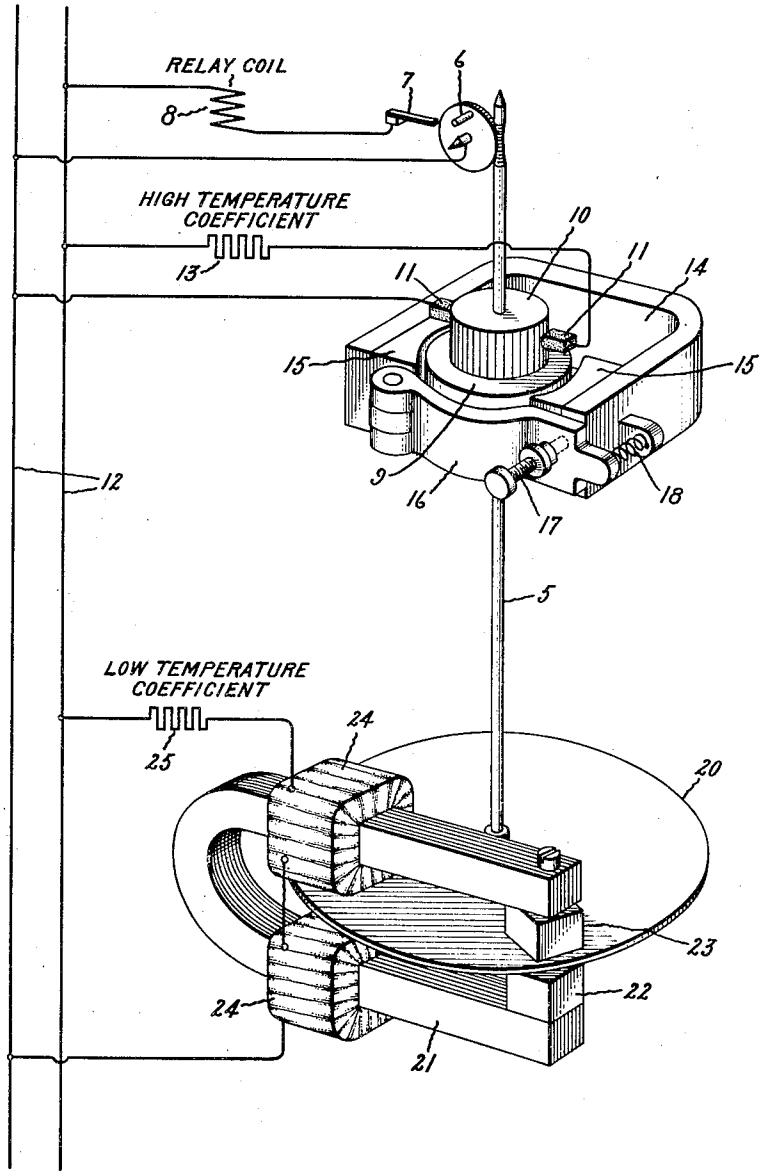
C. I. HALL.

CONSTANT SPEED DEVICE.

APPLICATION FILED SEPT. 19, 1916.

1,323,761. Patented Dec. 2, 1919.



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UNITED STATES PATENT OFFICE.

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CONSTANT-SPEED DEVICE.

1,323,761. Specification of Letters Patent. Patented Dec. 2, 1919.

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To all whom it may concern:

Be it known that I, CHESTER I. HALL, a citizen of the United States, residing at Fort Wayne, county of Allen, State of Indiana, have invented certain new and useful Improvements in Constant-Speed Devices, of which the following is a specification.

My invention relates to constant speed devices, and especially to electrically driven constant speed devices. The invention more particularly relates to electrically driven devices adapted for time-keeping purposes, such as are employed in electric time switches, maximum demand apparatus, and the like.

The object of the invention is to provide an improved electrically driven constant speed device. A further object of the invention is to provide an improved electrically driven device adapted for time-keeping purposes, and more especially to provide such a device for operation with electric energy in the form of direct current. Other objects of the invention will be brought out in the following description.

The use of electrically driven devices, such as electric motors, for time-keeping purposes in place of spring-actuated clockworks has many advantages. For example, spring-actuated clockworks need to be periodically wound, whereas electrically driven devices are practically automatic in operation. Accordingly, many types and designs of electrically driven devices have been proposed for this purpose. One of the chief difficulties heretofore experienced has been in providing an electrically driven device whose speed is not affected by voltage fluctuations, such as occur in commercial electric circuits, and, further, a device whose speed is substantially independent of temperature changes. Electrical apparatus in which time-keeping devices are embodied are frequently located in places where the temperature conditions are very far from uniform. Such apparatus are, accordingly, subjected to large changes in temperature with the changes in the seasons of the year, and to relatively smaller daily temperature variations, and for satisfactory operation the time-keeping devices thereof should be substantially independent of all such temperature changes. The principal aim of my present invention is, therefore, to provide a device for time-keeping purposes adapted to be driven at substantially constant speed by electric energy in the form of direct current and whose speed is for most practical purposes independent of such voltage and temperature changes as are encountered in commercial practice.

The novel features of the invention which I believe to be patentable are definitely indicated in the claims appended hereto. The invention itself and the construction and mode of operation of a device embodying the same will be best understood from the following description taken in conjunction with the accompanying drawing, in which;

The figure is a diagrammatic view in perspective of an electrically driven constant speed device embodying my present invention.

The constant speed device of my present invention consists broadly of two electrical elements, first, an electric motive element, and, second, an electromagnetic retarding element. The electric motive element is in principle of the conventional direct current motor type. The retarding element is in the nature of a uniform load imposed on the motive element, and preferably consists of an electromagnetic damping device. A device of the type to which my present invention particularly relates is called upon to perform little or no mechanical work. Usually, such a device is employed to close a pair of coöperating electric contacts. The device may, therefore, be made relatively small, and I have found the type of construction now employed in the well known forms of watthour meters to be particularly applicable to the device of my present invention. It should be noted in this connection, however, that the electric motive element of my present invention will always be operating at full torque, and hence the moving element may be made considerably heavier than in any electric meter construction of corresponding dimensions.

Referring now to the accompanying drawing, the improved constant speed device of my present invention comprises a rotatable shaft 5. This shaft is preferably of the same type now employed in watthour meters, and is pivotally mounted in suitable jewel bearings. For the purposes of explanation, I have illustrated the shaft 5 as driving a movable contact 6. The movable contact 6 coöperates with a fixed contact 7 to complete

the circuit of a relay coil 8. The relay coil 8 may be associated with any apparatus whose operation is to take place at predetermined time intervals.

A cylindrical magnetic core 9 is mounted on the shaft 5, and carries a commutated armature winding of the direct current type. In the drawing, the armature winding is conventionally represented by the commutator 10 and coöperating brushes 11. The armature winding is connected across a source 12 of direct current potential. A resistance 13 of high temperature coefficient is included in series relation with the armature winding. A stationary field magnet surrounds the armature core 9. In the motive element illustrated in the drawings, this field magnet comprises a permanent U-shaped magnet 14 having pole pieces 15. The poles of the permanent magnet 14 are bridged by a magnetic shunt 16. The magnetic shunt 16 diverts a portion of the flux of the magnet 14 from the armature winding, and for calibration purposes this shunt is preferably adjustable. To this end, I provide an adjusting screw 17 for varying the air gap between one pole of the magnet 14 and one end of the magnetic shunt 16. A spring 18 operates to firmly hold the magnetic shunt 16 in its adjusted position.

A disk 20 of conducting material such as aluminum, copper, or the like, is secured to the shaft 5 below the armature core 9. This disk is preferably of the well known type employed in watthour meters. The disk 20 is arranged to rotate in an air gap in the magnetic circuit of an electromagnet. In the device shown in the drawing, this electromagnet consists of a U-shaped magnetic core 21 having a fixed lower pole piece 22 and an adjustable upper pole piece 23. The pole pieces 22 and 23 are separated by a small air gap in which the disk armature 20 is positioned. Energizing coils 24 are mounted on the core 21 and are connected to the source of direct current potential 12. A resistance 25 of low temperature coefficient is included in series with the energizing coils 24.

The armature winding of the motive element and the energizing coils of the retarding element of my improved constant speed device are each connected to a common source of direct current potential. Any fluctuations in the voltage of this source will cause opposite effects of these two elements of the device, and these opposing effects are more or less balancing so that the device is for most practical purposes substantially independent of voltage fluctuations.

Changes in temperature affect the conductivity of the disk 20 and hence the load imposed on the motive element. This temperature error can be overcome to a certain extent by making the disk of a material of low temperature coefficient. In practice, however, it is desirable to make the disk of a material such as copper or aluminum. I have found that the temperature error can be practically eliminated by placing a resistance of high temperature coefficient in series with the armature winding, and a resistance of low temperature coefficient in series with the energizing coils of the damping device. The change in damping due to changes in the conductivity of the disk 20 is thus balanced by the variations in the torque of the motive element due to the change in current flowing in the armature circuit. I have found an iron or nickel wire of high temperature coefficient to be well suited for the resistance 13 in the armature circuit, while any of the well known commercial materials having a low temperature coefficient with respect to electrical conductivity may be employed for the resistance 25.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electrically driven constant speed device comprising an electric motive element, an electromagnetic retarding element, a resistance of high temperature coefficient associated with said motive element, a resistance of low temperature coefficient associated with said retarding element, and a common source of direct current potential for energizing said two elements.

2. An electrically driven constant speed device comprising a rotatable shaft carrying an armature winding and a disk of conducting material, a stationary field magnet within whose influence said armature is arranged, an electromagnet having an energizing coil and positioned to influence said disk, a resistance of high temperature coefficient in series with said armature winding, and a resistance of low temperature coefficient in series with said energizing coil.

3. An electrically driven constant speed device comprising a rotatable shaft, a stationary field magnet, a commutated armature winding carried by said shaft and positioned within the influence of said field magnet, a resistance of high temperature coefficient included in series relation in the circuit of said armature winding, an electromagnet having an energizing coil, a disk of conducting material secured to said shaft and arranged within the magnetic influence of said electromagnet, a resistance of low temperature coefficient included in series relation in the circuit of said energizing coil, and a common source of direct current potential for energizing said armature winding and said energizing coil.

4. An electrically driven constant speed device comprising a rotatable shaft, a magnetic core mounted on said shaft, a commutated armature winding carried by said core, a field magnet surrounding said core,

a resistance of high temperature coefficient included in series relation in the circuit of said armature winding, a stationary magnetic core having an air gap, a disk of conducting material secured to said shaft and positioned to rotate in said air gap, an energizing coil mounted on said stationary core, and a resistance of low temperature coefficient included in series relation in the circuit of said energizing coil.

5. An electrically driven constant speed device comprising a rotatable shaft carrying a commutated armature winding and a disk of conducting material, a stationary field magnet surrounding said armature winding and having an adjustable magnetic shunt adapted to divert magnetic flux from the armature winding, a stationary magnetic core having an air gap in which said disk is adapted to rotate, an energizing coil mounted on said stationary core, a resistance of high temperature coefficient included in series relation in the circuit of said armature winding, a resistance of low temperature coefficient included in series relation in the circuit of said energizing coil, and a common source of direct current potential to which said armature winding and said energizing coil are connected.

6. An electrically driven constant speed device comprising a rotatably mounted shaft, an electric motive element of the direct current type for driving said shaft, an electromagnetic damping element for retarding the rotation of said shaft, said motive element having a commutated armature winding carried by said shaft, a stationary permanent magnet having its poles separated from said armature winding by a small air gap, an adjustable magnetic shunt arranged to divert a portion of the flux of said magnet from said armature winding, a resistance of high temperature coefficient included in series relation with said armature winding, said damping element having a disk of conducting material secured to said shaft, a magnetic core having an air gap in which said disk is arranged to rotate, an energizing coil mounted on said magnetic core, a resistance of low temperature coefficient included in series relation with said energizing coil, and a common source of direct current potential to which said armature winding and said energizing coil are connected.

In witness whereof, I have hereunto set my hand this 15th day of September, 1916.

CHESTER I. HALL.