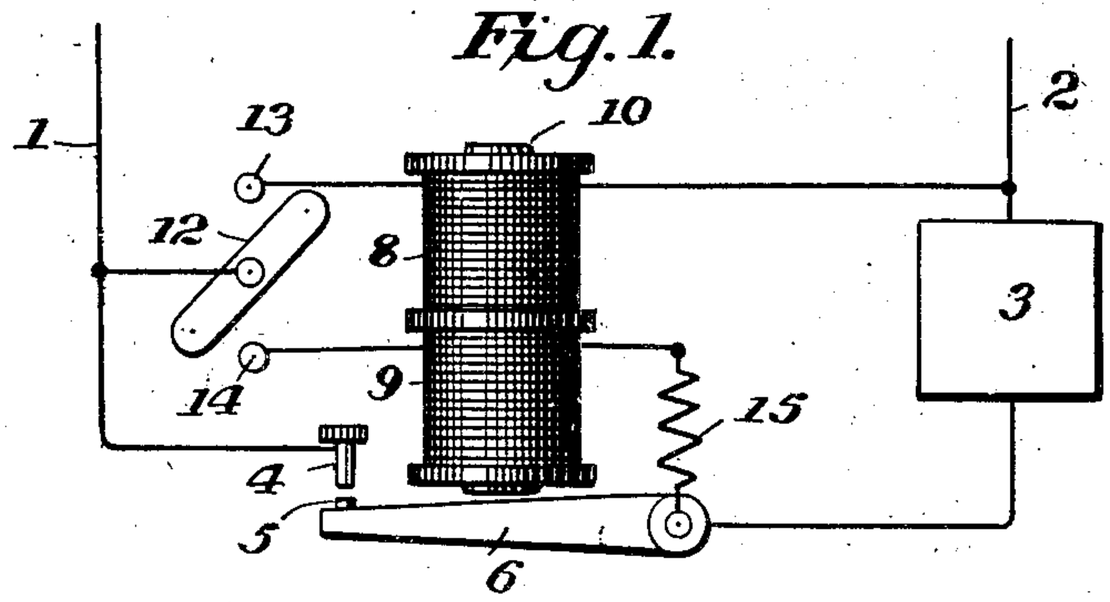
H. G. GEISSINGER.

ELECTROMAGNETIC CIRCUIT CONTROLLER.

APPLICATION FILED DEC. 23, 1909.

964,418. **Patented July 12, 1910.**

Fig. 1.



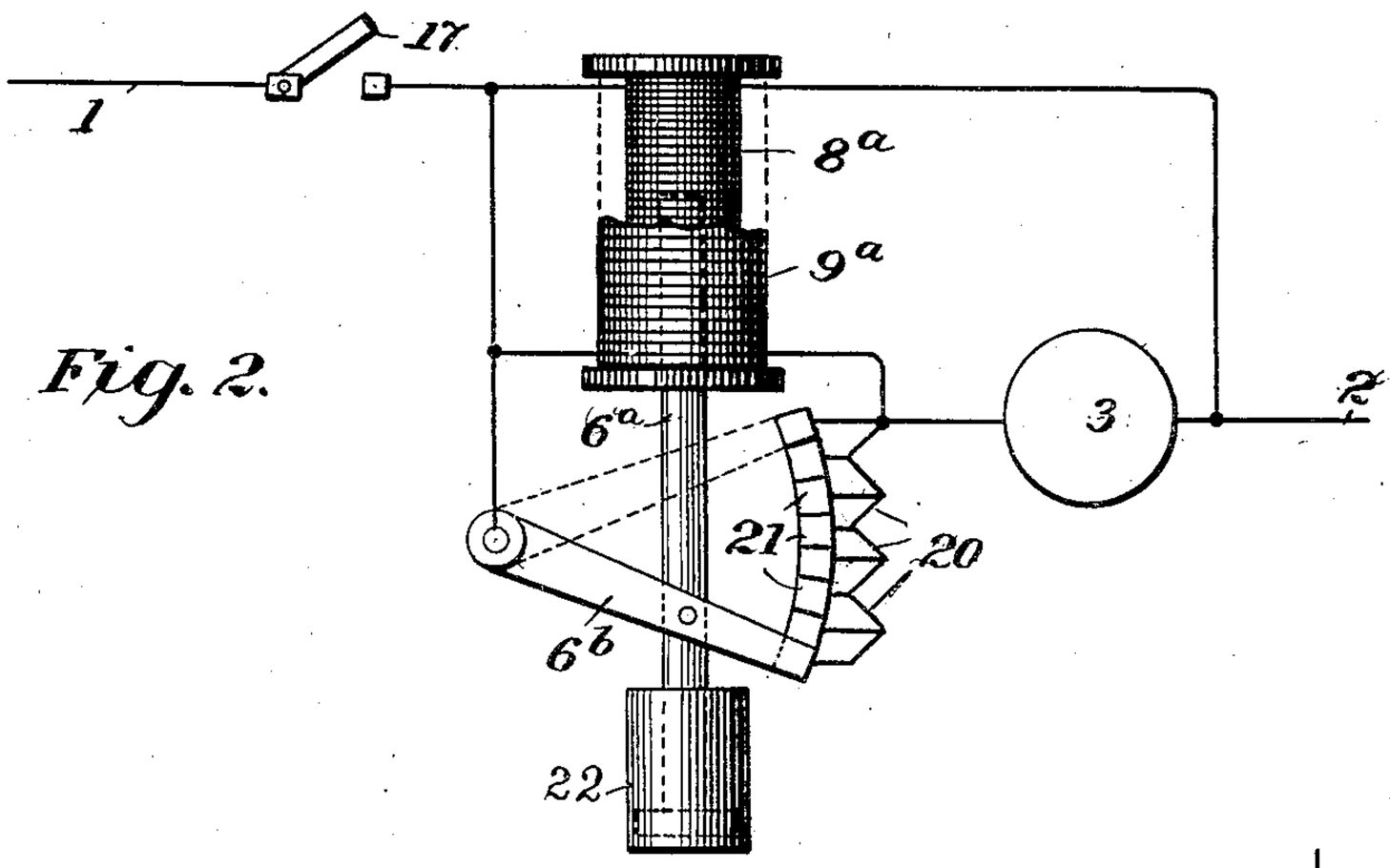
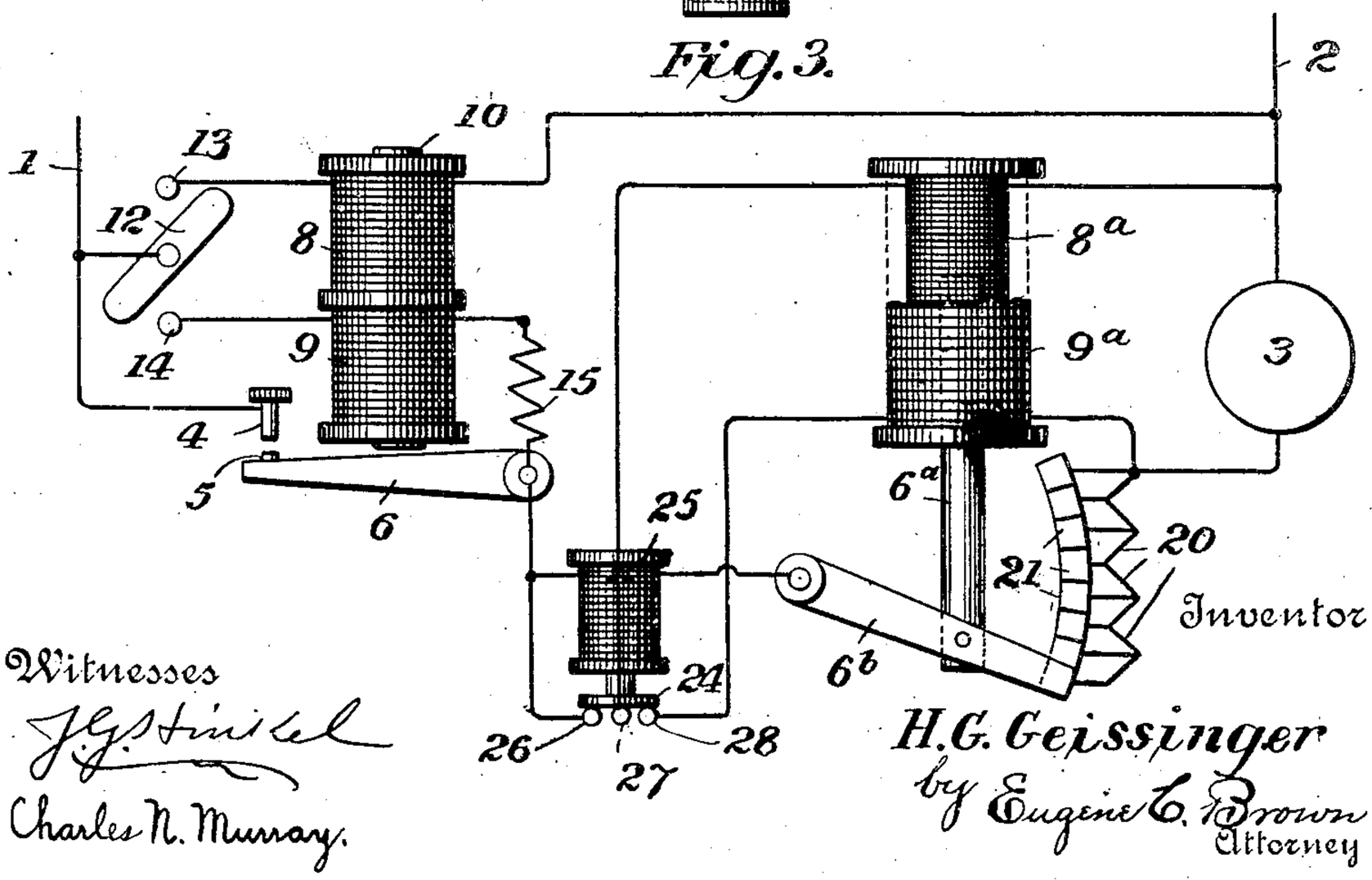


Fig. 2.

Fig. 3.



Witnesses

J. G. Strickel

Charles N. Murray.

Inventor

H. G. Geissinger

by Eugene C. Brown

Attorney

UNITED STATES PATENT OFFICE.

HARRY GRANT GEISSINGER, OF NEW YORK, N. Y., ASSIGNOR TO GEISSINGER REGULATOR COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTROMAGNETIC CIRCUIT-CONTROLLER.

964,418. Specification of Letters Patent. Patented July 12, 1910.

Application filed December 23, 1909. Serial No. 534,688.

To all whom it may concern:

Be it known that I, HARRY G. GEISSINGER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented new and useful Improvements in Electromagnetic Circuit-Controllers, of which the following is a specification.

This invention relates to improvements in electromagnetic circuit controllers, and is particularly applicable to automatic controllers, motor-starters, contactors, etc., which require the closing, regulating and opening of circuits adapted to carry heavy electric currents or the control of such circuits from a distance.

One of the objects of my invention is to reduce the expenditure of energy used by the apparatus employed to control electric circuits. It is well known that the loss of attractive power of electromagnets or other magnetic devices, which must operate their armatures at a distance sufficient to close the contacts of switches which operate to break powerful currents across a wide gap, necessitates the use of much larger starting currents through the magnet coils than is required to hold the contacts in position when they have been closed, the starting or attracting current being generally about three times as strong as the normal holding current. It has, therefore, been the common practice to cause a resistance to be inserted into the energizing circuit of the electromagnetic device at the completion of the pull or stroke of the armature in order to immediately reduce the volume of current to the minimum amount necessary to produce an attraction of the armature sufficient to hold the contacts together. This not only entails the expenditure of considerable electric energy which is dissipated as heat in the resistance, but necessitates the employment of auxiliary apparatus to introduce and cut out the resistance. My present invention obviates these objections, and avoids the use of a supplementary resistance and its operating switch.

Other objects will be apparent to those skilled in the art, while a clearer comprehension of my invention will be obtained from the following description in connection with the accompanying illustrative drawings, in which—

Figure 1 illustrates an electromagnetic circuit controlling mechanism embodying my invention; Fig. 2 illustrates my invention as applied to a motor-starter; and Fig. 3 shows the combination of an electromagnetic switch or contactor and a motor starter with automatic maximum current control, illustrating the application of my invention to a complete remote-control system.

Referring to the embodiment of my invention as disclosed in the contactor, or circuit controlling switch illustrated in Fig. 1, the mains or current leads are indicated at 1 and 2, to which the load 3, representing any device to be electrically energized, may be connected through the contact 4 and the contact 5, carried by the armature 6, and which may be integral therewith. The magnet which actuates the armature 6 is provided with two energizing coils, the holding or retaining coil 8 and the lifting or traction coil 9. I have shown these coils displaced longitudinally upon the core 10, but it will be understood that they will preferably be superposed with the lifting coil surrounding the holding coil. The control switch 12, with its two contacts 13, 14, which are simultaneously engaged by the switch bar, is merely indicated diagrammatically, and may be one of the many types on the market and preferably of the quick-acting, knife-blade type.

The operation of this circuit-controlling switch will be clearly understood by those skilled in the art. When the switch bar or blade 12, is thrown into contact with the contact-studs 13 and 14, two paths are formed for the current from the main 1 through the branch connected with the blade 12, to the other main 2, (a) through the holding coil 8, and (b) through the lifting coil 9, the resistance 15, and the load 3. The magnetic pull generated by the current passing directly between the leads 1, 2, through the holding or retaining coil 8, is insufficient to cause the armature 6 to move. The resistance 15, however, in the other path is so proportioned that it will permit a current to pass through the lifting coil 9, which is properly designed to the minimum

current of the load so that a magnetic power will be created amply sufficient to lift the armature 6. Upon the completion of the upward travel of the armature, the circuit is completed through the contacts 4, 5, and the armature to the load 3, which is thereby connected directly between the leads 1 and 2. It will be evident that said path through the contacts and armature is a complete short-circuit around the coil 9 and resistance 15, thus deënergizing said coil although leaving its terminals still connected in circuit with the leads through the load. The actual flow of current through the coil 9 is, therefore, of exceedingly short duration, being merely during the instant required to lift the armature and consequently may be of considerable magnitude without causing any appreciable heating effect in the coil. The armature will be maintained in raised position by the magnetic effect of the holding-coil 8, which, as previously explained, is so designed and may be of a resistance to permit of only the small amount of current necessary to maintain the armature in closed position. The circuit through the load is broken by opening the control switch 12, which breaks the circuits through the two coils 8, 9, deenergizing the holding coil 8, and permitting the armature 6 to drop by gravity, assisted by a spring if desired, and thus open the main circuit through the contacts 4, 5.

In Fig. 2, I have shown my invention applied to a motor-starter of the solenoid type. As in the construction previously described, the magnetic device is provided with two energizing coils, for lifting and holding the armature, respectivelv, which I have illustrated as being superposed. In this arrangement, the armature does not actually make and break the circuit through the motor 3, and it is merely necessary to use a single blade main switch. Upon closing the switch 17, there are three paths for the passage of the current; (a) through the holding or retaining coil 8^a connected directly between the main leads; (b) through the lifting or traction coil 9^a and the motor 3; and (c) through the rheostat-lever 6^b pivotally connected to the solenoid core 6^a, the resistance coils 20, and the motor 3. It will be apparent that in the lowermost position of the lever 6^b, shown in full lines, the current which flows through the lifting coil 9^a will be due to the difference of potential across its terminals caused by the drop across the resistance coils 20. The coils are so proportioned that the current through the coil 9^a, due to this difference across the resistance coils, is sufficient to move the core with its pivotally-attached rheostat-arm 6^b upwardly, but the magnetic pull of the other coil 8^a is insufficient to move the core. It will be noted that the amount of resistance 20 in circuit decreases as the arm 6^b moves over the rheostat segments 21, and therefore that the voltage across the terminals of the coil 9^a decreases correspondingly, causing less and less current to flow through the coil. Inasmuch, however, as the efficiency of the magnetizing current increases as the amount of iron of the core within the coil increases, the pull is fairly uniform throughout the stroke and the motion of the lever 6^b, restrained by the dash-pot 22, is more uniform than in existing types of motor-starters. When the lever-arm 6^b reaches the last segment, shown in the dotted line position, the coil 9^a will be completely short-circuited and no current will flow through the coil, although its terminals remain connected to the main conductor upon either side of the lever 6^a. The plunger or core 6^a will be maintained in the uppermost position by the holding coil 8^a. When the switch 17 is opened the coil 8^a is deënergized and the core falls by gravity, assisted by a spring if desired, gradually introducing the resistance 20 into the motor circuit, and finally assuming the starting position shown in full lines.

In Fig. 3, I have shown the devices illustrated in Figs. 1 and 2, combined into a complete remote-control system provided with an automatic control of the maximum current.

The operation will be understood from the previous description of the contactor and the motor-starter. Upon closing the switch blade 12, upon the contact-studs 13, 14, current passes from main 1, through the coarse wire coil 9, and resistance 15, to the other main 2, by the divided paths; (a) through the plate 24, attached to the core of the overload magnet 25, bridging the contacts 26, 27, 28, low resistance coil 9^a and the motor 3; (b) across bridge-plate 24 to contact-stud 27 and through the fine wire coil 8^a; and (c) through the coil of overload magnet 25, rheostat-arm 6^b, resistance coils 20, and motor 3. The current through these combined paths is sufficient to lift the armature 6 to close the main contacts 4, 5, and short-circuit the coil 9, the armature being maintained in raised position by the retaining-coil 8. The resistance 15, being also short-circuited, the current increases sufficiently through the coil 9^a to lift the core 6^a, causing the lever-arm 6^b to move over the successive segments 21 and cut out the rheostat resistance 20 from the motor circuit, and finally short-circuiting the coil 9^a and leaving the core 6^a under the control of the retaining coil 8^a.

In the arrangement disclosed in Fig. 3, it is unnecessary to restrain the movement of

the plunger 6^a by a dash-pot, since if the rheostat-arm 6^b should cut out the resistance coils 20 too rapidly, before the motor increases its speed sufficiently, the overload-relay 25, responding to the augmented current, will lift the bridge-plate 24 and break the circuit at the contacts 26, 28, thereby demagnetizing the lifting-coil 9^a and causing the plunger 6^a to stop or drop back until the resistance introduced decreases the current sufficiently to cause the relay to drop its armature and again close the circuit through the coil 9^a. The proper regulation of the starting current for the motor is thus automatically regulated as it starts up and increases to its maximum speed. Should the motor at any time become overloaded, causing a decrease in its speed and counter electromotive force, the resulting increase in current will cause the operation of the overload magnet with the corresponding regulation of current above described. An absence of voltage upon the mains causes both contactor and motor-starter to move to open or initial position.

It is to be understood that the arrangements shown and described herein are used for the purpose of illustrating one embodiment of my invention, and that changes can be made therein by those skilled in the art without departing from the spirit thereof.

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

1. An electromagnetic circuit-controlling device for connecting and disconnecting translating mechanism with main conductors, comprising an electromagnet having an armature and energizing coils for lifting and for retaining said armature respectively, means for connecting said lifting coil in series with the translating mechanism and said retaining coil directly between the main conductors, and means for short-circuiting said lifting coil.

2. An electromagnetic circuit-controlling device for connecting and disconnecting translating mechanism with main conductors, comprising an electromagnet having an armature and energizing coils for lifting and for retaining said armature respectively, means for connecting said lifting coil in series with the translating mechanism and said retaining coil directly between the main conductors, and means operable by said armature for short-circuiting said lifting-coil and connecting the translating mechanism directly with the main conductors.

3. An electromagnetic circuit-controlling device for connecting and disconnecting translating mechanism with main conductors, comprising an electromagnet having an armature and energizing coils for lifting and for retaining said armature respectively, a switch arranged to connect said lifting coil in series with the translating mechanism and said retaining coil in shunt thereto, and main contacts under control of said armature to short-circuit said lifting-coil and connect the translating mechanism directly with the main conductors.

4. An electromagnetic circuit-controlling device adapted to connect and disconnect translating mechanism with main conductors, comprising an electromagnet having an armature, a lifting-coil and a retaining coil, connections between one terminal of the lifting-coil and the translating mechanism, and between one terminal of the retaining-coil and one main conductor, a contact device operatively connected to the armature and arranged to short-circuit the lifting-coil, and a switch arranged to simultaneously connect one terminal of each of said coils with the other main conductor.

5. An electromagnetic circuit controlling device adapted to connect and disconnect translating mechanism with main conductors, comprising an electromagnet having a low resistance coil, a high resistance coil, and an armature, connections between one terminal of the low-resistance coil and the translating mechanism including resistance, and between one terminal of the high resistance coil and one main conductor, a switch arranged to simultaneously connect one terminal of each of said coils with the other main conductor, and a shunt circuit connected with the terminals of said low resistance coil having contacts under the control of said armature.

6. An electromagnetic device for controlling the current passing to a translating mechanism, comprising an electromagnet having an armature and energizing coils for lifting and for retaining said armature respectively, said lifting coil being in series with the translating mechanism and the retaining coil in shunt thereto, a resistance in shunt to the lifting coil, and means connected with said armature for cutting out successive portions of the resistance as the armature is raised to its attracted position.

7. An electromagnetic circuit controlling device, comprising an electromagnet having an armature and energizing coils for lifting and for retaining said armature respectively, a resistance in shunt to said coils when the armature is in its lowest or unattracted position, and means connected with said armature for cutting out said resistance and short-circuiting said lifting-coil when the armature is in its raised or attracted position.

8. An automatic starter for electric motors, comprising a regulating solenoid having an

armature and energizing coils for lifting and for retaining said armature core, said lifting and retaining coils being connected in series and in shunt respectively with the motor, a starting resistance in the motor circuit and in shunt to said lifting coil, a switch arm pivotally connected to the core and arranged to cut out successive portions of said resistance as it moves to attracted position.

9. A device for the remote control of translating mechanism comprising a current regulator having an electromagnet provided with an armature core and energizing coils for lifting and retaining said armature core respectively, said coils being respectively in series with and in shunt to the translating mechanism, a starting resistance in circuit with said mechanism and in shunt to said lifting coil, means connected with said armature core for cutting out said resistance, and a circuit closing device comprising an electromagnet having an armature and energizing coils for lifting and retaining said armature respectively, contacts controlled by said armature arranged to short-circuit said lifting coil, and a switch to connect said last-mentioned lifting and retaining coils in series and in shunt respectively with the translating mechanism.

10. A device for the remote control of translating mechanism comprising a current regulator having an electromagnet provided with an armature core and energizing coils for lifting and retaining said armature core respectively, said coils being respectively in series with and in shunt to the translating mechanism, a starting resistance in circuit with said mechanism and in shunt to said lifting coil, means connected with said armature core for cutting out said resistance, and a circuit closing device comprising an electromagnet having an armature and energizing coils for lifting and retaining said armature respectively, contacts controlled by said armature arranged to short-circuit said lifting coil, and a switch to connect said last-mentioned lifting and retaining coils in series and in shunt respectively with the current regulator.

11. A device for the remote control of translating mechanism comprising a current regulator having an electromagnet provided with an armature core and energizing coils for lifting and retaining said armature core respectively, said coils being respectively in series and in shunt to the translating mechanism, a starting resistance in circuit with said mechanism and in shunt to said lifting coil, means connected with said armature core for cutting out said resistance, a circuit closing device comprising an electromagnet having an armature and energizing coils for lifting and retaining said armature respectively, contacts controlled by said armature arranged to short-circuit said lifting coil, and a switch to connect said last-mentioned lifting and retaining coils in series and in shunt respectively with the current regulator, and an overload relay in circuit with the translating mechanism.

12. In an automatic starter for electric motors, a starting resistance for the motor circuit, an electromagnetic resistance-varying device having energizing coils in series and in shunt to said motor respectively, main contacts for the motor circuit, and an electromagnet for controlling said contacts having energizing coils in series and in shunt respectively with said resistance-varying device.

13. In an automatic starter for electric motors, a starting resistance for the motor circuit, an electromagnetic resistance-varying device having energizing coils in series and in shunt to said motor respectively, said series coil being in shunt to said resistance, main contacts for the motor circuit, and an electromagnet for controlling said contacts having energizing coils in series and in shunt respectively with said resistance-varying device and each of said series coils being short-circuited when the corresponding armatures are in attracted position.

14. In an automatic starter for electric motors, a starting resistance for the motor circuit, an electromagnetic resistance-varying device having energizing coils in series and in shunt to said motor respectively, main contacts for the motor circuit, an electromagnet for controlling said contacts having energizing coils in series and in shunt respectively with said resistance-varying device, and an overload relay in the motor circuit.

15. An electromagnetic circuit-controlling device, comprising an electromagnet having an armature and energizing coils for lifting and for retaining said armature respectively, a resistance in shunt to said coils when the armature is in its lowest or unattracted position, means connected with said armature for cutting out said resistance and short-circuiting said lifting-coil when the armature is in its raised or attracted position, and a maximum-current device for disconnecting the lifting-coil in the event of an excessive or overload current and for again restoring the same when the current decreases to normal value.

16. An automatic starter for electric motors, comprising a regulating solenoid having an armature and energizing coils for lifting and for retaining said armature core, said lifting and retaining coils being con-

nected in series and in shunt respectively with the motor, a starting resistance in the motor circuit and in shunt to said lifting coil, a switch arm pivotally connected to the core and arranged to cut out successive portions of said resistance as it moves to attracted position, and means for deënergizing said lifting coil and causing the reinsertion of resistance upon the flow of an excess current and for again energizing the lifting-coil upon the restoration of normal current.

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

HARRY GRANT GEISSINGER.

Witnesses:
LAURA E. SMITH,
LOUISA E. SIMSON.