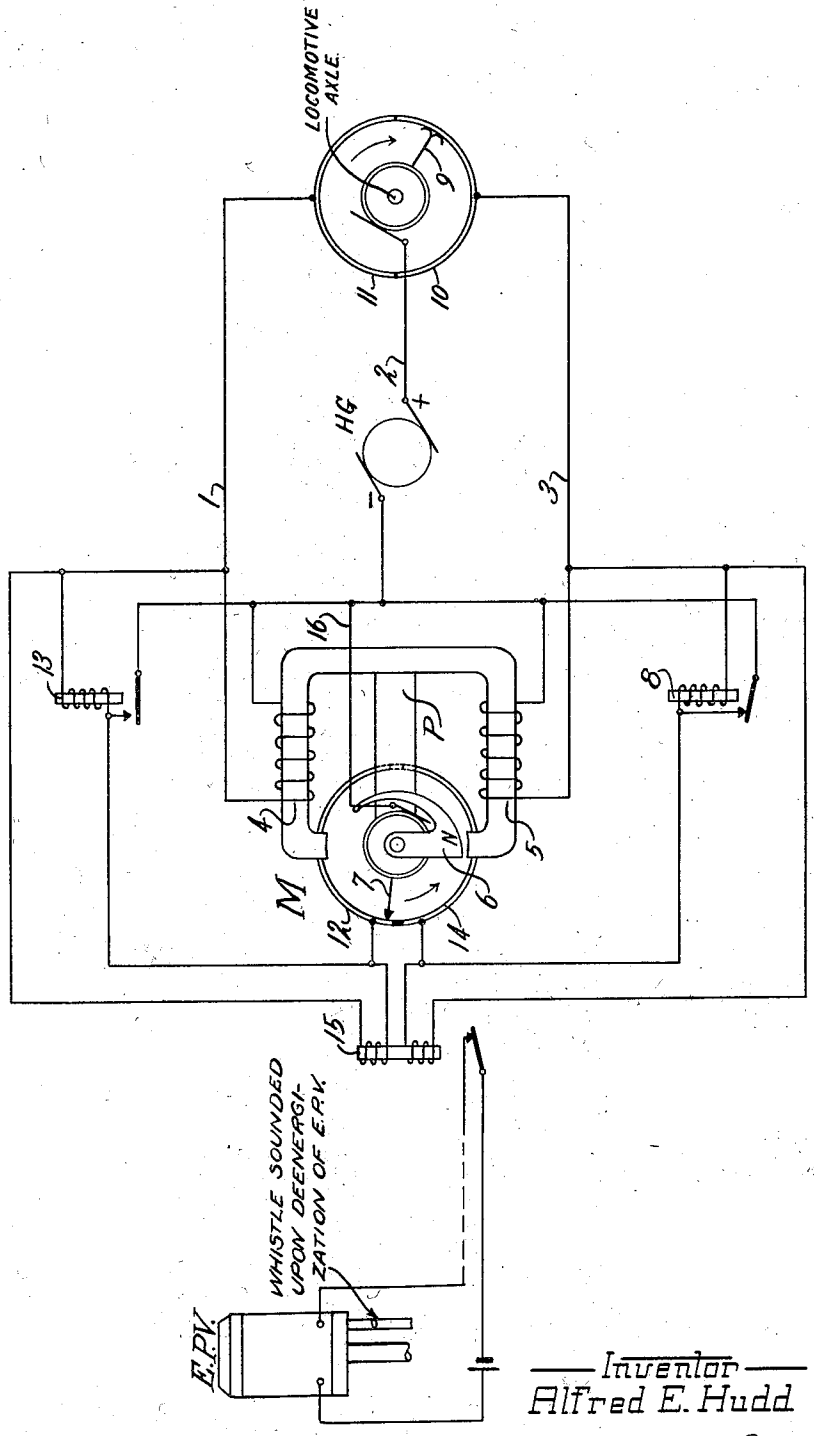
July 23, 1935. A. E. HUDD 2,008,912

DRIVING MECHANISM

Filed July 16, 1928




Inventor
Alfred E. Hudd

Wm. Watts Orrell Atty.

Patented July 23, 1935 2,008,912

# UNITED STATES PATENT OFFICE

2,008,912

## DRIVING MECHANISM

Alfred E. Hudd, Evanston, Ill., assignor, by mesne assignments, to Associated Electric Laboratories, Inc., Chicago, Ill., a corporation of Delaware

Application July 16, 1928, Serial No. 293,116

9 Claims. (Cl. 177—311)

The present invention relates in general to driving mechanisms for use in operating speed indicating distance measuring and similar devices located on a vehicle; and the objects of the invention are, first, to provide a mechanism of this character which requires no mechanical connection between it and the moving part of the vehicle from which the mechanism is controlled or driven; second, to provide a mechanism of this character which is self detecting, that is to say, it controls equipment for supervising the operation of the mechanism; third, to provide a mechanism of this character which is simple, inexpensive and therefore not likely to get out of order or give trouble.

These objects are attained by the mechanism and circuits illustrated in the accompanying drawing, which diagrammatically illustrates the invention applied to a locomotive.

The power for operating the mechanism to be driven is supplied by a motor M. In the present illustration this motor consists of a two pole field having windings 4 and 5, and of an armature 6, polarized by a permanent magnet P. The armature 6 is caused to rotate by alternately energizing the windings 4 and 5. For this purpose a stationary commutator having two segments 10 and 11 are mounted so that they surround an axle of the locomotive, and on this axle is mounted a brush 9, which rotates over the surface of the segments. The brush 9 is constantly supplied with positive current from a locomotive headlight generator HG, and the conductor 2 extending therefrom.

In order to detect any failure of the functioning of the device a pair of relays 8 and 13 and the commutator and brush arrangement associated with the motor M are provided. The commutator associated with the motor M is similar to the one surrounding the locomotive axle, and comprises two segments 12 and 14. The brush 7, is secured to the shaft of the armature 6 and is in substantially continuous engagement with one or the other of the segments 12 and 14. A conductor 16 and a collector brush associated with the hub of the brush 7 continually supply this brush with negative current from the negative terminal of the headlight generator. The relay 8 has one terminal of its winding connected to the commutator segment 10 via a conductor 3; while the other terminal of its winding is connected to the corresponding segment 14 of the commutator associated with the motor M. Likewise the relay 13 has the terminals of its winding connected with the commutator segments 11 and 12, respectively.

The normally energized relay 15 represents a detector relay which, it is assumed, only drops its armature upon failure of the driving mechanism. The relay 15, it will be understood, when energized, prevents alarm or train stopping mechanism from operating. For the purpose of illustration it is shown arranged, when deenergized, to open the circuit of an electropneumatic valve to operate a whistle and initiate an automatic brake application, as is common practice in many train control systems. This relay is so designed that it requires the energization of both windings to enable it to pick up its armature; but once energized either winding is sufficient to hold the armature in its energized position. The relay 15 has one terminal of each of its windings connected to the respective commutator segments 12 and 14, and has the other terminals of its windings connected to the respective segments 11 and 10 of the commutator associated with the axle of the locomotive. It will be seen therefore, that the windings of the relay 15 are in multiple with the windings of relays 13 and 8 respectively. The armatures and associated contacts of the relays 8 and 13 are effective, when closed to close circuits through the windings of relay 15 which exclude the segments 12 and 14 and the associated wiper 7.

It is believed that the invention can be best explained by describing the operations and functions as they take place. For this purpose it will be assumed that the apparatus is all in the condition shown, and that the locomotive is traveling in a direction which causes a clock-wise rotation of the locomotive axle indicated in the drawing. With the circuits and apparatus as shown, a circuit for holding the relay 15 operated may be traced from the positive terminal of the headlight generator HG, through conductor 2, brush 9, segment 10, conductor 3, through the lower winding of relay 15, and through the contact and armature of the relay 8 to the conductor leading to the negative terminal of the headlight generator. The relay 8 is held up over a circuit in multiple with the lower winding of relay 15 extending from a branch of the conductor 3 through the winding of relay 8, the contact and armature of the relay 8 and the conductor extending to the negative terminal of HG. The lower field winding 5 of the motor M is also energized at this time, from the positive potential on conductor 3 and negative potential direct from HG, making the lower field pole 5 of strong south polarity,

and therefore causing the polarized armature 6, of north polarity, due to the presence of the permanent magnet P, to remain in the position shown. The circuits for the winding of relay 13, the upper winding of 15 and upper field coil 4 are all open at this time, because of the position of the brush 9. The other terminals of these windings, it should however be noted, are connected with the negative terminal of the headlight generator; the one terminal of winding 15 and of 13 being connected via segment 12, brush 7, and conductor 16; and the field coil winding 4 being connected direct to the headlight generator.

As the vehicle progresses, the wiper 9 rotates about the segment 10 in the direction indicated by the arrow, and momentarily bridges both the segments 10 and 11. For this brief interval, therefore, an energizing circuit is also completed for the upper field coil 4, relay 13 and the upper winding of relay 15 by positive potential being applied to conductor 1. Since at this instant both of the field coils are energized in a direction to cause them both to produce the same polarity, no movement of the armature 6 takes place. The relay 13, however, operates and at its armature closes a circuit through the upper winding of relay 15, which circuit excludes the segment 12 and brush 7, to prevent it from deenergizing when the circuit through its lower winding and through the segment 12 and brush 7 is opened a moment later.

The instant the wiper 9 passes off the segment 10, the current formerly supplied from the positive terminal of the generator to the field winding 5, relay 8 and lower winding of the relay 15, is cut off, and the energized field coil 4 becomes effective to rotate the armature 6 in the direction indicated. The wiper 7 rotating with the armature 6 immediately opens a point in initially traced circuit through the upper winding of the relay 15 and stops at the extreme end of the segment 14 to again prepare an operating circuit for the relay 8. Owing to the substitute circuit traced through the upper winding of relay 15, this relay remains operated.

Nothing further happens now until the brush 9 again overlaps the two segments 11 and 10. When this occurs a circuit is again completed for relay 8, the lower winding of relay 15 via segment 14 and brush 7 to the negative terminal of the generator, and through the field winding 5 direct to the negative terminal of the generator. The relay 8 will therefore pick up its armature and complete a substitute circuit for the lower winding of relay 15 which excludes the segment 14 and brush 7. As soon as the brush 9 leaves the segment 11 the winding 5 again becomes effective to cause rotation of the armature 6 into association with it. It will be readily seen therefore that as long as all circuits and mechanism are in working order these operations will be repeated during the movement of the vehicle, and the relay 15 will maintain its armature attracted.

If, however, the armature 6 fails to move as the brush 9 leaves one of the segments, 10, for example, the brush 9 will first open the circuits through the winding of relay 8, the lower winding of relay 15, and the winding 5. Relay 8 will accordingly restore. As soon as wiper 9 moves off of segment 11 the circuit through the upper winding of relay 15 is opened and relay 8 and the lower winding of relay 15 are not energized since brush 7 of the motor M did not move to segment 14 to connect the relay 8 and the lower winding of 15 to HG. Since both windings are open at this time the relay 15 will drop its armature.

Should the armature 6 later start responding again, for instance when the segment 10 is again encountered, the traced circuit for the lower winding of 15 will also again be completed when the segment 10 is encountered. At the instant the brush 9/bridges the segments 10 and 11, at which time circuits are completed by it through both windings of relay 15, and this latter relay therefore again actuates its armature, which is held operated as before.

From the foregoing it will be appreciated that applicant has succeeded in developing an electrical driving mechanism which is equivalent to a mechanical driving mechanism, and which is simple, inexpensive and self detecting.

What is claimed is:

1. In combination with a vehicle, a motor, a commutator having a brush operated by said motor, a second commutator and brush assembly wherein the brush is driven from an axle of the vehicle, a signal, means controlled by the second commutator and brush assembly for controlling the operation of said motor to cause its brush to follow the movement of the brush of said second assembly, and means controlled by said commutator assemblies jointly for operating said signal only in case the motor armature and consequently its brush fails to follow the movement of the brush of said second assembly.

2. In a signalling system, a two segment distributor and a cooperating brush therefor, a motor having but two field windings and having a rotary armature, means including the field windings and armature for successively rotating the armature one half revolution by alternate energization of the field windings, a conductor connecting one of the terminals of each winding to said brush, second and third conductors extending respectively from the other terminals of said windings to the respective segments of said distributor, a source of current included in circuit with said first conductor and consecutively included also in circuit with said second, said second and third, said third, and with said third and second conductors, respectively, under control of said distributor to alternately energize said windings to rotate said motor armature during rotation of said distributor, a second two-segment distributor having a cooperating brush driven by said motor armature, operating circuits including a pair of relays in circuits including said source of current the brushes and the corresponding segments of said distributors and being alternately closed by the brush of the first distributor while such brush is in engagement with both its distributor segments, a locking circuit for one said relay including the one segment of the first distributor and its brush, a locking circuit for the other relay of said pair including the other segment of said first distributor and its brush, whereby each time such brush leaves one of its segments it interrupts the locking circuit of one relay of the pair, and a signal operating relay having windings included in said respective locking circuits.

3. In combination with a vehicle, a motor having a single pole armature and a pair of field coils, means including the field coils and the armature whereby the armature is rotated successively one half a revolution with alternate energization of said coils; a signal control relay having two windings, the energization of both of

which are required to operate the relay, while the energization of one is sufficient to maintain it operated; a pair of other relays, circuits for said relays and field coils, a source of current for energizing said field coils and relays, respectively over said circuits; means for sequentially transmitting overlapping operating impulses to the coils of said motor to rotate the armature of said motor at a speed dependent on the speed of the vehicle, a circuit switching device driven by said motor armature cooperative with said transmitting means to also alternately transmit said overlapping impulses to said pair of relays and to the respective windings of said control relay over their respective circuits so long as the motor armature is responding to the impulses transmitted to it, the circuits through both windings of said control relay closed by said pair of relays while the overlapping of impulses occurs to initially energize said control relay independently of said motor armature, the maintenance of the operated condition of said control relay being thereafter dependent on the continued rotation of said motor armature responsive to the impulses received by it.

4. In combination with a vehicle, an electric motor, field coils and an armature therefor, a source of current, means controlled by the vehicle for connecting said source to said coils of the motor, means including the coils and armature for rotating the armature responsive to the connection of the source to the coils, an indicator, and means including an impulse transmitting device operated by said motor armature for operating said indicator to indicate a failure of the motor operation.

5. In combination with a vehicle, a motor including a pair of field windings and an armature, means to drive said armature in a step-by-step manner when the windings are alternately energized, a commutator having a brush operated by said motor; a second commutator and brush assembly wherein the brush is driven from an axle of the vehicle, during its movement, a source of current and circuits for said windings controlled by said last brush to alternately energize said windings for causing rotation of the motor armature; and supervisory means including a normally energized relay jointly controlled by said commutators and operative consequent to the failure of said motor to step during the continued movement of the vehicle for giving an alarm to the effect of such failure.

6. In combination with a rotating element, a motor remotely located with respect thereto, a source of power; means including a pair of field windings for operating the armature of said motor, consequent to the rotation of said element, including a commutator and brush arrangement mechanically associated with said rotating element, conductors extending between said arrangement and said field windings and said source of current, respectively; said brush alternately connecting said windings to said source over said conductors to rotate the armature of the motor in a step-by-step manner, a pair of relays; means including said source of current, said conductors, and mechanism driven by the armature of said motor, for alternately operating said relays; a signal control relay; and circuits, for maintaining it energized, jointly controlled by the combined action of said pair of relays and said mechanism.

7. In a signalling system, a pair of rotary distributors remotely disposed from each other; a motor having an armature and having two windings, means including said windings and said armature for rotating said armature one half step when the windings are alternately energized and through the medium thereof causing the rotation of one of said distributors, a rotatable element effective to rotate the other of said pair of distributors; a source of current and associated circuits controlled by the latter distributor, during the rotation of said element, to alternately energize the windings of said motor for the purpose set forth; whereby said motor armature is operated in synchronism with said element, a signal control relay; and means, including the distributor driven by said motor and a pair of auxiliary relays controlled thereby and by the specified latter distibutor as well, for operating and maintaining operated said signal control relay so long as the armature of said motor follows the movement of the rotatable element and its associated distributor.

8. The combination with a rotating element, a commutator and brush arrangement associated with said element, a motor having a pair of field windings and an armature, a source of current, conductors connecting one terminal of each of the windings of said motor with the respective segments of the commutator of said arrangement and the other terminal of such windings with said source and with the brush of said arrangement whereby rotation of said element effects the alternate energization of said windings and the consequent rotation of said armature, and means including relays jointly controlled by the armature of said motor and said commutator and brush arrangement for actuating a signal in case the motor fails to follow the movement of the element.

9. In combination with a movable object, a circuit control device including a pair of elements and a third element alternately encountering said pair of elements during the movement of said object, an electromagnetic device having a movable armature and a pair of windings each for moving said armature, a source of current, conductors connecting one terminal of each of said windings with the respective element of said pair and the other terminals of such windings with said source and with the third element whereby movement of said object effects the alternate energization of said windings and the consequent operations of said armature, and means including relays jointly controlled by the armature of said electromagnetic device and said other device for actuating a signal in case the armature fails to respond to the movement of the third element.

ALFRED E. HUDD.