

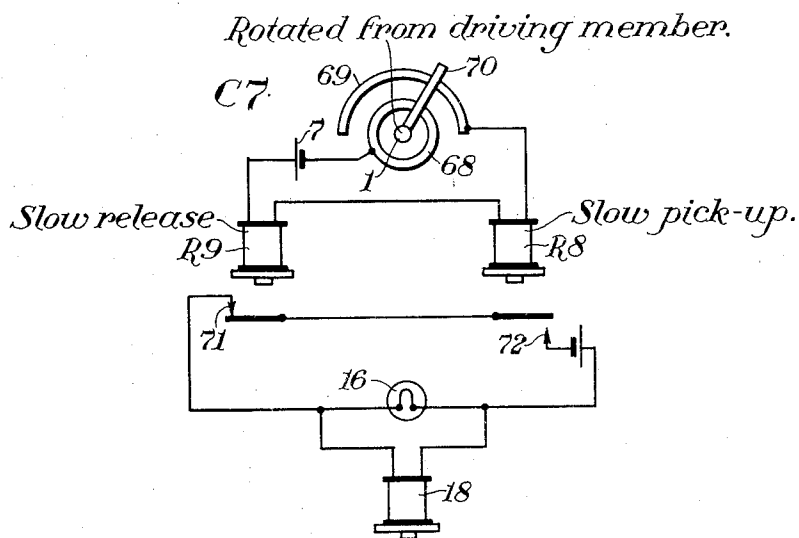
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SPEED RESPONSIVE APPARATUS

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SPEED RESPONSIVE APPARATUS

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6 Claims. (Cl. 175—355)

My invention relates to speed responsive apparatus.

An object of my invention is the provision of novel and improved speed responsive apparatus which is actuated by electrical means, and by which an unsafe indication due to loss of power or breakage of a part is avoided.

Speed responsive apparatus embodying my invention is particularly suitable for, although in no way limited to, use in connection with speed control systems for railway trains.

This application is a division of my copending application filed May 17, 1935, Serial No. 22,029, now Patent No. 2,103,706, Dec. 28, 1937, for Speed responsive apparatus.

I will describe one form of apparatus embodying my invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatic view illustrating one form of apparatus embodying my invention.

Speed responsive apparatus embodying my invention embraces a suitable speed responsive circuit interrupting means and a time limit electromagnetic means adapted to come into action a short period after the conditions actuating it have begun to exist. As shown in the drawing, the circuit interrupting means is a commutator, designated as a whole by the reference character C1, and the time limit electromagnetic means consists of two relays R8 and R9 of the direct current neutral type. The shaft 1 of the commutator C1 is operatively connected with a member the speed of whose movement it is desired to determine through the medium of any suitable drive mechanism such, for example, as a train of gears not shown. When the apparatus is utilized to control the circuits of a speed control system for railway trains, the shaft 1 is preferably operatively connected with an axle of the vehicle on which the apparatus is mounted, with the result that the speed of rotation of shaft 1 is in accordance with the speed of the railway train. A contact brush 70 is rigidly mounted on the shaft 1 for rotation therewith, and is adapted to engage two annular segments 68 and 69, the arrangement being such that the segment 68 is a complete ring and continuously engages the brush 70, but the segment 69 spans only a little over 180°. It follows that with the shaft 1 stationary electrical connection is completed between the segment 68 and the segment 69 through the brush 70 when the brush stops in the upper one-half of a revolution, as viewed in the drawing, and the electrical con-

nection is broken between the segment 68 and the segment 69 when the brush 70 stops in the lower one-half of a revolution. When the shaft 1 is rotated, electrical connection is periodically completed between the segments 68 and 69 during one-half of each rotation of brush 70, the duration which the connection is completed being dependent upon the speed of rotation of the shaft 1, and hence, in turn, dependent upon the speed of the driving member.

The operating windings of relays R8 and R9 are connected in series in a control circuit including a battery 7 and the commutator C1, as will be readily understood by an inspection of the drawing, with the result that current is supplied to these two relays in series during the one-half revolution the brush 70 engages the segment 69 and the supply of current is discontinued during the one-half revolution the brush 70 is out of engagement with the segment 69. The relay R8 is preferably provided with slow pick-up characteristics and relatively high pick-up characteristics, and the relay R9 is preferably provided with slow release characteristics and relatively low pick-up characteristics. That is to say, the armature of relay R8 is not raised out of engagement with the back contact 72 until a predetermined time interval subsequent to initiating the energizing of the relay by supplying current to its operating winding (slow pick-up characteristics). In the case of relay R9, the armature is retained in engagement with the front contact 71 a predetermined time period subsequent to termination of the supply of current to the winding of the relay (slow release characteristics). As stated above, the relay R8 is also provided with relatively high pick-up characteristics. For example, the relay R8 is so proportioned and adjusted that the tractive effort necessary to raise its armature out of engagement with the back contact 72 is produced when the value of the current flowing in its winding is, say, 75% of the ultimate current value resulting when the control circuit is closed and the battery 7 is at full voltage. The relay R9, in addition to being provided with slow release characteristics, is preferably also provided with relatively low pick-up characteristics. That is, the tractive effort necessary to raise its armature into engagement with the front contact 71 is produced when the current supplied to the winding of relay R9 is, say, only 25% of the ultimate current effected when the control circuit is closed and the full voltage of battery 7 is obtained. Preferably, the relay R8 would be

provided with a slow pick-up period substantially equal to the slow release period of relay R9. It will be understood that my invention is not limited to such adjustments of relays R8 and R9, and other adjustments may be used if desired.

The relays R8 and R9 may be utilized to control indication and control devices to determine whether or not the shaft 1 is moving at all or is moving about or below a predetermined critical speed. As here shown, relays R8 and R9 govern an indication lamp 16 and a control magnet 18 by virtue of a simple circuit which includes the back contact 72 of relay R8 and the front contact 71 of relay R9 in series.

At zero speed of shaft 1, and with the brush 70 in engagement with segment 69, both relays R8 and R9 are picked up and the indication circuit for the lamp 16 and magnet 18 is open at the back contact 72 of relay R8, with the result that the lamp 16 is dark and the magnet 18 is deenergized. With the brush 70 stopped at the position where it is out of engagement with the segment 69, both relays R8 and R9 are deenergized and the indication circuit is open at front contact 71 of relay R9. Thus, at zero speed of shaft 1 the lamp 16 is dark and the magnet 18 is deenergized, irrespective of the position at which the shaft 1 stops. When the speed of shaft 1 is such that the brush 70 is rotated at a speed below a predetermined critical speed and the duration of the contact between brush 70 and segment 69 is greater than the pick-up period of the relay R8, the relay R8 is picked up during one-half of each rotation and is released during the other one-half rotation of the brush 70. Under this condition of speed, the duration of the time interval between two consecutive current impulses supplied to the relay R9 is greater than the slow release period of relay R9, and that relay is released during the one-half rotation the brush 70 is out of engagement with the segment 69. Assuming the shaft 1 is rotated clockwise at a slow speed, the relays R8 and R9 are both picked up with the brush 70 in engagement with the segment 69. When the brush 70 moves off the segment 69, both relays are deenergized and relay R8 releases at once but relay R9 does not release until the end of its slow release period. During the interval between the release of relay R8 and the release of relay R9 the lamp 16 is illuminated. Again, when the brush moves onto the segment 69, both relays are energized and relay R9 is picked up at once but relay R8 is not picked up until the end of its slow pick-up period so that there is an interval when lamp 16 is illuminated. Hence, at speeds between zero and such critical speed, the indication circuit is alternately opened and closed, with the result that the indication lamp 16 is flashed and the control magnet 18 is intermittently energized. At speeds above such critical speed, the duration of the contact between brush 70 and segment 69 is less than the pick-up period of relay R8, and the back contact 72 of relay R8 remains closed. The relay R9, however, is now picked up and its front contact 71 is closed, since the time interval during which the brush 70 is out of engagement with the segment 69 is less than the slow release period of relay R9. Again, if the speed at which the brush 70 is rotated is relatively high and rapid impulses of current are supplied to the relays R8 and R9 and build up the magnetism in their respective magnetic circuits, the average value of the cur-

rent flowing in the winding of relay R8 does not reach the 75% pick-up value of current of this relay due to the inductance of the relay and relay R8 remains released. The average value of the current flowing in the winding of relay R9, however, does reach the 25% pick-up value of current of relay R9 and relay R9 is held picked up. Hence, at speeds above the critical speed, the lamp 16 is continuously illuminated and the control magnet 18 is steadily energized.

When apparatus embodying my invention is used in connection with speed control systems for railway trains, the lamp 16 may be used to indicate to the operator on the train the speed above the critical speed, and the magnet 18 may be used to effect a control over the train brake equipment, and when so used an unsafe indication due to a loss of power or breakage of a part is avoided.

Although I have herein shown and described only one form of speed responsive apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. Speed responsive apparatus comprising a shaft adapted to be rotated at different speeds, a commutator mounted on the shaft including a segment of a predetermined length, a brush effective to engage said segment in response to each rotation of the shaft, a first relay provided with a slow pick-up period, a second relay provided with a slow release period, a source of current; a control circuit including the source, the brush, the segment and a winding of each relay in series for energizing the relays a given portion of each rotation of the shaft; and an indication circuit including a back contact of said first relay and a front contact of said second relay in series.

2. Speed responsive apparatus comprising a shaft adapted to be rotated at different speeds, a segment, a brush fixed on said shaft and adapted to engage said segment during substantially one-half of each rotation, a slow pick-up relay, a slow release relay, an indicating device, an operating circuit for said device including a back contact of the slow pick-up relay and a front contact of the slow release relay, a current source, and means to serially connect the windings of said relays between said segment and one terminal of said source and to connect the other terminal of the source with said brush for retaining the slow release relay continuously picked up and the slow pick-up relay continuously released to continuously display the indicating device only when the shaft is rotated at greater than a speed predetermined by the pick-up and release periods of said relays.

3. Speed responsive apparatus comprising a member adapted to be actuated through an operating cycle at different speeds, circuit controlling contact mechanism operatively connected with said member and including a contact closed during a predetermined portion of each cycle, a slow pick-up relay, a slow release relay, an indicating device, an operating circuit for said device including a back contact of the slow pick-up relay and a front contact of the slow release relay in series, a current source, and a control circuit including the windings of said relays in series and said contact as well as said source for retaining

the slow release relay continuously picked up and the slow pick-up relay continuously released to continuously display the indicating device only when said member is actuated at greater than a speed predetermined by the pick-up and release periods of said relays.

4. Speed responsive apparatus comprising a member adapted to be actuated through an operating cycle at different speeds, circuit controlling contact mechanism operatively connected with said member and including a contact closed during a predetermined portion of each cycle, a slow pick-up relay, a slow release relay, an indicating device capable of displaying one indication when deenergized and a second indication when energized, an operating circuit for said device including a back contact of the slow pick-up relay and a front contact of the slow release relay in series, a current source, and a control circuit serially including the windings of said relays and said contact as well as the current source to cause said device to continuously display said one indication when said member is stationary at any point in its cycle and to cause the device to continuously display the second indication when said member is actuated above a predetermined speed.

5. Speed responsive apparatus comprising a member adapted to be actuated through an operating cycle at different speeds, circuit controlling contact mechanism operatively connected with said member and including a contact closed during a predetermined portion of each cycle, slow acting electromagnetic means provided with a

first contact closed only after said means is energized a predetermined time interval and a second contact closed only after said means is deenergized a predetermined time interval, an indicating device, an operating circuit for said indicating device serially including said first and second contacts, a current source, and a control circuit for energizing said electromagnetic means including said source and the contact of said mechanism.

6. Speed responsive apparatus comprising a member adapted to be actuated through an operating cycle at different speeds, circuit controlling contact mechanism operatively connected with said member and including a contact closed during substantially one-half of each cycle, slow acting electroresponsive means provided with a first contact which is closed only after said means is energized a predetermined time interval and a second contact which is closed only after said means is deenergized said predetermined time interval, an indicating device effective to display a given indication when energized, an operating circuit for said device serially including said first and second contacts, a current source, and a control circuit for said electroresponsive means including said source and the contact of said mechanism to cause the indicating device to continuously display said indication only when said member is actuated at greater than a speed determined by the predetermined time interval of the electroresponsive means.

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