

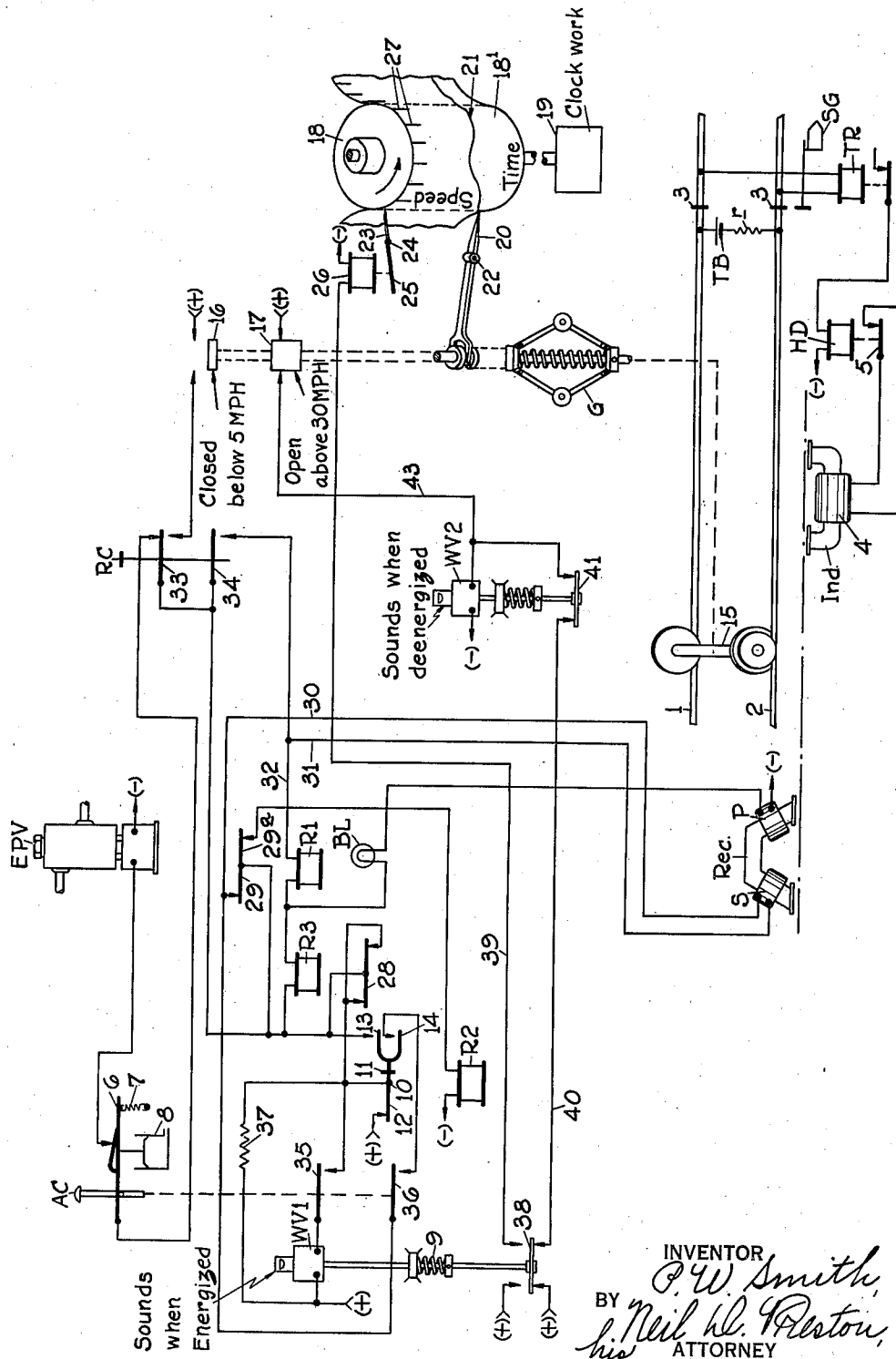
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INTERMITTENT INDUCTIVE TRAIN CONTROL SYSTEM

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INTERMITTENT INDUCTIVE TRAIN
CONTROL SYSTEMPercy W. Smith, New York, N. Y., assignor to
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This invention relates in general to train control systems of the intermittent inductive type and has more particular reference to a system wherein there is a speed limit imposed on passing each stop inductor combined with a whistle penalty, and also a record of acknowledgment on a speed-time curve.

The system forming the subject matter of the present invention is of the same general type as disclosed in the P. W. Smith patent, 2,190,505, granted February 13, 1940, and also in the C. S. Bushnell patent, 1,686,434, granted October 2, 1928.

In systems of this type, it is desirable that the passing of a caution or stop wayside signal should require acknowledgment on the part of the engineer to show that he is vigilant, and it is also desirable to enforce a speed restriction at each such passing in order to additionally insure against accidents.

With the above and other objects in view, it is proposed in accordance with this invention to provide a whistle which sounds on passing a stop inductor upon acknowledgment, if the speed be excessive and continues to sound until the speed be reduced to within prescribed limits.

A further object of the invention is to provide a speed-time curve on a tape or the like, and to mark on this tape the occurrence of each acknowledging act.

Further objects, purposes and characteristic features of the present invention will appear as the description progresses, reference being made to the accompanying drawing showing in a wholly schematic manner one form which the invention can assume. In the drawing:

The single figure of drawing is a schematic view of one form of this invention.

Referring now to the drawing, there is here shown a stretch of track constituted by track rails 1 and 2, separated into usual insulated track sections by insulating joints 3. At the entrance to each section is a wayside signal SG. Connected across the entrance end of each section is a track relay TR, while across the exit end of each section is a track battery TB, and a usual current limiting resistance r.

At each signal location is located a usual wayside inductor Ind having a choke winding 4 thereon, connected in a circuit including a contact finger 5 and front point of a home distant relay HD. This home distant relay reflects the conditions of occupancy of the two sections next in advance in a usual manner.

From the above it appears that winding 4 on

the inductor is in a closed circuit when relay HD is energized whereby to produce a choking effect on the inductor core, and that this choking effect is removed when winding 4 is open circuited. Accordingly, if the two blocks immediately in advance of a particular block be unoccupied, the inductor is choked, while if either or both of these two advance blocks be occupied, the inductor is unchoked.

With reference to the car carried apparatus, a car carried receiver Rec is provided, having a usual core carrying separate windings, a primary winding P, and a secondary winding S.

On the locomotive is an acknowledging contactor AC, provided with a time controlled contact 6, biased downwardly by a spring 7, and retarded in its downward movement by a dash-pot 8. Also provided on the locomotive is a brake applying device EPV, which, when deenergized, operates to produce an automatic emergency brake application, in the manner well recognized in this art and as disclosed in the above referred to patents.

There is also provided on the locomotive control relays R1, R2 and R3, a whistle valve WV1, which sounds when energized, and a second whistle valve WV2, which has a tone distinctive from the whistle WV1, and sounds when deenergized. The whistles are somewhat similar in construction, and whistle valve WV1, for example, has a spring or the like 9, for biasing its armature to retracted position.

The relay R2 operates a contact finger pivoted at 10, and carrying an insulating separator 11 for electrically insulating the contact finger portion 12 from the forked contact finger portions 13 and 14.

Carried by the locomotive is a centrifuge, or speed responsive device, in the form as illustrated, of a fly ball governor G which is driven in any usual or suitable way, as from the axle 15 of a car on the track rails 1 and 2. This centrifuge G operates contacts 16, 17, to close 16 on its co-operating contacts at all speeds below 5 miles per hour, and to open contact 17 from its co-operating contacts at all speeds above 30 miles per hour.

Also on the locomotive is a device which may be constituted by a portion of a so-called "Loco valve pilot," as said by the Valve Pilot Corporation, of 230 Park Avenue, New York city, and includes in diagrammatic form a tape or the like 18, on a drum 19, which is rotated by a clock-work, or other constant speed drive means 19, to move the tape at a uniform speed so as to co-

operate with a stylus 20, controlled by centrifuge G, to mark as at 21 on the tape, to thus form a speed-time curve. The stylus is pivoted at 22 so as to move under the influence of the centrifuge to accurately record the speed of the moving vehicle at all times.

Cooperating with the tape is a second stylus 23, pivoted at 24, and having an armature 25 attracted by a relay 26, when energized, to move the stylus 23 into contact with the tape and form a vertical mark thereon, such as the marks 27, for a purpose to be described below.

The tape 18', with its speed-time curve, can be of any usual or desired form, but in the present embodiment of the invention, it is constituted by a portion of the so-called "automatic pilot control," now employed in many locomotives, and includes a pointer indicating the speed of the locomotive, and cooperating with the throttle handle of the locomotive or the stem cut-off valve of the locomotive whereby to give the engineer visual information of the most economical position of the steam control means for the particular locomotive speed then in force. This same tape, having the speed-time curve thereon, is employed in the present invention for an added purpose as will appear below.

The relays and circuits shown in the single figure of drawing and constituting a portion of a usual auto-manual system of train control, are all shown in their normal running condition, the symbols (+) and (-) being employed to indicate connections to the opposite terminal of a turbo-generator or other suitable source or sources of current on the locomotive.

Relay R3 is normally energized in series with the primary coil P of the receiver by a circuit which can be traced from (+), through front contact 12 of relay R2, front contact 28 in multiple of relay R3, the winding of relay R3, the ballast lamp BL, and the primary winding P, to (-).

The drop in potential across the winding of relay R3 provides an energizing potential for the normally closed stick circuit of the primary or impulse responsive relay R1 in series with the secondary coil S. The circuit in which current flows due to this drop of potential can be traced from the left hand side of relay R3, through front contact 29 of relay R1, wire 30, winding S, wires 31 and 32, and the winding of relay R1, to the other side of relay R3.

The repeater relay R2 is normally energized by a circuit which can be traced from (+), front contact 12 of relay R2, front contact 28 of relay R3, front contact 29a of relay R1, the winding of relay R2, to (-).

A circuit for normally energizing the brake applying electro-pneumatic valve EPV can be traced from (+), front contact 12 of relay R2, front contact 28 of relay R3, normally closed contact 33 of reset contactor RC, time controlled contact 6 of acknowledging contactor AC, and the winding of EPV, to (-).

Thus, it is clear that under normal running conditions, relays R1, R2 and R3 are all energized and the electro-pneumatic valve EPV is also energized to thereby maintain the brakes released. The engineer can apply and release the brakes as he desires, and operate the train at any speed. Upon passing a trackway inductor at a clear signal, the primary relay R1 is not deenergized, and no effect is produced on the car carried apparatus.

Assume now that the train passes a trackway

inductor in its active stopping condition, that is, at a caution or stop signal, and further, assume that the engineer, for any reason whatever, fails to actuate the acknowledging contactor AC in recognition of the signal. The inductive impulse in the secondary coil S deenergizes the primary relay R1, which opens its stick circuit at its front contacts 29 and 29a to thereby deenergize relay R2, which in turn opens its front contact 12 to open the energizing circuit for relay R3, and the circuit for the electro-pneumatic valve EPV.

As a result, the brakes are applied to give an emergency brake application, which cannot be prevented or cancelled by the engineer and which can be released only after the control relays are restored to their normal energized conditions and the valve EPV is again energized to again allow the engineer to operate his rotary valve. This constitutes a penalty stop for failure to acknowledge a restrictive signal.

While it is realized that the reset contactor RC can be located in a position accessible only from the ground to thereby require, for its operation, that the train come to a full stop, it is recognized that, under certain conditions, as on trestles, this is undesirable. Accordingly, the reset contactor is accessible from the cab but is associated with the speed controlled contact 16, which is closed only below 5 miles per hour, thus necessitating that the train come substantially to a stop before operation of the reset contactor RC is effective.

Upon bringing the train down to a speed below 5 miles per hour, and operating the reset contactor RC, a circuit is established for energizing relay R3, which can be traced from (+), through speed contact 16 in its closed position, contact 33 in its operated position, the winding of relay R3, the ballast lamp BL, and the primary winding P, to (-).

The energization of relay R3 produces a potential drop across its winding to thereby cause current to flow through relay R1 over a circuit which can be traced from the left hand side of relay R3, reset contact 34 in its operated position, and the winding of relay R1, to the other side of relay R3.

Upon picking up, relay R1 has its winding in series with the secondary winding S, but at this time, with RC operated, a short-circuit for the secondary winding S is preferably provided through the reset contact 34 in order that any voltage that may be induced in the secondary winding S by the rise of flux in the primary winding P will not be effective upon relay R1 to cause any release or chattering of its armature.

The energization of relay R1 picks up relay R2, thereby closing a stick circuit to hold up relay R3, and permit the reset contactor to be released, leaving the relay R1 connected to the secondary coil S and in condition to respond to another trackway impulse. When the reset contactor RS is restored to close its contact 33, the circuit for energizing the valve EPV is closed, thereby completing the resetting of the apparatus.

Since valve EPV is deenergized upon operation of reset contactor RS, this contactor is protected against careless or malicious operation, or fastening down.

Assume now that the engineer, upon approaching a caution or stop signal, operates the acknowledging contactor AC prior to passing the trackway inductor. In these circumstances, when relay R1 and its repeater relay R2 are deenergized by the inductive impulse, a circuit for maintain-

ing relay R3 energized is established through the whistle valve WV1, from (+), through the winding of valve WV1, contact 35 of contactor AC in its closed position, contact 28 of relay R3, etc.

When relay R2 becomes deenergized and its contact fingers move to retracted position, the acknowledging contactor being in operated position to close its contact 36, a shunt is established around the front stick contact 29 of relay R1, so that this relay is reenergized, and in turn reenergizes relay R2. The closing of front contact 12 of relay R2, establishes a low resistance shunt around the winding of whistle valve WV1, which stops sounding, thus to advise that the acknowledging contactor can be released. A resistance 37 is preferably employed to protect contact 12 of relay R2 against arcing, and is high enough to prevent energy through it affecting relay R3.

In the manner just described, an automatic brake application and a penalty stop can be forestalled by the timely operation of acknowledging contactor AC. The time controlled contact 6 of contactor AC is included in the energizing circuit for the valve EPV and is automatically opened to cause a brake application if contactor AC be held in its operated position longer than a predetermined time interval, such, for example, as 15 seconds. The acknowledging contactor is therefore protected against misuse while sufficient latitude is allowed the engineer for its proper operation to effect its proper function.

Recalling now that upon preventing a brake application by acknowledgment, the whistle valve WV1 becomes energized, and sounds, it can be seen that, upon this energization, its contact 38 is picked up against the bias of spring 9 to close a circuit for relay 26 which includes contact 32 and its front points, and wire 39, to thereby pick up armature 25 of relay 26, and press the stylus 23 against the tape 18¹ to produce a mark, such as the marks 27. This mark thus makes a record of an acknowledgment, and further, shows the speed of the train at the time that acknowledgment was made, and if this speed be above a predetermined value, it indicates that a further penalty was incurred by the engineer, as disclosed more fully below.

It can be noted that the whistle valve WV2, which has a tone distinctive from that of whistle valve WV1, is normally energized through a stick circuit including contact 38 and back points of WV1, wire 40, contact 41 and front points of WV2, and the winding of whistle valve WV2.

There is also a pick-up circuit for the whistle valve WV2 which includes speed operated contact 17 in its closed position, wire 43, and the winding of whistle valve WV2. Accordingly, upon acknowledgment, and resulting energization of whistle valve WV1, the stick circuit for whistle valve WV2 is broken at contact finger 38, and if the speed of the train at that time be above 30 miles per hour, whereby to have opened the pick-up circuit traced just above, whistle valve WV2 becomes deenergized, thus to cause it to sound. The valve remains deenergized even after the acknowledging contactor be restored to its normal position, until the speed be brought down to 30 miles per hour, whereby to close the pick-up circuit for the valve and silence the same.

It thus appears clear that the engineer, upon passing a restrictive signal, must acknowledge to avoid a brake application, and if at the time he acknowledges, the speed be above 30 miles per hour, he must reduce his speed at least to 30 miles per hour to silence whistle WV2, which has

been caused to sound upon acknowledgment. The control of the train is not taken out of his hands by producing a brake application, even though he acknowledges and provided the speed be excessive, as such might cause undue delay. However, the sounding of the whistle, upon WV2 becoming deenergized, is sufficient to make the engineer alert, and insure that he will promptly reduce the train speed to the then prescribed limits.

It should also be noted that the marks 27 made by the stylus 23 upon each acknowledgment clearly indicates the speed existing at the time of acknowledgment and hence indicates the operation of the whistle valve WV2. The marks 27, 15 represented on the drawing as single lines, are, of course, a double line, one drawn on energization of relay 26 and the other on deenergization of the relay, but the speed of drive of the tape and the duration of acknowledgment are so related that the two lines constitute but a single line in effect. If the two lines should be separated, however, the marks could still be interpreted with full significance. If the speed curve between two successive marks 27 should remain above 30 miles per hour, this would indicate that the engineer has ignored the penalty whistle and has proceeded at an excessive speed while the whistle was sounding continuously. Thus, the indications of the times of acknowledgment, in connection with the associated speed curve of the locomotive, gives a definite picture of the train operation with regard to the operation of the apparatus involved in this train control system, and permits a check-up on the actions of the engineer which, in many cases, may be very desirable as, for example, in the case where an accident or an undue delay behind schedule, had occurred during the run.

The above rather specific description of one form which this invention can assume, is given solely by way of example, and is not intended in any manner whatsoever in a limiting sense. It should be understood that various modifications and adaptations may be made from time to time as may appear desirable, and still be included in the purview of the present disclosure, insofar as they are not specifically excluded therefrom by the appended claims.

Having described my invention, I now claim:

1. In intermittent train control systems having wayside signals, and associated wayside inductors each controlled in accordance with traffic conditions ahead to constitute a less restrictive, or a more restrictive inductor, car carried means comprising, penalty means operative to impose a penalty upon passing a more restrictive inductor unless forestalled by acknowledgment, acknowledging means operable to forestall the operation of the penalty means, a warning device cut into operation upon acknowledgment if the then car speed be above a predetermined limit, and means to cut the warning device out of operation upon the car speed being reduced at least to said limit.

2. In intermittent train control systems having wayside signals, and associated wayside inductors each controlled in accordance with traffic conditions ahead to constitute a less restrictive, or a more restrictive inductor, car carried means comprising, penalty means operative to impose a penalty upon passing a more restrictive inductor unless forestalled by acknowledgment, acknowledging means operable to forestall the operation of the penalty means, a warning device

cut into operation upon acknowledgment if the then car speed be above a predetermined limit, means to cut the warning device out of operation upon the car speed being reduced at least to said limit, means for continuously plotting the speed of the car, and means for recording each acknowledgment on the speed curve at the time of acknowledgment.

3. In intermittent train control systems having wayside signals, and associated wayside inductors each controlled in accordance with traffic conditions ahead to constitute a less restrictive, or a more restrictive inductor, car carried means comprising, a normally inactive brake applying device, means making the brake applying device active upon passing a more restrictive inductor unless acknowledged, an acknowledging contactor operable to acknowledge, a normally silent penalty whistle, control means causing the whistle to sound upon acknowledgment if the then car speed exceeds a limit, and means effective to silence the whistle only upon the car speed being reduced at least to said limit.

4. In intermittent train control systems having wayside signals, and associated wayside inductors each controlled in accordance with traffic conditions ahead to constitute a less restrictive, or a more restrictive inductor, car carried means comprising, a normally inactive brake applying device, means to make the brake applying device active upon passing a more restrictive inductor unless acknowledged, an acknowledging contactor operable to acknowledge, a normally silent penalty whistle, circuit control means causing the whistle to sound upon acknowledgment if the car speed at that time exceeds a limit, and circuit means, including a speed controlled contact, effective to silence the whistle only upon the car speed being reduced at least to said limit.

5. In intermittent train control systems having wayside signals, and associated wayside inductors each controlled in accordance with traffic conditions ahead to constitute a clear, or a stop, inductor, car carried means comprising, a normally inactive brake applying device, means making the device active upon passing a stop inductor unless acknowledged, an acknowledging contactor operable to acknowledge, a normally silent penalty whistle, control means causing the whistle to sound upon acknowledgment if the then car speed exceeds a limit, means to silence the whistle only upon the car speed being reduced at least to said limit, a tape, means controlled by the car speed to continuously trace a curve on the tape representing the car speed, and means for making a mark on the tape opposite the part of the speed curve representing the then car speed at the time of each operation of the acknowledging contactor.

6. In intermittent train control systems having wayside signals, and associated wayside inductors each controlled in accordance with traffic conditions ahead to constitute a clear, or a stop, inductor, car carried means comprising, a normally inactive brake applying device made active upon passing a stop inductor unless acknowledged, an acknowledging contactor operable to acknowledge, a normally silent penalty whistle, circuit control means causing the whistle to sound upon acknowledgment if the then car speed exceeds a limit, circuit means including a speed controlled contact to silence the whistle only upon the car speed being reduced at least to said limit, a tape, means controlled by the car speed to continuously trace a curve on the tape representing the car speed, and means for recording on the tape opposite the part of the speed curve representing the then car speed, each operation of the acknowledging contactor.

7. In intermittent train control systems having wayside signals, and associated wayside inductors each controlled in accordance with traffic conditions ahead to constitute a clear, or a non-clear, inductor, car carried means comprising, a normally inactive brake applying device made active upon passing a non-clear inductor unless acknowledged, an acknowledging contactor operable to acknowledge, a normally silent penalty whistle, circuit control means causing the whistle to sound upon acknowledgment if the then car speed exceeds a limit, circuit means including a speed controlled contact effective to silence the whistle only upon the car speed being reduced at least to said limit, a recording medium, means controlled by the car speed to continuously trace a curve on the medium representing the car speed, and means for making a record on the medium, opposite the part of the speed curve representing the then car speed, at the time of each operation of the acknowledging contactor and regardless of the then car speed.

8. In train control systems, in combination, wayside control means controlled in accordance with traffic in advance to set up a less restrictive or more restrictive control zone, car carried means comprising penalty means operative to impose a penalty upon passing into a more restrictive zone unless forestalled by acknowledgment, acknowledging means operable to forestall the operation of the penalty means, a warning device cut into operation upon acknowledgment if the then car speed be above a predetermined limit, and means to cut the warning device out of operation upon the car speed being reduced at least to said limit.

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