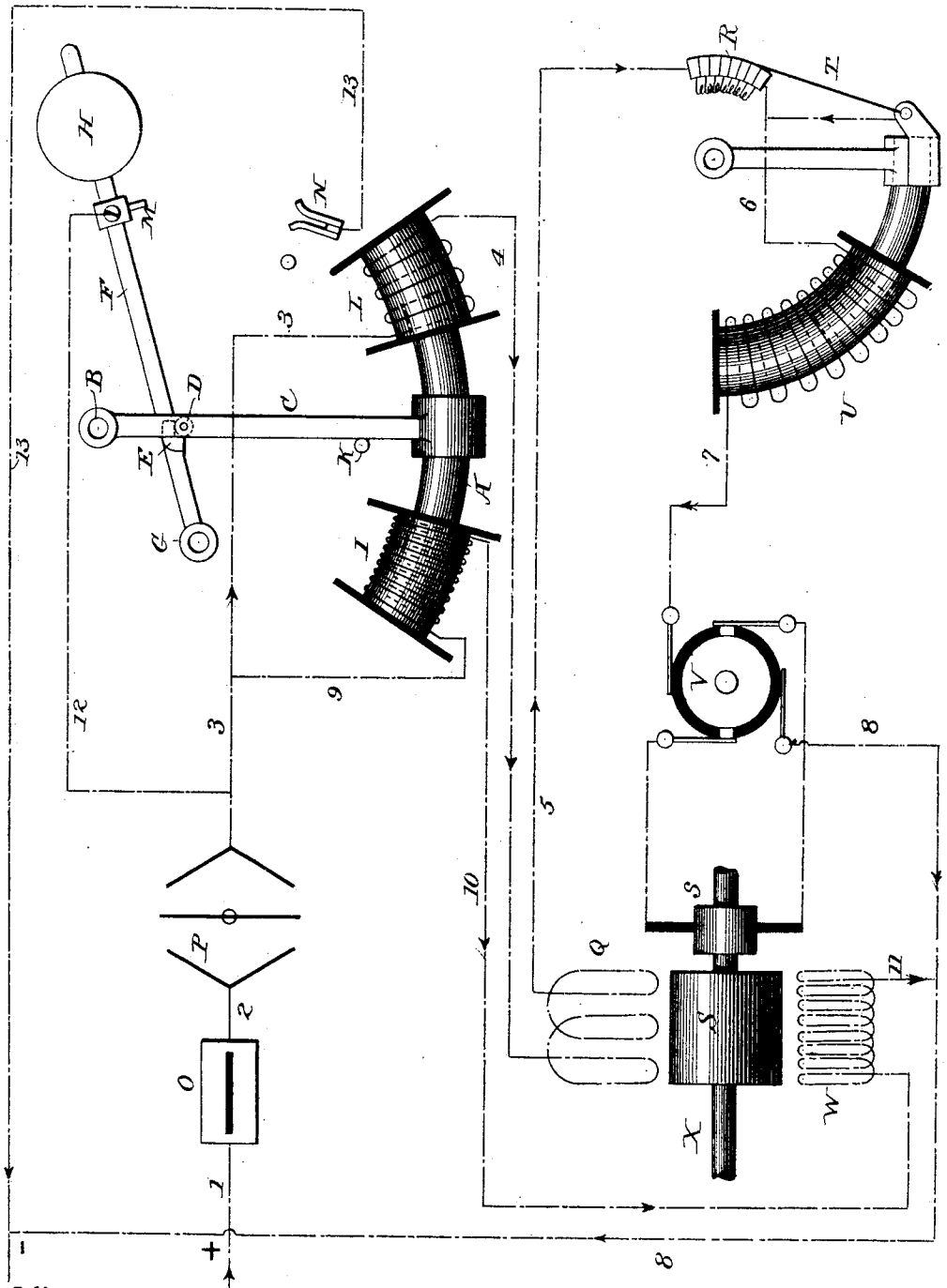
(No Model.) 2 Sheets—Sheet 1.

R. EICKEMEYER.

SAFETY DEVICE FOR ELECTRIC MOTORS.

No. 538,669. Patented May 7, 1895.



Witnesses
Jno. J. Hinkel
Alice N. Dobson

Fig. 1.

Inventor
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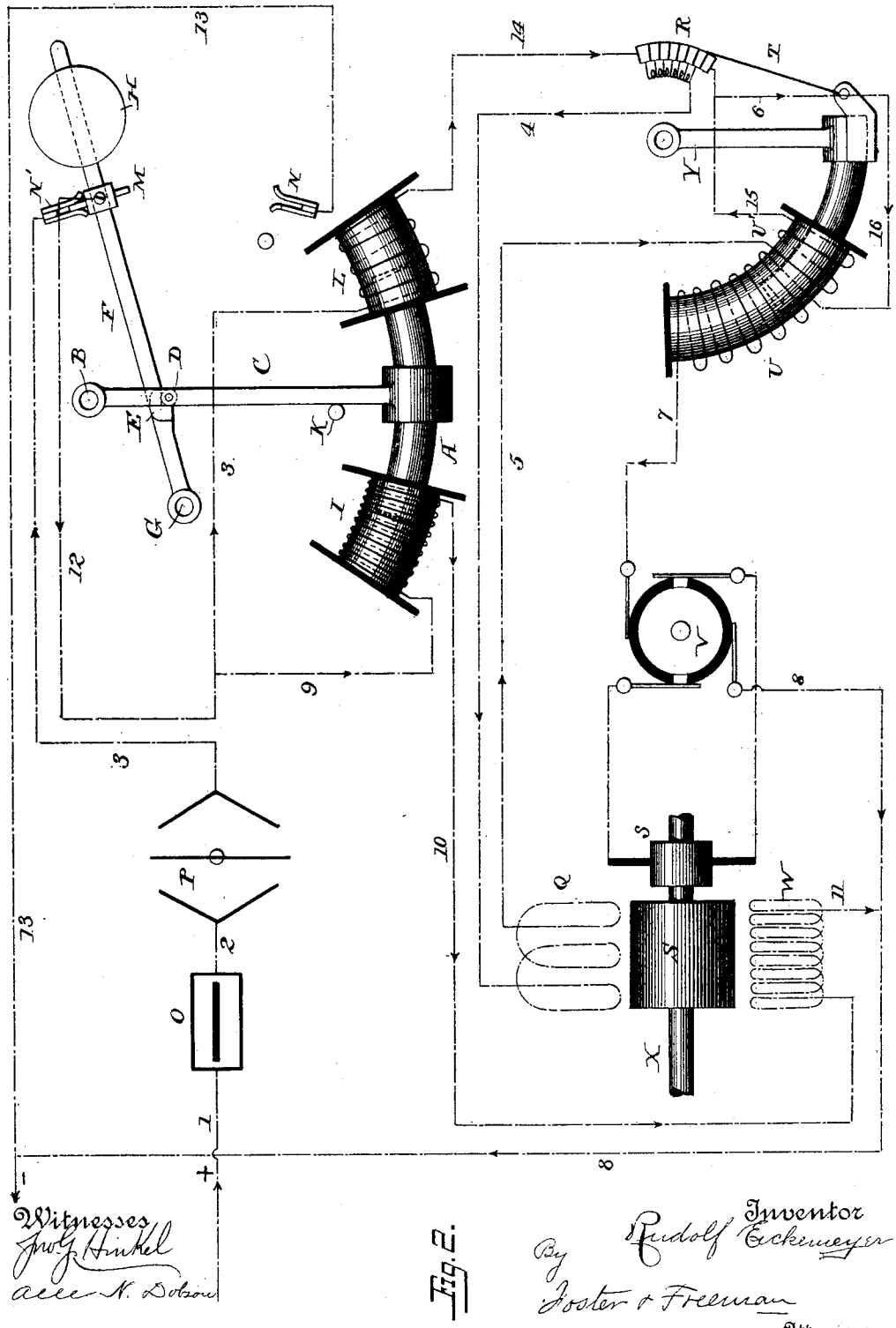

Fig. 2.

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UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER, OF YONKERS, ASSIGNOR TO THE OTIS BROTHERS & COMPANY, OF NEW YORK, N. Y.

SAFETY DEVICE FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 538,669, dated May 7, 1895.

Application filed July 13, 1892. Serial No. 439,908. (No model.)

To all whom it may concern:

Be it known that I, RUDOLF EICKEMEYER, a citizen of the United States, and a resident of Yonkers, Westchester county, New York, have invented certain new and useful Improvements in Safety Devices for Electric Motors, of which the following is a specification.

My invention relates to safety devices for shunt or compound motors, and it has for its object to provide means whereby an electric motor, in which the field magnet coils are wound in shunt, or in which they are wound in shunt and series as in compound motors, is automatically cut out of circuit in case the shunt should be disabled or deranged in any manner and accidents thereby prevented.

It is well known that a shunt wound motor will maintain an approximately constant speed under all variations of load, and even when it is doing no work, and, in the case where the motor is used for elevators or hoisting machinery and the cage is descending, the motor may be driven by the descending load, and the motor will still maintain a practically constant speed. It is also well known that in a series wound motor, the speed varies in accordance with the load, and will under light or no load reach a dangerously high speed. It is, therefore, with the object of providing safety devices for use with such motors, especially in connection with hoisting or elevating devices, that my invention is made, and while it is especially applicable to such uses, it will be understood that my invention is not limited in this respect, as it may be used with any system of compound or pure shunt motors, and can be arranged not only to guard against accidents due to the derangement of the shunt, but also against excessive or abnormal current in the motor, as the dimensions of the relative parts being properly proportioned, the safety devices will operate whenever the armature current exceeds a safety limit.

My invention consists in the means substantially hereinafter more particularly set forth, arranged and operating substantially in the manner described and for the purpose set forth.

Referring to the accompanying drawings, Figure 1 is a diagrammatic illustration of one embodiment of my invention sufficent to enable those skilled in the art to make and use the same. Fig. 2 is a similar view of a slightly-modified arrangement.

In the drawings plus and minus represent the main leading wires of a system or circuit of distribution over which the current passes to operate the motor X, which is shown diagrammatically, and is adapted to be connected to an elevator or hoisting apparatus, or to any other working device.

The safety device comprises, as shown in the drawings, an iron core A, which is suspended from a support B, by a rod C, and carries a detent device D in the shape of a roller. This detent engages with a projection or nose E, on a rod F, which is shown as pivoted at G, and carrying at its free end a weight H, the weighted rod being supported in its normal position by the nose resting on the detent on the rod C.

Arranged with relation to the rod A, as at one end thereof, is a magnet or solenoid I, which is connected in the shunt circuit of the motor X, in the manner hereinafter set forth, and arranged so as to hold the core A in its normal position with the rod C against a suitable stop or pin K. Arranged with relation to the other end of the arm, is a magnet or solenoid L, which is connected in the main or armature circuit of the motor X, in the manner hereinafter indicated. These two solenoids I and L are arranged and adjusted so that with the maximum permissible armature current, the solenoid I, will overpower the solenoid L, and hold the core A in its normal or vertical position, but if by chance the shunt circuit is broken or deranged so that it is not acting properly, the core A will be moved to the right by the excess of current in the solenoid L, even if that excess is but slight, and the device operates automatically to short circuit the motor and line so that the motor will act as a series dynamo under short circuit, which as is well known will operate as a brake, and this is especially advantageous in the use of the motor in hoisting or elevating devices. At the same time the line circuit being short circuited, the safety fuse

will be burned out and the motor be entirely disconnected from the line.

While of course this safety device may be used in various connections and circuits, I have shown in Fig. 1, one simple arrangement which has been found to be effective. Thus from the plus leading wire, the line 1 leads to a switch or cut-out P, and includes a safety fuse O, and from the switch the wire 3 leads to the solenoid L, and thence by wire 4 to the field magnet coils Q of the motor X, which are shown as arranged in series, and thence by the wire 5 to the resistances R, and thence through more or less of these resistances according to the position of the brush T, which is controlled by the solenoid U, and constitutes the well known Eickemeyer safety attachment, the operation of which is well understood by those skilled in the art, and thence through the wire 6, around the coils of the solenoid U, wire 7, to the reversing commutator or switch V, and thence either in one or the other direction through the commutator *s*, and armature S of the motor X, and thence over wire 8 to the minus conductor of the main line. The branch or shunt circuit passes from the wire 3 over the wire 9, through the coils of the solenoid I, thence by the wire 10, through the shunt field magnet coils W of the motor, and by the wire 11, to the wire 8, and back to the main line. Also connected to the positive wire 3, is a wire 12, the free end of which is connected to a contact piece M, carried by the arm F, while arranged within the range of movement of this arm is another contact piece N, connected by a wire 13 with a minus main line conductor. Under these conditions when the motor is operating normally, the safety device is in the position shown with the rod resting against the contact K, and the strength of the solenoids I and L are so proportioned that under all conditions of normal operation, the solenoid I will predominate and hold the core A, in the position shown, but if, for instance a break should occur in the shunt circuits 9, 10 and 11, or other derangement, should distribute the balance of the current flowing through the shunt and the main line, the solenoid L, will be energized in such a manner as to draw the core A, toward it and this will release the rod F by the detent D passing out from under the nose E, and allow the weight to cause the rod to drop, so that the contacts M and N will come together, short-circuiting the main line, and the line current passing from the plus leading wire through the wire 1, the safety fuse O, the switch P, and the wires 12 and 13, through the contacts M and N, will increase enormously by the short circuit, and the safety fuse O will melt, thereby cutting the line off, while the motor circuit will be closed upon itself, and the motor will generate a current as a series dynamo, which will flow from the armature through the commutator V, wires 8 and 13, through the contacts M and N, wires 12, 3 to the solenoid L, and thence by the wire 4, through the series field magnet coils Q and by the wire 5 through the safety device R, T, and U, and thence back to the armature by the wire 7.

In the arrangement of circuits indicated in Fig. 2, the series field coils Q, are shown as connected to two bars of the controlling or safety switch Y, instead of one of the resistances R, as in the first instance, and at the same time this circuit includes a few turns, as U′, of the coils of the controlling solenoid U, so that the series field Q, is in circuit only when the motor starts, or runs under a heavy load, but is cut out of circuit as soon as the controlling switch operates, and at the same time of course the turns U′ of the solenoid are also eliminated from the circuit. The resistance device R, is in the present instance composed of a number of blocks b, b, b^2, &c., insulated from each other, and each pair connected by a resistance conductor r, r', &c., except that in this instance, the block b^8 is not connected to its adjacent block by a resistance device, but is connected to the conductor 15, leading to the coil U′, of the solenoid, and to the series field coils Q of the motor, the other terminal of the series field coils 4 being connected to the next adjacent block b^7. From this it will be seen that when the brush T is in the position shown, the series field magnet coil Q is included in the circuit, but when the brush T moves upward toward the block b, the field magnet coil Q will be cut out of circuit. In this arrangement also the bar B is shown as carrying a contact M, which normally engages the contact N′, connected to the wire 3. Under these conditions, the path of the current may be traced from the main leading wire to the safety fuse and switch O, P as before, by the wire 3, through the contacts N′ N, the wire 12, through the solenoid L, wire 14, through the resistances R, more or less as the case may be, and by the wire 4, through the series field Q, and back by the wire 5, to and including the solenoid turns U′, and thence by the wires 15, 6, and 16, through the remaining coils of the solenoid U, to the commutator B, and thence through the armature and out as before; but if, perchance, the brush T should move to the top of the resistance device R, the current would pass directly from the wire 14, through the brush T, the wire 16, and the coils of the solenoid U, to the reversing switch V, and on as before, thereby short-circuiting the series field magnet coils, and the shunt field magnet coils W, will be included in the circuit, the same as set forth in connection with the first arrangement. If under these conditions, through an excess of current, or other derangement of the parts, the core A, should move away from its stop, the bar F, will fall, breaking the circuit between the wires 3 and 12, and short-circuiting the main line by closing the contacts M and N, and the same results may be produced as in the first instance.

It will be understood that when the main

line is short circuited and the safety device operates, the motor cannot be started again until the rod has been raised by hand, and the parts made to assume their normal positions.

From the above description the general principles of my improved safety device will be clearly understood, and its application to motors in general, and more especially to motors used in connection with hoisting and elevating devices, will be appreciated, and while I have set forth the preferred form, it will be understood that the details of construction and arrangement may be varied by those skilled in the art, without departing from the general principles of my invention, and I do not therefore limit myself to the precise construction shown.

What I claim is—

1. The combination with a shunt motor, of a safety device including both branches of the circuit of the motor and arranged to short circuit the motor on disturbance in the balance of said circuits, substantially as described.

2. The combination with a shunt motor, of a safety device having a magnet included in both branches of the circuit of the motor, and mechanism controlled by said magnets for automatically short circuiting the motor on disturbance of the balance of said magnets, substantially as described.

3. The combination with a shunt motor, of a safety device comprising the core, coils controlling said core, and arranged in the circuits of the motor, and a short circuiting device controlled by the movements of the core, substantially as described.

4. The combination with the main line, of a shunt motor connected thereto, a fusible cut-out between the main line and motor, a safety device having coils included in both branches of the motor and arranged to automatically short circuit the motor and main line on disturbance of the balance of the circuits of the motor, substantially as described.

5. The combination with the main line, of a shunt motor connected thereto, a safety device interposed between the motor and main line, the safety device comprising a core, and coils included in the branches of the motor, and a short circuiting device controlled by the core, substantially as described.

6. A safety device for motors comprising a core, coils included in the branch circuits of the motor, an arm connected to the main line, a detent controlling said arm and controlled by the core, and a contact for the arm also connected to the main line, substantially as described.

7. A safety device for electric motors comprising a core, coils connected in the branch circuits of the motor, a pivoted arm supporting the core, a weighted arm connected to the main line, a detent controlling said weighted arm, a contact on the weighted arm, and a contact connected to the main line, substantially as described.

8. The combination with the main line, of a compound wound motor connected thereto, a safety device having two coils, one of which is in circuit with the shunt field magnet coils of the motor, and the other of which is in circuit with the field magnet coils of said motor, the whole arranged to short circuit the motor on derangement of the circuits, substantially as described.

9. The combination with the main line and a compound wound motor connected therewith, of a safety device interposed between the line and motor, and having a coil in each branch circuit of the motor, and a safety resistance included in the series circuit of the motor, a portion of the coils of the controlling magnet of the safety resistance being included in the series circuit of the motor, and arranged to be short circuited by the safety resistance device, substantially as described.

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

RUDOLF EICKEMEYER.

Witnesses:
EMIL GARNJOST,
JAMES E. IRVINE.