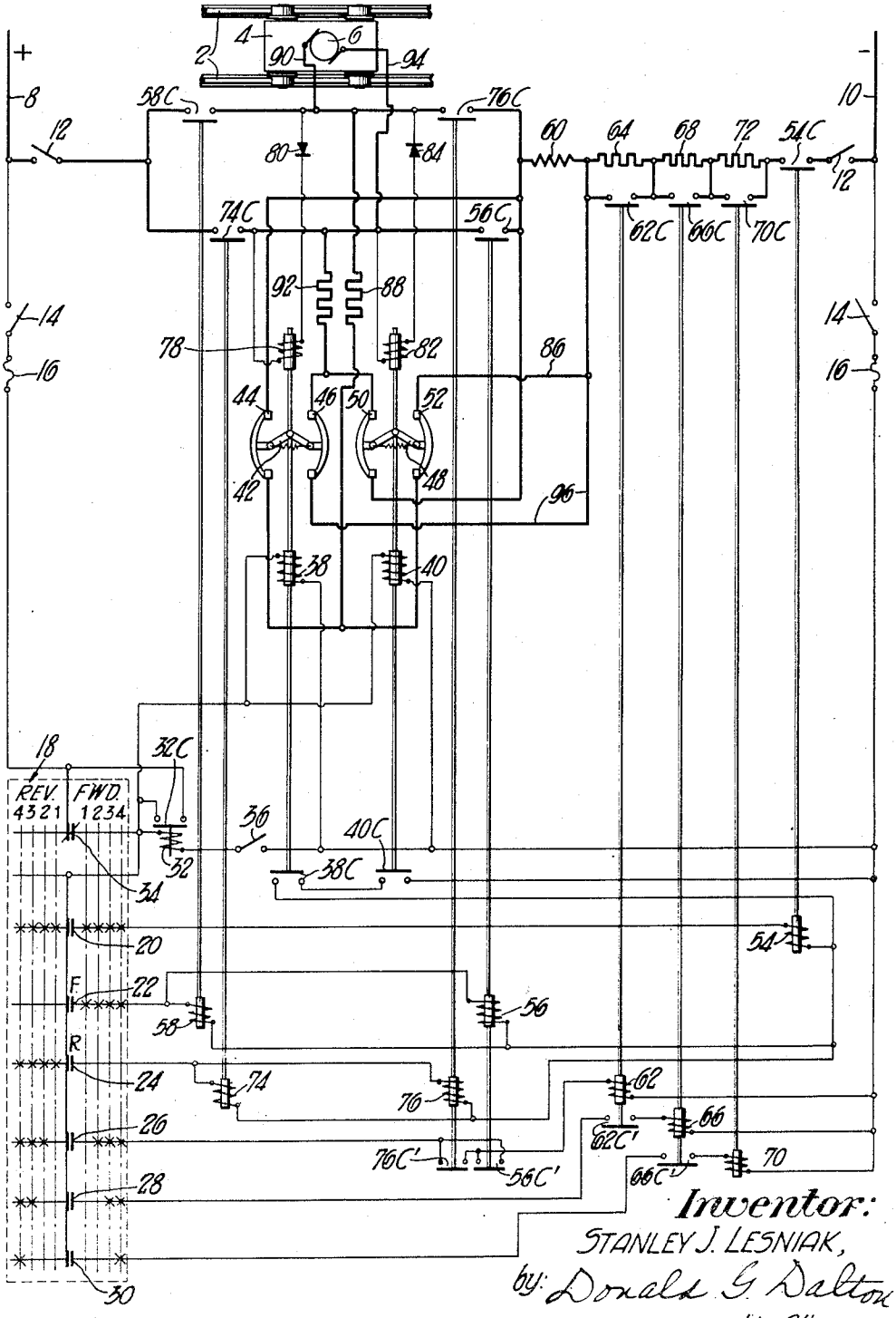
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TWO-DIRECTIONAL DYNAMIC BRAKING CIRCUIT

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TWO-DIRECTIONAL DYNAMIC BRAKING CIRCUIT

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4 Claims. (Cl. 318—368)

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This invention relates to a two-directional braking circuit and more particularly to such a circuit for use with a single series motor which is used to drive ingot buggies. At the soaking pits the ingot buggies are stopped by plugging the motor. However, when power fails the buggy will drift until the inertia is dissipated and during that period it will be entirely out of control and may do a lot of damage.

It is therefore an object of my invention to provide a two-directional braking circuit for the motor which will stop the ingot buggies from drifting when power to the motor fails for any reason.

This and other objects will be more apparent after referring to the following specification and attached drawings, in which:

The single figure shows a schematic wiring diagram of the circuit.

Referring more particularly to the drawings, the reference numeral 2 indicates a track for an ingot buggy 4 which is driven by a single series field motor having an armature 6. The power circuit for the motor is shown in heavy lines and the control circuit is shown in light lines. Power is supplied to the motor armature 6 from power source 8, 10 through a switch 12. Power is supplied to the control circuit through a switch 14 and fuse 16. The control circuit is provided with a master switch 18 having a number of contacts operated by cams whose positions are controlled by the master switch handle. As shown, the master switch is provided with four forward and four reversing positions. The switch is provided with contacts 20, 22 24, 26, 28 and 30. When the operator places the master switch handle in the first position on the forward side the contacts 20 and 22 close, this being indicated by the X adjacent the contacts under position 1. A relay coil 32 is connected across the lines 8 and 10 through point 34 in the switch 18. A dead-man switch 36 is preferably provided in series with the coil 32 which will be energized as long as the switch 36 is closed. When the coil 32 is energized its contacts 32C will also be closed. A relay coil 38 is arranged in series with the contact 32C and a second relay coil 40 is arranged in parallel with the coil 38. When the coil 38 is energized it will operate toggle mechanism 42 to open sets of contacts 44 and 46. In like manner when the coil 40 is energized it will operate toggle mechanism 48 to open sets of contacts 50 and 52. When the master switch handle is in the first position and the switches 12 and 14 closed a relay coil 54 will be energized through contacts 38C and 40C. This

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will close contacts 54C. Relay coils 56 and 58 will also be energized closing their contacts 56C, 56C' and 58C. This closes the power circuit through motor armature 6 to series field 60 and starts the car 4 in its forward movement. The master switch handle is then moved to its second position in which contacts 20, 22 and 26 are closed as indicated by the X adjacent each of these contacts under position 2. Closing of contact 26 energizes relay coil 62 thus closing its contacts 62C and 62C'. Closing of contact 62C by-passes resistance 64 thus increasing the speed of the motor. The master switch handle is then moved to the third position to close contact 28 thus energizing relay coil 66 and closing its contacts 66C and 66C'. Closing of contact 66 by-passes resistance 68 to further accelerate the motor. The master switch handle is then moved to its fourth position to energize relay coil 70 and close its contacts 70C which by-passes resistance 72 and brings the motor up to full speed. When it is desired to reverse the motor the master switch handle is moved to reversing position number one to close contacts 20 and 24. Closing of contacts 24 will energize relay coils 74 and 76 thus closing their contacts 74C, 76C and 76C'. This completes a circuit through the armature 6 to cause the motor to move in the reverse direction. The master switch handle is then moved to the second reversing position to complete a circuit through coil 62 to by-pass the resistance 64 and thus accelerate the motor. In like manner the master switch handle is moved successively to the third and fourth reversing positions in which relay coils 66 and 70 are closed to by-pass resistances 68 and 72.

A relay coil 78 is also connected to the toggle mechanism 42 and when energized will cause the toggle mechanism to close the contacts 44 and 46. The relay coil 78 is connected to the motor armature 6. A rectifier 80 is provided in this connection and permits flow of current in the direction indicated only. A relay coil 82 is also connected to operate toggle mechanism 48 and when energized will cause contacts 50 and 52 to close. The relay coil 82 is connected to the motor armature 6 and a rectifier 84 is provided in this connection to permit passage of current only in the direction indicated. The series field 60 is connected in series with the contacts 52 through lead 86 and is also in series with a resistor 88. Resistor 88 is connected to the motor armature 6 through a lead 90. The series field 60 is also connected in series with the contacts 50 and a resistor 92. Resistor 92 is connected to the arma-

ture 6 through a lead 94. The series field 60 is connected through a lead 96, contacts 46, resistor 92 and the lead 94 to one side of the armature 6 and to the opposite side of armature 6 through contacts 44, resistor 88 and lead 90. Coils 38 and 40 are sufficiently powerful to hold their respective contacts open against operation by coils 78 and 82, respectively, prior to dynamic braking operation. When coils 38 and 40 are de-energized coils 78 and 82 have sufficient strength to close their respective contacts.

The operation of the device is as follows: When the power is lost for any reason, such as when the dead-man switch 36 opens or when there is a general power failure, the relay coil 32 will be deenergized thus deenergizing coils 38 and 40. Progressively, all the other coils will become deenergized and their contacts will return to their normal position with the exception of contacts 44, 46, 50 and 52 which will be held open by toggle mechanisms 42 and 48. Assuming that the car 3 is moving in a forward position the inertia of the moving car will drive the motor as a generator and set up a counter electromotive force. This will energize relay coil 78 through lead 90, rectifier 80 and lead 94. Relay coil 82 will not be energized because the current will not be able to flow through recifier 84. Energization of coil 78 will close contacts 44 and 46 thus completing a circuit from the motor armature 6 through series field 60 and resistors 88 and 92 which will dissipate the power generated. If the car 4 is traveling in the reverse direction the coil 82 will be energized by the counter electromotive force from the motor armature 6 through lead 94, rectifier 84 and lead 90. In this case coil 78 will not be energized because rectifier 80 will not permit passage of current. Energization of coil 82 will close contacts 50 and 52 thus completing a circuit through series field 60 and resistors 88 and 92 which will dissipate the power generated.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. In a dynamic braking circuit for a reversible direct current motor having an armature and a series field winding, a first relay having an opening coil, a closing coil and two sets of contacts, a second relay having an opening coil, a closing coil and two sets of contacts, a first circuit connected in parallel with said armature, said first circuit including in series a first rectifier and the closing coil of said first relay, a second circuit connected in parallel with said armature, said second circuit including in series a second rectifier and the closing coil of said second relay, said rectifiers being oppositely poled with respect to the voltage across said armature, a first closed series circuit including said first named contacts, a resistance, said armature and said field winding, and a second closed series circuit including said second named contacts, said resistance, said armature and said field winding.

2. In a dynamic braking circuit for a reversible direct current motor according to claim 1, a relay having a normally energized coil and normally closed contacts, said normally closed contacts being connected in series with each of said opening coils.

3. In a dyamic braking circuit for a reversible direct current motor according to claim 1, each of said first and second relays including a toggle mechanism for operating the contacts of said relay, said toggle mechanism being operable by the coils of the relay.

4. In a dynamic braking circuit for a reversible direct current motor according to claim 3, a relay having a normally energized coil and normally closed contacts, said normally closed contacts being connected in series with each of said opening coils.

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No References Cited.