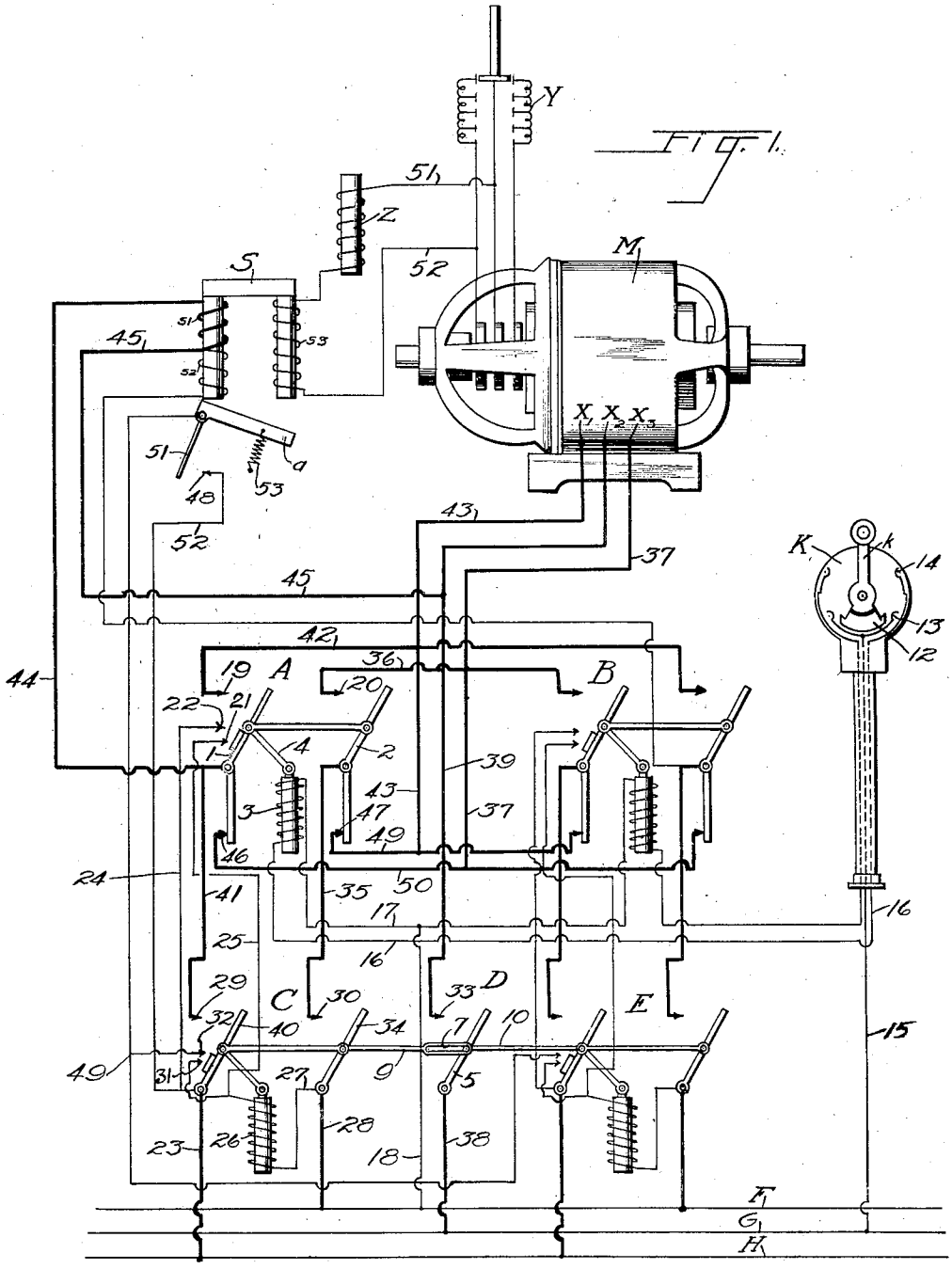
Aug. 12, 1924. 1,504,224

R. H. FISHER

DYNAMIC BRAKE FOR ALTERNATING CURRENT MOTORS

Filed April 29, 1920 2 Sheets-Sheet 1



INVENTOR

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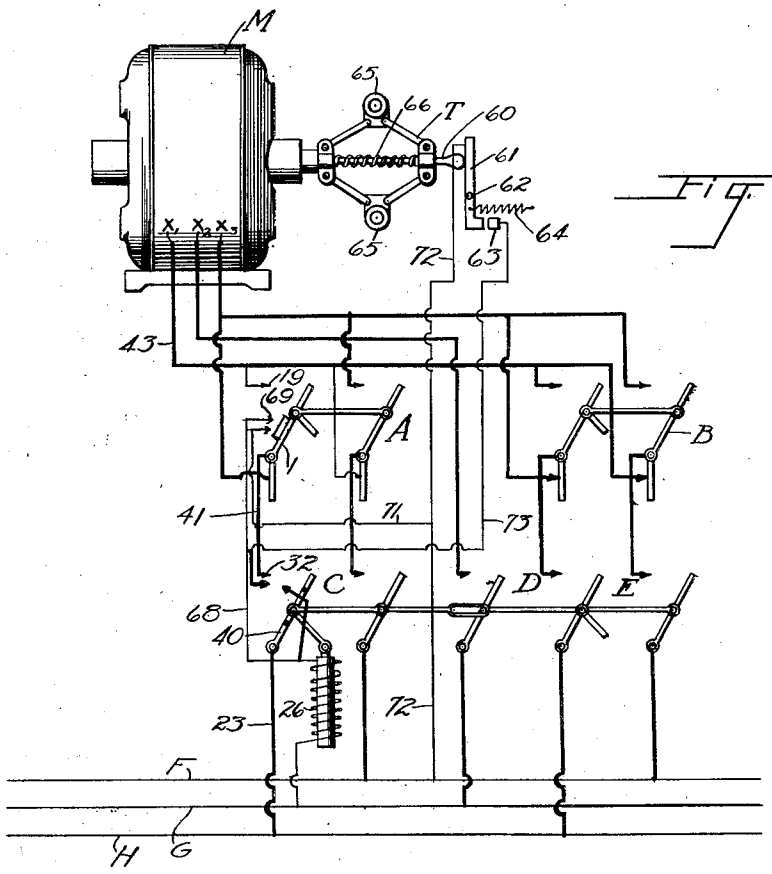


Fig. 2.

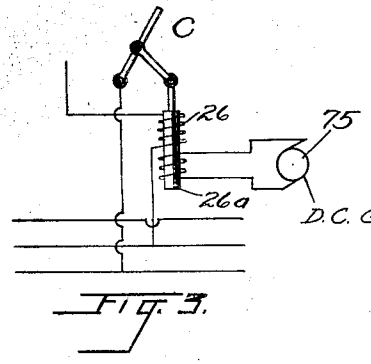


Fig. 3.

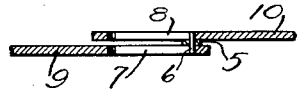


Fig. 4.

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UNITED STATES PATENT OFFICE.

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DYNAMIC BRAKE FOR ALTERNATING-CURRENT MOTORS.

Application filed April 29, 1920. Serial No. 377,660.

To all whom it may concern:

Be it known that I, ROBERT HENRY FISHER, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Dynamic Brakes for Alternating-Current Motors, of which the following is a full, clear, and exact description.

My invention relates to dynamic brakes for alternating current motors, and it consists in the combinations, constructions and arrangements herein described and claimed.

An object of my invention is to provide novel means for controlling the dynamic braking of induction motors of the single and polyphase type, the invention being applicable more particularly to motors used for electric elevators and hoists.

A further object of my invention is to provide a novel means of applying a dynamic braking action, said means being controlled by an arrangement of switch mechanisms which co-operate therewith to effect the result desired.

Other objects and advantages will appear in the following specification, and the novel features of the invention will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings, forming part of this application, in which—

Figure 1 is a diagrammatic view, showing one embodiment of my invention,

Figure 2 is a diagrammatic view, showing a modified form of the device,

Figure 3 is a view, showing a third form, and

Figure 4 is a section detail view, showing a switch connection.

In carrying out my invention, I provide switches, such as those shown in general at A, B, C, D, and E in Figure 1. The switch A is of the double acting type, that is to say, the blades 1 and 2 are pivoted so as to make contacts on one side of the pivot, while breaking contacts on the opposite side, the blades 1 and 2 being connected together to act simultaneously. The actuation of the switch A is preferably accomplished through the medium of the solenoid 3, whose core is connected with the blade 1 by means of the link 4. The switch B is similar to the switch A. The switches C and E are actuated by solenoids similar to the switch A, but are single action switches, that is to say, the blades are pivoted at their ends so as to open or close contacts only on one side of the pivot. The switch D is connected with the switch C and also with the switch E by a connection like that shown in Figure 4, in which the switch arm 5 of the switch D has a pin 6 arranged to enter registering slots 7 and 8 in links 9 and 10 respectively. The construction is such that when the switch C is closed, that is to say, is moved to the left in Figure 1, the switch D will also be closed, and when the switch E is closed, the switch D will be closed, but the closing or opening of either of the switches C or E will not affect the other.

In the drawing I have shown a single speed alternating current motor M of the 3-phase slip ring induction type, the connections to the phases being indicated at X_1, X_2 and X_3 respectively. A selecting switch S has three windings s_1, s_2, and s_3 respectively, which control an armature a. A choke coil Z is connected in the rotor circuit of the motor, together with the coil s_3 of the selecting switch. Y indicates a rotor resistance.

At K, I have shown a master control switch having a handle k arranged to move a bridging contact 12 to the right or to the left, depending upon the movement of the handle. This master control switch is located on the elevator or other device which is being moved by the motor.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood. Let us assume that the elevator is to be raised. The handle k of the master control switch K is moved to the left, thus causing the contact 12 to bridge the contacts 13 and 14. Current now flows from feed wire G, through wire 15, contacts 13, 12, 14, conductor 16, solenoid 3 of switch A, conductors 17 and 18 to feeder wire F. The solenoid of switch A is now energized, closing the contacts at 19 and 20, and also bringing the contact 21 into engagement with the contact 22, the contact 21 being insulated from the switch blade 1. As soon as the contacts 21 and 22 are closed, the current is permitted to flow from the feeder wire H, through conductors 23 and 24, contacts 22 and 21, conductor 25, solenoid winding 26, conductors 27 and 28, to wire F. The solenoid of the switch C is now ener-

gized, closing the contacts at 29 and 30, as well as the insulated contact 31 against the stationary contact 32. The switch D is also actuated so that the contact at 33 is closed. Switches A, C and D being closed, all circuits are established to the motor as follows: from wire F, through 28, switch blade 34, 30, conductor 35, switch blade 2, 20, 36, and 37, to phase X_2 on motor; from wire G, through conductor 38, switch blade 5, contact 33, conductor 39, to phase X_2 on motor; from wire H, through 23, switch blade 40 of switch C, 29, 41, switch blade 1 of switch A, 19, 42, and 43, to phase X_1 on motor. At the same time, the coil s_1 of the selecting switch is energized with full line voltage and frequency from wire 41, through wires 44, through the coil, wire 45, and 39, to phase X_2 of motor.

Now all phases of the motor are energized and the motor begins to revolve, and as the torque overcomes the inertia, the motor accelerates to its final speed, which is determined by the number of poles of the motor, the alternations of the power circuit, and the per cent of slip of the motor.

Now when it is desired to stop the motor, to apply a dynamic brake automatically the master control switch is restored to its central neutral position. This breaks the circuit of solenoid 3 of switch A, which, dropping back, breaks the contacts at 19 and 20 and 21—22. It also closes the contacts at 46 and 47. When the contact at 21 is open, the switch C does not open, because the circuit of the solenoid 26 of the switch C is made through the contact 48 of the selecting switch, which by-passes the contact 21 on the switch A. With the switch A in this position, the motor now receives its power as follows: from wire F, through 28, 34, 30, 35, 47, 49, and by 43, to phase X_1 of motor; from wire G, through 38, 5, 33, and 39, to phase X_2 of motor; from wire H, through 23, 40, 29, 41, switch blade 1, 46, 50, and by conductor 37 to phase X_3 of motor. This creates a torque on the motor, which tends to bring it to rest.

The coils Z and s_3 are energized by the induced current in the rotor, this current being from the wire 51, through Z, s_3, and back by wire 52. The coil Z is the choke coil, as stated, while the coil s_3 is wound on the same magnetic circuit as the coils s_1 and s_2. The function of the contact 48 has been explained before. When the motor is revolving at full load speed, or substantially at this speed, the frequency and voltage of the rotor circuit is very low, and therefore the coil s_3 has very little current in it, and the flux produced by the coil s_1 predominates to hold the armature a closed. Now when the reversed torque is produced, the frequency of the rotor circuit is nearly twice the line frequency, and the voltage is the maximum. At this time the coil Z chokes off the current to coil s_3 because of its high frequency. But as the motor slows down, the frequency also reduces, until the motor has almost stopped, at which time the voltage and the frequency in the coil s_3 is just sufficient to produce a magnetomotive force equal and opposite to the coil s_1. The resultant flux, then at zero or nearly zero, is not sufficient to hold the armature against the spring 53. Consequently, the contact at 48 is broken, which in turn deenergizes the solenoid 26 of the switch C, thus opening the switches C and D, which fall back by gravity. This breaks the circuit of the motor.

The switches B and E act similarly to the switches A and C in conjunction with the switch D to control the motor when it is reversed, by shifting the handle k of the master switch to the right, as, for instance, in causing the elevator to go down. It will be observed that the selecting switch S closes immediately upon the closing of the switches C or E.

It will be seen that I have provided an arrangement whereby the motor may be actuated in one direction, and dynamic braking action applied to bring the motor to rest, after which the circuit of the motor is automatically broken.

In Figure 2 I have shown a modified form of the device. In this form of the device there is the same arrangement of switches A, B, C, D, and E. The motor M has connected with it a centrifugal device T which is provided with a push rod 60 arranged to engage a switch arm 61 which is pivotally mounted at 62, and which may be brought into engagement with a contact 63 by means of a spring 64. When the motor is speeded up, the weights 65 of the centrifugal device move upwardly, thus withdrawing the push rod 60 and permitting the closing of the contacts 61 and 63. When the motor slows down, the spring 66 forces the push rod against the switch arm 61, opening the contacts. The arrangement of switches is substantially the same as that already described. Instead, however, of making use of a dynamic selecting switch for holding the actuating circuit of the solenoid of the switches C and E closed, when the switches A or B are deenergized, a locking circuit is provided for these solenoids which is controlled by the centrifugal device in the following manner: Consider the solenoid 26 of the switch C. The actuating circuit is from the wire G, through the coil, thence through wire 68, contacts 69 and 70, wires 71 and 72, to feed wire F. The actuating circuits of the motor are the same as those set forth in connection with Figure 1. When the motor speeds up, there is a locking circuit which is closed at the contact 63 by the movement of the cen-

trifugal device, this locking circuit being from the wire 68, through conductor 73, contact 63, switch lever 61, and back by conductor 72. It will, therefore, be seen that when the switch A is deenergized in the manner already described in connection with Figure 1, and the contacts 69 and 70 are broken, the solenoid 26 is not deenergized, but still keeps the switch C closed, while the dynamic braking circuit is acting on the motor to slow it down. When, however, the motor is slowed up sufficiently, then the push rod 60 of the centrifugal device will engage the switch lever 61 so as to break the contact at 63, thus breaking the locking circuit of the solenoid 26 and permitting the switches C and D to fall back to their normal position. It will be understood that the switch E is applied with the solenoid which is operated in precisely the same manner.

Instead of making use of the locking circuit just described, or of the dynamic selecting switch, I may place a separate winding on the solenoid and excite these windings by a local circuit. In Figure 3 I have shown such an arrangement. In this figure the solenoid 26 has an additional winding 26^a which is connected with a direct current generator 75. The latter is designed to be connected with the shaft of the motor M, so that when the motor is actuated, the current in the coil 26^a tends to keep the switch C (or E, as the case may be) closed as long as the motor is in operation, but when it, and the generator 75 connected with it, slows down to a certain point, the current in the coil 26^a is decreased to such an extent that the weight of the switch causes it to fall back by gravity, thus breaking the motor circuit in the manner already described.

In addition to operating on motors of the single speed type, I may operate with motors of the two speed type, and in such case I make use of two additional switches, such as those shown at A and B, each switch being associated with its individual winding on the motor, and operating with a switch, such as that shown at C for exerting a dynamic braking effect on the motor and for subsequently disconnecting the motor when it is slowed down.

I claim:

The combination of an induction motor, a source of current for the motor, switching mechanism for connecting the source of current to the motor to rotate the same, said switching mechanism comprising a plurality of electro-magnetic responsive switches acting conjointly to complete the motor circuit, one of said switches being deenergized at will, another constituting an auxiliary switch cooperating with said deenergized switch to effect a reversing of the phases of the motor, whereby a dynamic braking effect is applied to the motor, and automatic means actuated through the slowing down of the motor for deenergizing said auxiliary switch to cut off the motor circuit, whereby the motor is stopped, said automatic means comprising a locking circuit for the auxiliary switch, and a selecting switch connected with the rotor circuit of the motor for breaking the locking circuit when the motor slows down.

ROBERT H. FISHER.