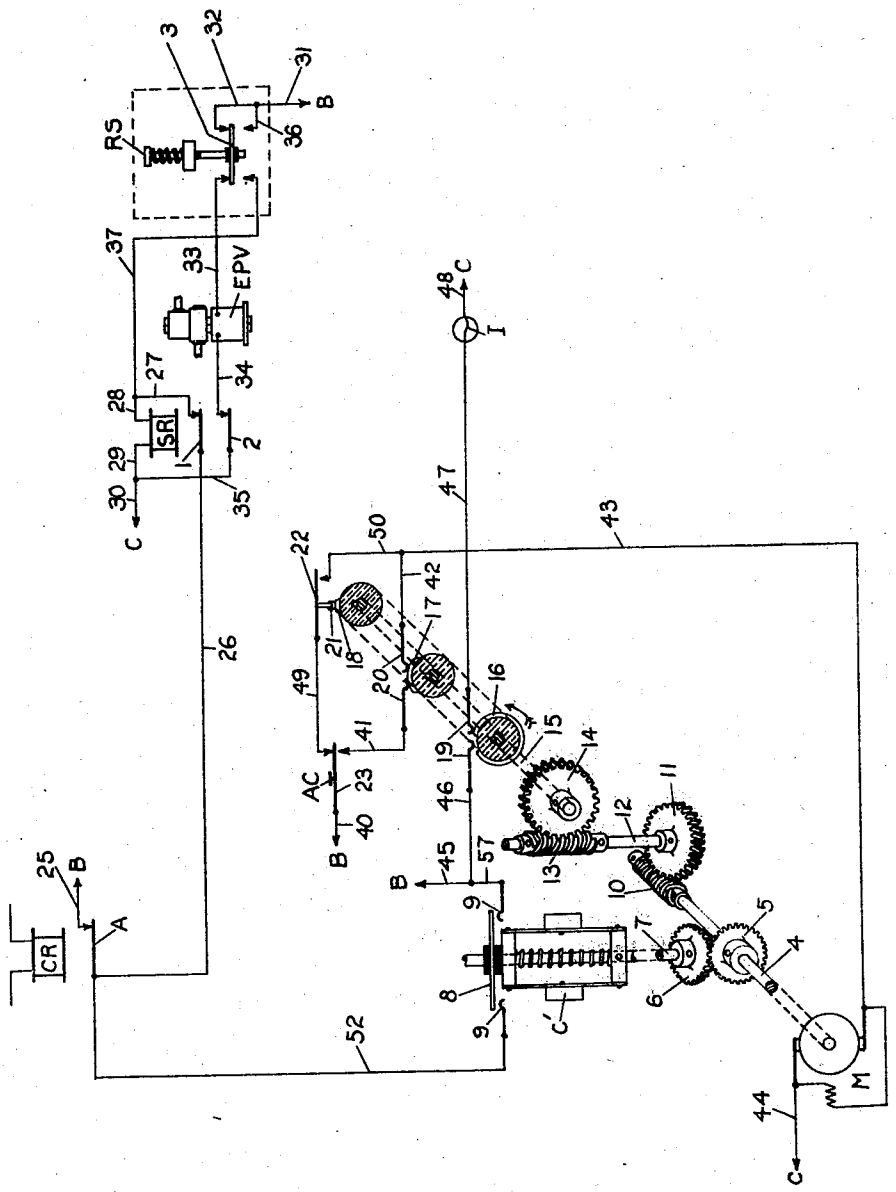
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ACKNOWLEDGING DEVICE FOR TRAIN CONTROL SYSTEMS

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ACKNOWLEDGING DEVICE FOR TRAIN-CONTROL SYSTEMS

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This invention relates to automatic train control systems, and more particularly to a device or mechanism, commonly termed an acknowledging device, which is employed in certain types of train control systems to enforce vigilance on the part of the engineer.

In the application of certain types of automatic train control systems to railroads, it has been proposed to provide means which will automatically apply the brakes and bring the train to a stop at each caution or stop signal, or corresponding control point, unless the engineer takes suitable anticipatory action, ordinarily termed acknowledgement. To carry out the principles of acknowledgment, it is desirable to include in the system a manually operable acknowledging device, which the engineer manipulates to avoid the automatic brake application, and which is effective for a limited time only, or otherwise suitably protected, so that the engineer cannot fasten or hold this device in its effective position, but must acknowledge every unfavorable signal indication. One type of a system embodying this acknowledging feature is disclosed in the patent to Winthrop K. Howe, No. 1,551,515, dated August 25, 1925.

The present invention relates more particularly to an improved form of protected acknowledging device. One object of the present invention is to provide a simple, efficient, and reliable time element mechanism, comprising in one form an electric motor and reduction gearing. According to the invention, such an electric motor and reduction gearing as a time element mechanism is combined with circuits and controlling contacts in such a way that the engineer may acknowledge for a limited time only, and so that ordinary failures, such as broken wires and connections, will be on the side of safety. In particular, it is proposed to provide an organization in which the time element mechanism has to function in order to effect acknowledgement, and failures of this mechanism will prevent acknowledgment.

Other objects, purposes and characteristic features of the invention will be in part obvious, and in part pointed out hereinafter.

In describing the invention in detail, reference will be made to the accompanying drawing which shows in a simplified and diagrammatic manner one specific embodiment of the invention, the parts and circuits being illustrated more with the view of making it easy to understand the nature of the invention, rather than with the purpose of illustrating the particular construction preferably employed in practice.

Referring to the drawing, since the acknowledging feature, constituting the subject matter of the present invention, is applicable to various types of train control systems, both a speed control and a permissive stop system, and may be employed with various types and forms of means for transmitting impulses on the trackway to the moving train, either by intermittent or continuous control, no attempt has been made to illustrate any particular type of train control system. In these various systems, however, there exists in some form or other a suitable means which operates at each caution or danger signal, or corresponding control point, when acknowledgment should be made. Ordinarily, this means takes the form of a normally closed contact, automatically opened at the control points; and to illustrate the adaptability and application of the invention, a contact A is shown, assumed to be controlled by relay CR, and temporarily opened at each caution or stop signal. It should be understood that this contact A is opened for a limited interval of time, distance or the like, at each control point.

Assuming such a controlling contact A, or equivalent, the organization in general, constituting the invention, comprises a stick relay SR; a brake control device, assumed to be an electro-pneumatic valve EPV; a reset switch RS; an acknowledging contactor or push button AC; and a time element mechanism, including an electric motor M, a speed-responsive device or centrifuge C′ and associated contacts and circuits. All of these parts are carried on the railway vehicle or train. The relay SR is of any suitable type, such as well known and commonly used on

locomotives or other railway vehicles. The electro-pneumatic valve EPV is assumed to act upon suitable brake applying means to give the desired automatic application of the brakes, either by venting the brake pipe direct, automatically operating the engineer's brake valve, or the like, producing a limited reduction in brake pipe pressure, if desired, or having other auxiliary features in accordance with the established practice of the art. The reset switch RS is of any suitable construction for opening a break in a normally closed circuit, and closing a break in a normally open circuit. As shown, this reset switch RS comprises a simple spring return plunger, having a contact member 3 movable from engagement with a pair of stationary contacts, indicated conventionally as arrows, into engagement with another pair of contacts. This reset switch is ordinarily located so that it is accessible only from the ground, and cannot be operated until the train has been brought to a stop. The acknowledging contactor AC, as shown, comprises a simple push button or strap key 23, having normally closed, and normally open contacts.

The time element mechanism comprises a small electric motor, ordinarily direct current, which has constant speed characteristics. This motor is shown diagrammatically as a shunt-wound motor. The motor M drives the shaft 4, which is connected by beveled gears 5 and 6 to a shaft 7 of the speed-responsive device or centrifuge C′. This centrifuge C′ is intended to move a contact disc 8 into engagement with stationary contacts 9 while the shaft 4 is rotating, and to open these contacts as soon as this shaft stops. This centrifuge C′ may take various forms; and in its simplified construction shown comprises a lower collar, fixed to the shaft 7, an upper collar slidable on said shaft in opposition to a spring, and spring arms connecting said collars and provided with weights. The shaft 4 is connected by a double worm reduction gearing, comprising the worm 10, worm gear 11, shaft 12, worm 13, and worm gear 14, to a circuit controller shaft 15. This reduction gearing is designed, in conformity with the normal running speed of the motor M, so as to cause the shaft 15 to make one complete revolution, during the time interval selected for acknowledgment, such as, for example, fifteen or twenty seconds. The shaft 15 opens and closes three pairs of contacts at different positions of the shaft, and for different portions of its revolution. Various constructions may be employed to perform this circuit controlling function. In the form shown, a drum, of suitable insulating material, is secured to the shaft 15, and has fastened thereon contact strips 16 and 17 and a cam 18. The shaft 15 and its drum are shown in the normal initial position. The contact strip 16 engages and bridges contact fingers 19, after the drum has been moved a short distance from its initial position counter-clockwise, as indicated by the arrow, and maintains this contact until the drum has nearly completed one revolution. Contact strip 17 bridges the fingers 20 in the initial position of the drum, and for a short distance of movement thereof away from the initial position. The cam 18 engages a roller 21 in the initial position of the drum and holds the spring finger or contact member 22 out of engagement with its cooperating contact for a small distance of movement of the drum from its initial position. The sequence of opening and closing of these contacts will appear from the following explanation of the operation.

Operation.—When the train passes a caution, or a stop signal, or a corresponding control point, at which it is desired to enforce acknowledgement, the contact A is opened, breaking a normally closed stick circuit for the relay SR. As a convenience in illustration, this circuit, and also the other circuits shown, are indicated conveniently as terminating at B and C, indicating opposite terminals of the battery, turbo-generator, or other suitable source of current.

The normally closed energizing circuit for the relay SR may be traced as follows:—commencing at B, wire 25, contact A, wire 26, front contact 1 of relay SR, wires 27 and 28, relay SR, and wires 29 and 30 to C.

Electro-pneumatic valve EPV is normally energized by a circuit which may be traced as follows:—commencing at B, wires 31 and 32, contact member 3 of the reset switch RS and its normally closed contacts, wire 33, valve EPV, wire 34, front contact 2 of relay SR, and wires 35 and 30 to C.

Assuming first that the engineer does not properly acknowledge, when the contacts A open and break the normal energizing circuit for the relay SR, this relay is de-energized, opening its front contact 2, and de-energizing the valve EPV, to automatically apply the brakes. Although the contact A is only temporarily opened, the relay SR is not again energized, when once de-energized, due to its stick circuit, upon the re-closing of the contact A; and hence the brakes are maintained applied until the train is brought to a stop and the reset switch RS operated. When the reset switch RS is operated, a pick-up circuit for the relay SR is established as follows:—commencing at B, wires 31 and 36, contact member 3 of switch RS and its normally open contacts, wires 37 and 28, relay SR, and wires 29 and 30 to C. It will be evident that when this pick-up circuit is established, the energizing circuit for the valve EPV hereinbefore traced, is at the same time broken at the normally closed contacts of the switch RS. Thus, while the relay SR is re-

energized, the valve EPV cannot be energized, and the brakes released, until the reset switch RS is restored to its normal position. Consequently, the reset switch cannot be carelessly or improperly left in the resetting position, but must be restored to normal each time, in order to permit the train to proceed.

In order to prevent this automatic brake application, and stopping of the train, the engineer is required to operate his acknowledging contactor AC prior to the opening of the contact A and de-energization of the relay SR. In other words, the engineer must forestall the automatic brake application, acting upon information obtained from the wayside signals, or suitable cab indicating means, if so provided. When the engineer operates the acknowledging contactor AC, closing its normally open contacts, the motor M is energized and started by a circuit as follows:—commencing at B, wire 40, switch 23 down, wire 41, contacts 17—20, wires 42 and 43, motor M, and wire 44 to C. Shortly after the motor starts, and the shaft 15 has been turned counter-clockwise through a small angle, the contacts 16—19 close, lighting an indicator lamp I through a circuit from B, wires 45 and 46, contacts 16—19, wire 47, lamp I and wire 48 to C. Before these contacts close, however, the cam 18 rides out from under the roller 21, allowing the spring finger 22 to engage its contact; and when the lamp I lights, the engineer is supposed to return the acknowledging contactor AC to the normal position, establishing a second energizing circuit for the motor M as follows:—starting at B, wire 40, switch 23 up, wire 49, finger 22 down, wires 50 and 43, motor M, and wire 44 to C. After a short time, sufficient to afford the engineer all reasonable latitude in restoring his acknowledging contactor AC to normal, the contacts 17—20 open, breaking the first energizing circuit for the motor M although the circuit may already have been broken at 23—41 by the engineer. If the engineer has properly returned his acknowledging contactor to the normal position, a supply of current to the motor is maintained through the finger 22, and the motor continues to drive the shaft 15 until, near the end of one revolution, the cam 18 engages the roller 21 and opens contact at the finger 22. The friction of the parts driven by the motor brings it quickly to rest; and the parts are so proportioned and designed that, once the finger 22 is opened by the cam 18, the motor cannot overrun to the point where this finger is again closed, but will stop and remain at rest until the acknowledging contactor AC is again operated.

While and so long as the shaft 4 is being rotated by the motor M, the centrifuge C' maintains the contacts 8—9 closed, establishing an auxiliary energizing circuit for the relay SR, including a shunt for the contact A, which may be traced as follows:—from B, wires 45 and 57, contacts 8—9, wires 52 and 26, front contact 1 of relay SR, wires 27 and 28, relay SR, and wires 29 and 30 to C. Thus, during the time interval or cycle or operation of the timing mechanism, constituting one revolution of the shaft 15, the relay SR is maintained energized, and the automatic brake application prevented, in spite of the opening of the contact A. Obviously, the engineer must operate his acknowledging contactor and get the shaft 4 in motion to close the contacts 8 and 9 before the contact A opens and the relay SR is de-energized; or, in other words, the engineer must forestall the automatic brake application. If the contact A is operated quickly upon the reception of a control influence from the trackway, without any preceding intervening delay, the engineer must observe the indications of the wayside signals and operate his acknowledging contactor AC before passing the control point for the caution or stop signal; and if he fails to do so, the relay SR is de-energized, the brakes applied, and the train brought to a stop.

Pointing out some of the characteristic features of the invention, it should be noted that the engineer cannot hold his acknowledging contactor in the operated position with any effect because the shaft 15 will only be rotated a short distance until the contacts 17—20 open, whereupon the motor stops, and the contacts 8—9 open, eliminating the preventing or suppression of automatic braking. Hence, if the engineer holds or fastens down his acknowledging contactor, the brakes will be automatically applied at the next stopping control point. If the motor should become damaged, or its operating circuits broken, or other failure occur preventing the timing operation, the centrifuge C' fails to rotate, and the contacts 8—9 remain open, so that the brakes are applied at the first stopping control point. If the timing mechanism stops at an intermediate point in its cycle, the contacts 8—9 open, and the acknowledgment is not effected. In short, the parts and circuits are so organized that ordinary failures are on the side of safety, preventing acknowledgment, rather than permitting the engineer to perpetually acknowledge by one act, as may happen when the time element mechanism is used to limit the time interval of acknowledgment, rather than permit acknowledgment to exist. The indicator lamp I is optional, but conveys helpful information to the engineer and enables him to determine accurately when he should restore his acknowledging contactor AC to normal. In other words, when the lamp I lights, the engineer knows that the motor energizing circuit is closed at the contact finger 22, and that he should restore his acknowledging contactor AC promptly, before the motor circuit

is broken at the contacts 17—20. These contacts 17—20 are preferably made to remain closed for a few seconds after the shaft 15 is started, so as to afford the engineer all reasonable opportunity to restore his acknowledging contactor AC; but this time is preferably made relatively short.

It will be observed that the engineer may operate his acknowledging contactor any time he wishes, and may hold it down as long as he pleases, without producing any automatic brake application; but if he holds it down, the brakes are applied at the first stopping control point, and if he operates the acknowledging contactor too soon before passing the control point, the time element mechanism completes its cycle and stops. Consequently, the engineer in any event must perform the acknowledging act within a limited time before passing each stopping control point. In practice, this time interval is selected so as to afford reasonable latitude in acknowledging but not long enough to permit one acknowledging act to take the train past two succeeding control points. This time interval may be adjusted by changing the ratio of the reduction gearing between the shaft 4 and shaft 15, or by varying the speed of the motor M, by varying its voltage, or by any other well known expedient.

Only one specific embodiment of the present invention has been shown and described, and it should be understood that this is to illustrate the nature and purpose of the invention, rather than its scope, and that various changes and modifications may be made in the construction and arrangement of circuits shown and described, and in adapting the invention to various types of train control systems, all without departing from the invention or the idea of means underlying the same.

What I claim is:—

1. In an automatic train control system, the combination with a brake applying appliance, a stick relay governing said appliance, means controlled from the trackway for temporarily interrupting the stick circuit of said relay, and manually operable means for maintaining said relay energized for a limited time, said manually operable means including an electric motor.

2. An acknowledging device for the purpose described comprising, the combination with contacts to be closed for a limited time, of a shaft, a centrifuge driven by said shaft for closing said contacts only while the shaft is rotating, an electric motor for driving the shaft, circuit controlling means operated by the shaft, and means including a manually operable circuit controller and said circuit controlling means for energizing the electric motor for a limited number of revolutions for each operation of said manually operable circuit controller.

3. In a train control system, the combination with a brake control device, of normally open contacts for preventing operation thereof when closed, and manually controllable time element mechanism for closing said contacts for a limited time, said mechanism comprising, an electric motor, a centrifuge for closing said contacts only while said motor is operating, an acknowledging contactor having normally closed and normally open contacts, circuit controlling means driven by the motor, an energizing circuit for the motor including the normally open contacts of the acknowledging contactor and normally closed contacts of said circuit controlling means, and an auxiliary energizing circuit for said motor including the normally closed contacts of the acknowledging contactor and normally open contacts of said circuit controlling means, said normally open contacts of the circuit controlling means being automatically closed after the motor has made a few revolutions and being maintained closed until the motor has completed a number of revolutions consuming the desired time interval, said normally closed contacts of the circuit controlling means being automatically opened a short interval of time after said normally open contacts of the circuit controlling means have been closed.

4. An acknowledging device of the character described comprising, a power-operated time element mechanism, manually operable means shiftable to one position for initiating operation of said mechanism but ineffective in that position to maintain such operation for more than a short interval of time, said manually operable means when shifted to another position after such initiation of operation of said mechanism acting to maintain that operation for a limited time, and brake preventing means effective only while said mechanism is operating.

5. In a train control system, acknowledging means comprising an electric power-operated time element device having a cycle of operation consuming a predetermined time interval, manually controllable means effective if actuated alternately during said cycle of operation to two different positions to cause said mechanism to complete its cycle of operation, and means effective only while said mechanism is operating to prevent an automatic brake application.

6. An acknowledging device for train control systems for closing contacts for a predetermined period of time only for each acknowledging act comprising, a shaft, a centrifuge driven by said shaft, contacts closed if said centrifuge is rotated above a predetermined speed, a motor for rotating said shaft, a starting circuit for starting said motor including normally open manually op-

erable contacts, and a stick circuit for said motor including normally open contacts closed during a predetermined extent of rotation of said shaft, whereby said motor if once initiated will remain in operation during a predetermined extent of rotation thereof.

7. An acknowledging device for train control systems for closing contacts for a predetermined period of time only for each acknowledging act comprising, a shaft, a centrifuge driven by said shaft, contacts closed if said centrifuge is rotated above a predetermined speed, a motor for rotating said shaft, a starting circuit for starting said motor including normally open manually operable contacts, and a stick circuit for said motor including normally open contacts closed during a predetermined extent of rotation of said shaft and contacts closed only if said manually operable contacts are in their normal open condition, whereby said motor if once initiated will remain in operation for a predetermined cycle of operation provided said manually operable contacts are returned to normal.

8. An acknowledging device for closing an auxiliary circuit for a brake control device to maintain such brake control device energized while the main circuit for said brake control device is open comprising; a shaft; a motor for driving said shaft; a contact in such auxiliary circuit closed only while said shaft is rotating above a predetermined speed; two contacts closed alternately during the operation of said motor, one of which is closed during a predetermined number of revolutions of said motor and the other of which is closed at all other times; a push button for controlling a normally closed contact and a normally open contact; and a circuit for said motor including two branch circuits in multiple one branch of which includes said one contact and said normally closed contact, and the other branch of which includes said other contact and said normally open contact.

9. Car-carried apparatus for train control systems comprising; normally energized brake control means; a control relay energized under favorable traffic conditions ahead; an energizing circuit for said brake control means including a front contact of said control relay; and means requiring recurrent manual action for keeping an auxiliary circuit for said brake control device closed including; a motor, a contact closed only when said motor is rotating above a predetermined speed, and manually operable means requiring intermittent operation to maintain said motor operating so long as said control relay is de-energized.

10. Car-carried apparatus for train control systems comprising; normally energized brake control means; a control relay energized under favorable traffic conditions ahead; an energizing circuit for said brake control means including a front contact of said control relay; and means requiring recurrent manual action for keeping an auxiliary circuit for said brake control device closed including; a motor, a contact closed only when said motor is rotating above a predetermined speed, and manually operable means requiring intermittent operation at equally spaced time intervals to maintain said motor operating so long as said control relay is de-energized.

In testimony whereof I affix my signature.

CHRISTIAN A. CHRISTOFFERSON.