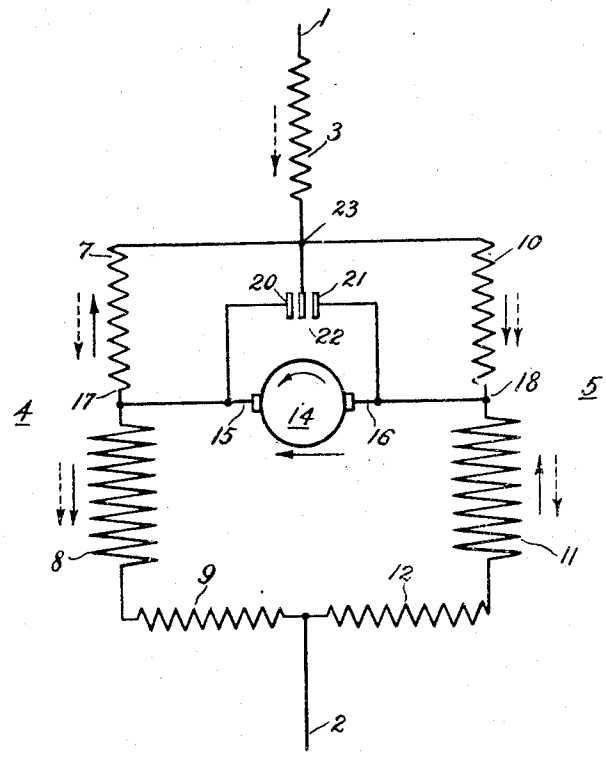
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1,580,457

V. H. TODD

MOTOR CONTROL CIRCUITS

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UNITED STATES PATENT OFFICE.

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MOTOR-CONTROL CIRCUITS.

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To all whom it may concern:

Be it known that I, VICTOR H. TODD, a citizen of the United States, and resident of Summit, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Motor-Control Circuits, of which the following is a specification.

My invention relates to motor-control circuits and particularly to control circuits for graphic-meter motors.

One object of my invention is to provide a circuit, of the above indicated character, that shall render a graphic-meter motor sensitively and accurately responsive to changes in the quanity being measured by the meter.

Another object of my invention is to provide means that shall eliminate arcing between the control contact members of a graphic-meter motor.

Another object of my invention is to provide a motor-control circuit that shall permit the motor to be operated on direct-current circuits and on alternating-current circuits of widely varying frequencies.

Another object of my invention is to provide a motor-control circuit that shall utilize dynamic braking to quickly stop rotation of the armature.

A further object of my invention is to provide a motor-control circuit for graphic-meter motors that shall be simple and durable in construction and effective in its operation.

In graphic-meters practices, it is usual to provide a Kelvin balance that is actuated in accordance with volts, amperes, watts or any other quantity of a circuit that it is desired to measure.

To relieve the movable element of the balance of the necessity of moving a stylus or pen carriage, a pilot or control motor is ordinarily provided and the movable element is only required to open and close contact members to de-energize or reverse the field-winding current of the pilot motor in accordance with variations in the quantity being measured.

Trouble has been experience because of arcing at the contacts and because the inertia of the pilot motor armature has caused the pen carriage to over and under travel. Certain other faults have been inherent in meters of this type which rendered them troublesome and inaccurate.

In order to ensure suitable sensitivity of operation, that is, to ensure quick response of the pilot motor, it is necessary to have the clearances between the control contact members extremely slight. The least clearance at which good positive operation is obtainable is about two mils. The least practicable spacing has heretofore been about four mils. These small clearances, which have been used only in special cases requiring extreme sensitivity, have required extreme care in setting the gap to avoid short-circuiting the stationary contacts with the moving contact. However, such settings have heretofore frequently caused blown fuses and burned armatures in the pilot or control motors.

In practicing my invention, I provide a pair of parallel-connected constantly-energized field-winding circuits, across equipotential points of which the control-motor armature is connected in the de-energized condition of the armature. A contact-making device so alternately connects the armature terminals to one end of the parallel-field-winding circuits as to alternately shunt a portion of each parallel leg of the field-winding circuit. This operation causes a sufficient voltage drop across the armature to cause the latter to rotate in the one or the other direction. The contact-making device is so connected to opposite terminals of the armature as to have no appreciable voltage-drop between a pair of its terminals in the de-energized condition of the motor, and is also connected to the motor field magnet windings through resistors, which absorb arcs between each contact member of said pair and a third contact member which alternately engages each of them.

Other resistors are provided and the circuits, including the armature and the field windings, are so arranged as to adapt the device for operation in direct-current circuits or in alternating-current circuits of widely varying frequencies, without arcing at the control contact members, and in an effective and quickly-responsive sensitive manner.

The single figure of the accompanying

drawings is a diagrammatic view of the motor control circuit of my invention, the Kelvin balance, the pen carriage and other parts being omitted as not essential to an understanding thereof.

Between terminals 1 and 2, across which the actuating electromotive force is impressed, are disposed a series resistor 3 and two parallel-field-magnet winding circuit paths 4 and 5. The path 4 comprises a resistor 7, a field-magnet winding 8 and a non-inductive resistor 9; and the path 5, similarly, comprises a resistor 10, a field winding 11 and a non-inductive resistor 12.

An armature 14 has terminals 15 and 16 that are respectively connected to equi-potential points 17 and 18 in the paths 4 and 5.

Stationary contact members 20 and 21 are connected to the armature terminals 15 and 16, respectively, and a movable contact member 22, for alternate engagement with the stationary contact members 20 and 21, is connected to a common terminal 23 of the resistors 7 and 10.

In operation, with electromotive force being constantly impressed across the conductors 1 and 2 and the contact members 20, 21 and 22 in the positions illustrated in the drawing, the armature 14 is stationary, because there is no voltage drop between the points 17 and 18.

However, when the Kelvin balance, as above mentioned, responds to a change in the quantity being measured to move the contact member 22 into engagement with one of the contact members 20 and 21, one of the resistors 7 and 10 is shunted to cause a drop of potential across the armature 14. This operation causes the armature to rotate.

When the movable contact member again moves to the disengaged position, the arc, which would ordinarily attempt to form, is absorbed by the resistor 7 or the resistor 10 which had previously been shunted.

When the armature rotates under its own momentum, it generates a voltage which is short-circuited through the resistors 7 and 10, to thus, bring the armature to a quick stop. This effect is known as dynamic braking.

The resistors 9 and 12 are provided to reduce the field magnet current and to thus effect the correct speed of the armature 14 when the actuating electromotive force is direct. When the actuating force alternates, at sixty cycles, the inductance of the field magnet windings 8 and 11 is ordinarily sufficient to ensure the correct speed.

It was found that the amount of resistance necessary in the field magnet circuit for various frequencies in the actuating force is practically constant, so an average value was chosen, which permits the motor to operate in circuits of widely varying frequencies without changing the resistors.

While I have shown and described one form of my invention, various modifications and changes may be made without departing from the spirit and scope of the invention I desire, therfore, that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:

1. A motor-control circuit comprising parallel field-magnet-winding circuits, an armature connected between equi-potential points in the field-magnet-winding circuits and means for shunting a portion of one of the field-magnet winding circuits.

2. A motor-control circuit comprising parallel-field-magnet-winding circuits, an armature connected between equi-potential points in the field-magnet-winding circuits and means for alternately shunting a portion of one of said field-magnet-winding circuits and a portion of the other for reversing the direction of rotation of the armature.

3. A motor-control circuit comprising parallel-field-magnet-winding circuits, an armature connected between equi-potential points in the field-magnet winding circuits and means for alternately shunting a portion of one of said field-magnet-winding circuits and a portion of the other for reversing the direction of rotation of the armature comprising a pair of contact members connected one to each armature terminal and a third contact member for alternate engagement with said pair of contact members and connected to one end of the parallel field-magnet circuit paths.

4. A motor-control circuit comprising parallel field-magnet winding circuits, each comprising a field magnet winding and a resistor, an armature connected across said circuits to positions between the resistor and the field magnet winding at each armature terminal, a pair of contact members connected one to each armature terminal and a third contact member for alternate engagement with said pair of contact members and connected to a common terminal of said resistors.

5. A motor-control circuit comprising parallel field-magnet winding circuits each comprising a resistor, a field magnet winding and a second resistor arranged in the order named, an armature connected across said circuits between the first resistor and the field magnet winding at each armature terminal, a pair of contact members connected one to each armature terminal and a third contact member connected to a common terminal of said first resistor for alternate engagement with the contact members of said pair.

6. A motor control circuit comprising parallel field-magnet-winding circuits each comprising a resistor, a field magnet winding and a second resistor arranged in the order named, an armature connected across said circuits between the first resistor and the field magnet winding at each armature terminal, a pair of contact members connected one to each armature terminal, a third contact member connected to a common terminal of said first resistors for alternate engagement with the contact members of said pair and a resistor connected in series with said parallel field-magnet winding circuits.

In testimony whereof, I have hereunto subscribed my name this twenty-ninth day of May 1924.

VICTOR H. TODD.