105 are respectively connected with the conductors 88 and 89. It will thus be seen that as each solenoid-winding is energized, thereby bridging the pairs of contacts, they will serve to cut out a section of the resistance in the motor-circuit.

The core of the solenoid-winding 61 carries at its top a contact-plate 113, which bridges the contacts 114 and 115, thereby providing a switch in the circuit of the solenoid-windings 48 and 49, which is normally open until the last section of resistance is removed from the motor-circuit. When the last section of resistance has been removed from the motor-circuit, this switch is closed, and the circuit through the windings of the solenoid 48 and 49 may be closed by a further movement of the lever 38. As the lever 38 is moved farther to the left the circuit

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through the solenoid-switch 49 is closed, circuit being traced from the main 67, through conductors 69 and 70, contact 54, brush 39, contact 45, conductor 116, switch 117, conductor 118, through the winding of the solenoid 49, conductor 119, contact 115, plate 113, contact 114, conductor 120, conductor 74, to the opposite main 75. This energizes the winding of the solenoid and causes the plate 121 to make contact with the contact-points 122 and 123, thereby closing the circuit through the windings of the slow-speed clutch 17, the circuit being traced from the main 67, through the conductor 69, conductor 124, across the contact-plate 121, conductor 125, through the windings 21, conductor 125, through the winding 65 of the solenoid-brake, thereby releasing said brake and conductor 126, back to the main 75. The skip is thus started, moving on the slow-speed gear, and as the lever is moved farther to the left the brush makes contact with the contact-plate 44, thereby opening the circuit through the slow-speed side of the clutch and closing the circuit through the winding of the solenoid 48, the circuit being traced from the main 67, conductor 68, conductor 69, conductor 70, contact-plate 54, brush 39, contact-plate 44, conductor 127, switch 128, conductor 129, through the winding of the solenoid 48 to conductor 119, and thence, as previously traced, back to the opposite main 75. The winding of the solenoid 48 being energized, the core thereof will be attracted, and the contact-plate 130 will bridge the contacts 131 and 132, thereby closing the circuit from the main 67 through conductor 69, conductor 133, contact-plate 130, conductor 134, through the windings 12, conductor 125, through the winding of the solenoid-brake 65, conductor 126, to the opposite side of the circuit. In this way the winding 12 is energized, and the skip will run at its highest speed.

When the skip approaches the limit of its travel, the traveling nut 40 will engage the dog 42, causing the switch-lever to be moved in an opposite direction, thereby first deenergizing the high-speed clutch and energizing the slow-speed clutch, bringing the speed of the skip down to such a degree that when the slow speed clutch is finally deenergized by a further movement of the lever 38 and the friction-brake permitted to operate the skip may be readily stopped without danger of its running over and falling into the hopper. The same movement of the lever which finally deenergizes the clutch may be continued to the right far enough so that the brush 39 will make contact with the contact-plate 51, starting the motor in a reverse direction, circuit being closed from the main through the conductors 69 and 70, contact-plate 54, contact-plate 51, conductor 135, through the wind-

ing of the solenoid 53, and thence by conductors 72 and 74 to the opposite main 75. This energizes the winding of the solenoid 53 and causes the plates 130 and 137 to make contact with the contact-points 138, 139, 140, and 141, respectively, thereby closing the circuit through the motor in an opposite direction and causing the same to reverse. A further movement of the lever to the right will energize the high and slow speed sides of the clutch, respectively, and the skip will be returned to a position for loading again. In this manner the motor may be reversed while the skip is unloading its contents and have attained full speed in a reverse direction before the skip is started in an opposite direction.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a driving mechanism, of a driven mechanism, a clutch for connecting the same having a member driven at a relatively slow speed and a member driven in the same direction at a relatively high speed, a member adapted to engage either of said members, and automatically-operated means for causing the operation of the driven mechanism through said high-speed and low-speed members respectively.

2. The combination with a driving mechanism, of a driven mechanism, a clutch having a member driven at a relatively high speed and a member driven in the same direction at a relatively low speed, automatically-operated means for causing the operation of said driving mechanism through said high-speed and low-speed members respectively, and means to stop the driven mechanism at a predetermined point.

3. The combination with a driving mechanism, of a magnetic clutch to connect the same with the machinery to be driven, said clutch having parts connected with said driving mechanism and adapted to be driven in the same direction at different speeds, and a part connected with the driven machinery and adapted to engage either of said first-mentioned parts, and automatically-operated means to cause said engagement.

4. The combination with a driving mechanism, of a magnetic clutch to connect the same with the machinery to be driven, said clutch having parts geared to the driven mechanism and driven in the same direction at different speeds and a part geared to the machinery to be driven and adapted to engage either of said first-mentioned parts, and automatically-operated means to cause said engagement.

5. The combination with a driving mechanism, of a magnetic clutch to connect the same with the machinery to be driven, said clutch having two members connected with the driven mechanism and driven in the

same direction at different speeds and a third member connected with the machinery to be driven and adapted to engage either of said first-mentioned members, and automatically-operated means to cause said engagement.

6. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively closing the circuit of said electromagnets, and electromagnetic means for operating said movable element.

7. In combination, an electric motor, and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively closing the circuit of said electromagnets, and an electromagnet for operating said movable element.

8. In combination, an electric motor, a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, an electromagnet for operating said movable element, and a magnetically-operated switch for closing the circuit through said last-mentioned electromagnet.

9. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively closing the circuit of said electromagnets, an electromagnet for operating said movable element, and means for closing the circuit through the armature of the motor and through said last-mentioned electromagnet.

10. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step, by step, a movable element for successively including said electromagnets in circuit, an electromagnet for operating said movable element, and a magnetically-operated switch for closing the circuit through the armature of the motor and through said last-mentioned electromagnet.

11. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit, step by step, a movable element for successively including said electromagnets in circuit, an electromagnet for operating said movable element, and a pair of magnetically-operated switches for controlling the circuit through said motor, and through said second-mentioned electromagnet.

12. In combination, an electric motor, and

a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, a magnetically-operated switch for controlling the circuit through the motor in one direction, a second magnetically-operated switch for controlling the circuit through the motor in an opposite direction, said switches being also adapted to control the circuit through said electromagnet.

13. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, a pair of magnetically-operated switches for controlling the circuit through the motor, and through said second-mentioned electromagnet, and a switch for controlling the circuit through the magnets of said magnetic switches.

14. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, a pair of electromagnetically-operated switches for controlling the circuit through the motor, and through said second-mentioned electromagnet, and an automatically-operated switch for controlling the circuit through the magnets of said magnetically-operated switches.

15. In combination, an electric motor, and a resistance therefor, a magnetic clutch, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, and means to prevent the closing of the circuit through said clutch until all of the resistance has been removed from the motor-circuit.

16. In combination, an electric motor and a resistance therefor, a magnetic clutch, a plurality of electromagnets adapted to be successively energized, to remove said resistance from circuit step by step, and means controlled by one of said electromagnets to prevent the closing of the circuit through said clutch until all of the resistance has been removed from the motor-circuit.

17. In combination, an electric motor and a resistance therefor, a plurality of magnetic clutches, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, and means for preventing the closing of the circuit to said clutches until all of the resistance has been removed from the motor-circuit.

18. In combination, an electric motor and

a resistance therefor, a plurality of magnetic clutches, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit, step by step, a movable element for successively including said electromagnets in circuit, and means operated by one of said electromagnets for preventing the closing of the circuit to said clutches until all the resistance has been removed from the motor-circuit.

19. In combination, an electric motor and a resistance therefor, a magnetic clutch, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, and a switch controlling the circuit through said clutch and adapted to be closed only after all of the resistance has been removed from the motor-circuit.

20. In combination, an electric motor and a resistance therefor, a magnetic clutch, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a switch controlling the circuit through said clutch, and adapted to be closed by the last of said electromagnets, whereby the circuit through the clutch will not be closed until all of the resistance has been removed from the motor-circuit.

21. In combination, an electric motor and a resistance therefor, a plurality of magnetic clutches, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnet in circuit, a switch controlling the circuit to said clutches and adapted to be operated only when all of the resistance has been removed from the motor-circuit.

22. In combination, an electric motor and a resistance therefor, a plurality of magnetic clutches, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, and a switch controlling the circuit through said clutches and adapted to be operated by the last of said electromagnets, whereby the circuit to said clutches will not be closed until all of the resistance has been removed from the motor-circuit.

23. In combination, an electric motor, and a resistance therefor, a magnetic clutch, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, a magnetically-operated switch for controlling the circuit through said clutch, and an automatically-operated switch for operating the circuit through the magnet of said magnetically-operated switch.

24. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove the said resistance from circuit step by step, a plurality of magnetic clutches, a plurality of magnetically-operated switches for controlling the circuit to said clutches, and an automatically-operated switch for controlling the circuit through the magnets of said magnetically-operated switches.

25. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, a plurality of magnetic clutches, a plurality of magnetically-operated switches for controlling the circuit through said clutches, means for preventing the closing of the circuit through said clutches before all of the resistance has been removed from the motor-circuit, and a switch for controlling the circuit through the magnets of said magnetically-operated switches.

26. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said electromagnets in circuit, a plurality of magnetic clutches, a plurality of magnetically-operated switches controlling the circuit through said clutches, means operated by one of said electromagnets for preventing the closing of the circuit through said clutches before all of the resistance has been removed from the circuit, and a switch for controlling the circuit through the magnets of said magnetically-operated switches.

27. In combination, a motor and a resistance therefor, a plurality of electromagnets adapted to be successively energized to remove said resistance from circuit step by step, a movable element for successively including said resistance in circuit, an electromagnet for controlling said movable element, a plurality of electromagnetic switches for controlling the circuit through the motor and through said electromagnet, a plurality of magnetic clutches, a plurality of electromagnetic switches controlling the circuit through said clutches, and a switch for controlling the circuit through said motor-controlling switches and through said clutch-controlled switches.

28. In combination, an electric motor and a resistance therefor, a plurality of electromagnets adapted to be successively included in circuit to remove said resistance step by step, a movable element for successively including said electromagnets in circuit, a plurality of magnetically-operated switches for

controlling the circuit through said motor,
and through said electromagnet, a plurality
of magnetic clutches, a plurality of magnetic
switches for controlling the circuit through
5 said clutches, a switch for controlling the cir-
cuit through said motor-controlling switches,
and said clutch-controlling switches, and
means operated by one of said resistance-op-
erating electromagnets for preventing the op-
10 eration of said clutches before all of the re-

sistance of said motor has been removed from
said circuit.

In witness whereof I have hereunto sub-
scribed my name in the presence of two wit-
nesses.

HENRY H. CUTLER.

Witnesses:

FREDERIC S. WILHOIT,
NORMAN C. BASSETT.