Oct. 1, 1940. W. B. WAIT 2,216,713

TRAIN CONTROL SYSTEM

Filed Oct. 8, 1938

Fig. 1.

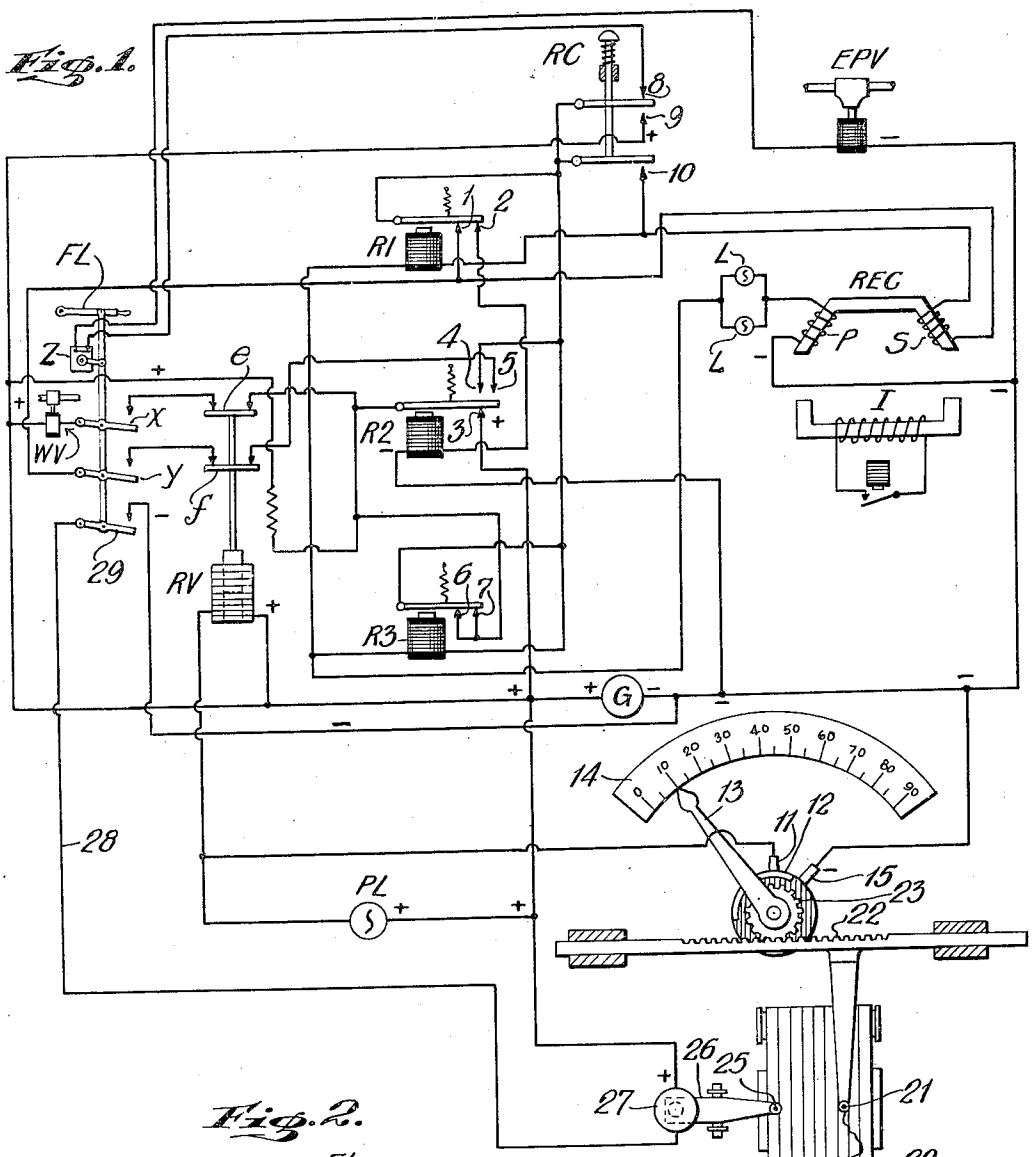
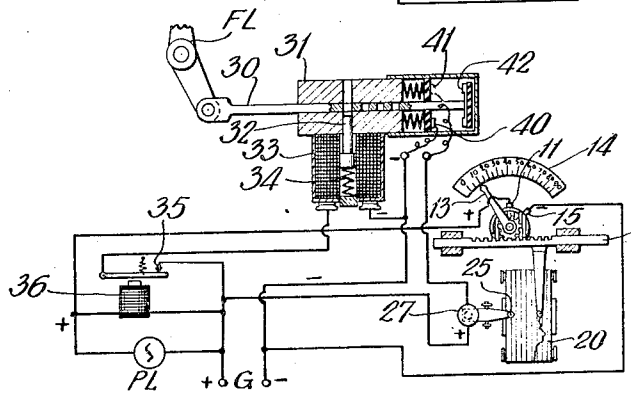


Fig. 2.



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Patented Oct. 1, 1940 2,216,713

UNITED STATES PATENT OFFICE

2,216,713

TRAIN CONTROL SYSTEM

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Application October 8, 1938, Serial No. 234,069

9 Claims. (Cl. 246—185)

This invention relates to improvements in train control systems and especially to means for controlling forestalling of the automatic application of brakes when the brakes are subject to control of a wayside signal.

In known train control systems comprising electrical or mechanical apparatus controlled either electrically or mechanically from the wayside block signal system the air-brake valve on the locomotive is automatically actuated when the wayside signal is other than clear which demands cautionary speed reduction or stopping of the train. These systems generally include an acknowledging or forestalling lever which can be used by the engineman to prevent the automatic operation of the air-brake control valve. Provision is made whereby the forestalling lever may be operated to forestall automatic application of the brake only during a period of predetermined time prior to passing the wayside signal. If the forestalling lever is used and held before said period begins, the brake valve will be automatically operated by control of the forestalling lever. If used and held during said period automatic operation of the air-brake control valve under control of the wayside signal will be prevented and the train may be controlled in the usual manner. If the forestalling lever is not operated during this period, then the air-brake valve will be automatically actuated and the locomotive and train will be brought to a stop. Before the brakes can be released it is necessary for a member of the engine crew to leave the cab and walk to the rear of the tender and reset the train control apparatus before the brakes may be released.

Forestalling as described is based on the premise that if the engineman acknowledges and forestalls, he is alert and able to perform the required functions necessary to operate the locomotive and braking apparatus according to prescribed practice.

In practice it has sometimes occurred that an engineman would "forestall" the automatic application of the brakes and run past the yellow signal, expecting that the block would clear and that the next signal would be yellow and not red. If the next signal encountered is also yellow, he may again similarly "forestall" and so run from block to block on the yellow without slowing the speed of the train.

Such practice is found to be undesirable for the reason that if the next signal after "forestalling" be red instead of yellow, the train may have approached the red signal too late to avoid a collision even by an emergency application of the brakes. This has been known to occur. If the train is travelling at a high rate of speed this practice of "forestalling" is or may be very dangerous and has been known to be followed by disastrous consequences, involving the loss of life and injury to property.

On the other hand, if the train be moving at a slow rate of speed when the engineer "forestalls" at the yellow, "forestalling" may be accomplished with safety, dependent on the length of the blocks and the curvature of the line which may hide from the sight of the engineer all but a short distance of track ahead of him.

Knowing the speed at which an engineman might "forestall" with the possibility of stopping his train before running into the next block if the signal turns out to be red, would make it possible to lay down a definite rule of action in such cases which, however, within the safety limits above referred to, would leave the matter of "foretalling" in the judgment of the engineman.

The difficulty with the application of such a rule by the engineman is that, left to his unguided judgment, he frequently is not able to accurately estimate the speed and, again using his best judgment, he might "forestall" at a speed exceding the speed beyond which "forestalling" is interdicted.

One of the objects of my invention is the provision of mechanism whereby the automatic operation of the air-brake control valve can be forestalled only when the train is traveling below a predetermined rate. This object may be carried out by electrical or mechanical means, either by rendering the operation of the forestalling lever ineffective or by preventing an operation of the forestalling lever, at speeds above the predetermined rate.

Another object of my invention is to provide means controlled by a speedometer or other speed responsive or speed controlled means on the locomotive for opening the forestalling circuits and maintaining the same open while the train runs at speeds above the predetermined rate.

Another object of the invention is to provide means controlled by the speedometer or other speed responsive or speed controlled means on the locomotive for locking the forestalling lever against operation when the locomotive is traveling at a speed above the predetermined rate.

Another object of the invention is to associate with the acknowledging mechanism a graphic pen or the like adapted to make a mark on a

tape upon which is recorded the speed of the locomotive, whereby a mark is made on the tape when the acknowledging lever is operated whether the same is effective or ineffective.

Another object is the provision of a signal automatically operated under control of the speed of the train to indicate when forestalling may be effected.

Other objects of the invention will appear from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a diagram of an automatic train control system with which my improvements may be associated showing one embodiment of my invention associated therewith; and

Fig. 2 is a diagrammatic view of a second embodiment of my invention.

For purposes of illustration, I have disclosed diagrammatically a known system for controlling trains. This system comprises inductors I under control of a wayside block signal system, a receiver REC supported on the locomotive, control relays R1, R2 and R3, and an electro-pneumatic valve EPV to apply the brakes to the train. This system also includes a reset contactor RC by means of which the system may be adjusted for operation after the same has functioned to apply the brakes. The mechanism also includes an acknowledging and forestalling lever FL by means of which the automatic operation of the electro-pneumatic valve EPV may be forestalled.

The control relays R1, R2 and R3 and the electro-pneumatic valve EPV are normally energized. The forestalling lever FL is provided with switches X, Y and Z of which X and Y are normally open and switch Z is normally closed.

The primary coil P of the receiver REC and the primary control relay R3 are energized by curent flowing from the positive side of the generator G through contact 3 of relay R2, contacts 6 and 7 of relay R3, ballast lamps L,L, primary coil P of receiver REC, to the negative side of the generator G.

The primary control relay R1 and secondary coil S of the receiver REC are energized by the drop in voltage across the coils of relay R3 by current flowing from the right hand side of the coils of relay R3, through contact 1 of relay R1, secondary coil S of receiver REC, coils of relay R1, back to the left hand side of the coils of relay R3.

The relay R2 is energized by current flowing from the positive side of the generator G, over contact 3 of relay R2, contacts 6 and 7 of relay R3, contact 2 of relay R1, coils of relay R2, to the negative side of the generator G.

The electro-pneumatic valve EPV is energized by current flowing from the positive side of the generator G, over contact 3 of relay R2, contacts 6 and 7 of relay R3, contact 8 of reset contactor RC, closed switch Z of the acknowledging or forestalling lever FL, coils of the electro-pneumatic valve EPV to the negative side of the generator G.

When the receiver REC passes over an inductor I the coils of which are closed as in the case where the wayside signal is clear, the current through the primary control relay R1 is not changed sufficiently to release this relay. When under the control of the wayside signal the coils of the inductor are opened as in the case where the signal is not clear, the current through the coils of relay R1 is decreased sufficiently to open its contacts. The opening of contact 2 of relay R1 opens the circuit of relay R2, opening of contact 3 of relay R2 opens the circuit of relay R3, and opening of contacts 6 and 7 of relay R3 opens the circuit of the electro-pneumatic valve EPV resulting in a full service application of the brakes.

To reenergize the electro-pneumatic valve EPV, it will be necessary to reenergize the relay R3. By operating the reset contactor RC, current will flow from the positive side of the generator G, over contact 9 of the reset contactor RC, across the coils of relay R3, ballast lamp L,L, primary coil P of the receiver REC, back to the negative side of the generator G. This produces a drop in voltage across the coils of relay R3, so that relay R1 will be energized by current from the right hand side of the coils of relay R3, through contact 10 of the reset contactor RC, across the coils of relay R1 and back to the left hand side of the coils of relay R3.

Relay R2 will be energized by current over contact 2 of relay R1, closing contact 3 thereby permitting return of reset contact RC to normal which closes contact 8 and reestablishes the operating circuit of the electro-pneumatic valve EPV. The control system has been operated under control of the wayside signal and restored to normal.

If at the time the receiver REC passes over the inductor I, the acknowledging or forestalling lever FL is operated, switch X on the acknowledging contactor is closed and relay R3 will not release as it is held energized by current from the positive side of the generator G over switch X, contacts 6 and 7 of relay R3, coils of relay R3, ballast lamps LL, primary coil P of receiver REC, to the negative side of generator G. With contact 3 of relay R2 open, the whistle valve WV is operated, when the receiver REC passes over the inductor I, and the relay R1 will be released but will immediately be reenergized under control of energized relay R3. Opening of relay R1 causes relay R2 to open momentarily. Immediately after relay R2 is opened, with switch Y of the acknowledging contactor closed, relay R1 will be energized by the drop in voltage across the coils of relay R3 over a circuit from the right hand side of the coils of relay R3, contact 4 of relay R2, contact 5 of relay R2, switch Y, secondary coil S of the receiver REC, coils of relay R1, to left-hand side of the coils of relay R3. The closing of contact 2 of relay R1 energizes relay R2. All of the circuits are now restored to normal.

The forestalling lever operated mechanism includes time delay means for opening the switch Z if the forestalling lever is held operated for a predetermined time period usually approximately fifteen seconds. Opening of switch Z will release the electro-pneumatic valve EPV and cause an application of the brakes.

The mechanism known and so far described is such that the forestalling lever may be operated at any speed of the locomotive and the automatic braking device rendered ineffective. For the purpose of preventing an effective operation of the forestalling lever at speeds above a predetermined rate of speed, I have provided switches *e* and *f* in the forestalling circuits including the switches X and Y, which may be operated by a solenoid RV, one terminal of the coil of which is connected to the positive side of the generator G and the other terminal of which is connected to a brush 11 cooperating with a commutator 12 which moves with an indicator hand 13 for indicating the speed on a dial 14. Cooperating also with the commutator is a brush 15 connected to the negative side of the generator G, the commutator being so located and of such length that

it will close the circuit of the solenoid RV in all positions of the speed hand above a predetermined speed indication considered a safe speed at which the wayside signal block may be passed. The forestalling circuits will therefore open at switches *e* and *f* when the speed of the train exceeds said predetermined speed and an operation of the forestalling lever will have no effect on the operation of the automatic train control apparatus.

A lamp PL may be connected in parallel with the solenoid RV. When the solenoid RV is energized and forestalling is prevented, the PL pilot lamp is lighted.

In known constructions such as shown in the patent to Bond 2,099,100, November 16, 1937 and the patent to Porskievies 2,099,101, November 16, 1937, provision has been made to record the speed of the train on a tape 20 by means of a stylus 21 operated from the speedometer by a rack and pinion 22 and 23 as indicated. The tape may be fed by any suitable means proportionately to the distance traveled by the train. For the purpose of indicating an operation of the forestalling lever on the tape, I provide a stylus 25 on a rocking armature 26 of a solenoid 27 operated by current from the positive side of the generator G, over the coils of the solenoid 27, and over line 28 and switch 29 when closed by the forestalling lever, to the negative side of the generator G.

In the modification disclosed in Fig. 2 the forestalling lever FL is provided with a pivoted locking bar 30 slidably mounted in a block 31 perforated to receive a locking pin 32 on an armature of a solenoid 33, the pin being pressed forwardly by a spring 34 through one of a plurality of apertures in the locking bar 30 when the solenoid is deenergized and withdrawn when the solenoid is energized over a circuit from the positive side of the generator G, contact 35 of relay 36 when deenergized and coil of solenoid 33 to the negative side of the generator G. The circuit of the relay 36 is controlled by the brushes and commutator associated with the speedometer in the same manner as is the RV solenoid in the first modification. By means of these circuits the forestalling lever is released for operation only at speeds below the predetermined rate of speed. A pilot lamp PL may be connected in parallel with the relay 36. When the relay 36 is energized and the solenoid 33 is deenergized and forestalling is prevented, the pilot light PL is lighted.

For the purpose of marking the tape at the speed at which the forestalling lever is operated, I connect the coil of the solenoid 27 in a circuit which includes spring pressed contacts 40 and 41 and a bridging contact 42 carried by the end of the locking bar 30. By this means the stylus 25 is operated to indicate on the tape the speed of the train at which the forestalling lever is operated.

In describing my invention I have described briefly and illustrated diagrammatically a known system of train control with which my invention may be associated. It is to be understood however that the invention may be associated with other forms of train controls and that my invention is not limited to the modifications illustrated and described as this has been done merely for the purpose of disclosing my invention and is not to be considered limitative. It is to be understood that I reserve the right to make all such changes as fall within the principles of the invention disclosed and the scope of the appended claims.

I claim:

1. In combination with a vehicle, a tape mounted on the vehicle and movable proportionately to the distance traveled by the vehicle, a marker associated with the tape, means automatically controlled by means along the wayside for reducing the speed of the vehicle, and manual means for concurrently forestalling an operation of said first mentioned means and for operating said marker.

2. In combination with a vehicle, a tape mounted on the vehicle and movable proportionately to the distance traveled by the vehicle, a marker associated with the tape, means automatically controlled by means along the wayside for reducing the speed of the vehicle, and manual means for concurrently forestalling an operation of said first mentioned means at speeds below a maximum predetermined speed only and for operating said marker at all speeds.

3. In combination with a vehicle, a tape mounted on the vehicle and movable proportionately to the distance traveled by the vehicle, a marker associated with the tape, manual means for operating said marker, means automatically controlled by means along the wayside for reducing the speed of the vehicle, and means under control of the speed of the vehicle for locking said manual means against operation at speeds above a maximum predetermined rate of speed.

4. In combination with a vehicle, means on the vehicle responsive to wayside devices for automatically reducing the speed of the vehicle, means for forestalling an operation of said first mentioned means at speeds below but not above a maximum predetermined speed, a signal, and speed controlled means operating said signal and rendering said forestalling means ineffective at speeds above said maximum predetermined speed.

5. In combination with a vehicle, means on the vehicle responsive to wayside devices for automatically reducing the speed of the vehicle, means for forestalling an operation of said first mentioned means at speeds below but not above a maximum predetermined speed, a signal, speed controlled means operating said signal and rendering said forestalling means ineffective at speeds above said maximum predetermined speed, a distance tape operated by said vehicle, a marker for said tape, and manual means for operating said forestalling means and said marker.

6. In combination with a vehicle, means carried by the vehicle responsive to wayside devices for automatically reducing the speed of the vehicle, a forestalling means for forestalling an operation of said first mentioned means, manual means for operating said forestalling means, a distance tape, means for locking said manual means against operation at speeds above a maximum predetermined speed, a marker associated with the tape, and means operated by said manual means for operating said marker.

7. In combination with a locomotive, a tape mounted on the locomotive and movable proportionately to the distance traveled by the locomotive, a marker associated with the tape for recording any desired wayside information and its point of origin on the tape, and manual means for controlling the operation of the marker at will regardless of the rate of speed of travel of the locomotive and of the tape.

8. In combination with a locomotive, a tape mounted on the locomotive and movable proportionately to the distance traveled by the locomotive, speed recording means for recording the rate of travel of the locomotive in a predetermined zone of the tape, a marker associated with a different zone of the tape for recording any desired wayside information and its point of origin on the tape, and manual means for operating said marker at will regardless of the rate of speed of travel of the locomotive and of the tape.

9. In combination with a vehicle, means carried by the vehicle responsive to wayside devices for automatically reducing the speed of the vehicle, a forestalling means for forestalling the operation of said first mentioned means, manual means for operating said forestalling means, a distance tape, means for rendering said manual means ineffective as to its operation of said forestalling means at speeds above a maximum predetermined speed, a marker associated with the tape, and means operated by said manual means for operating said marker upon each operation of said manual means.

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