

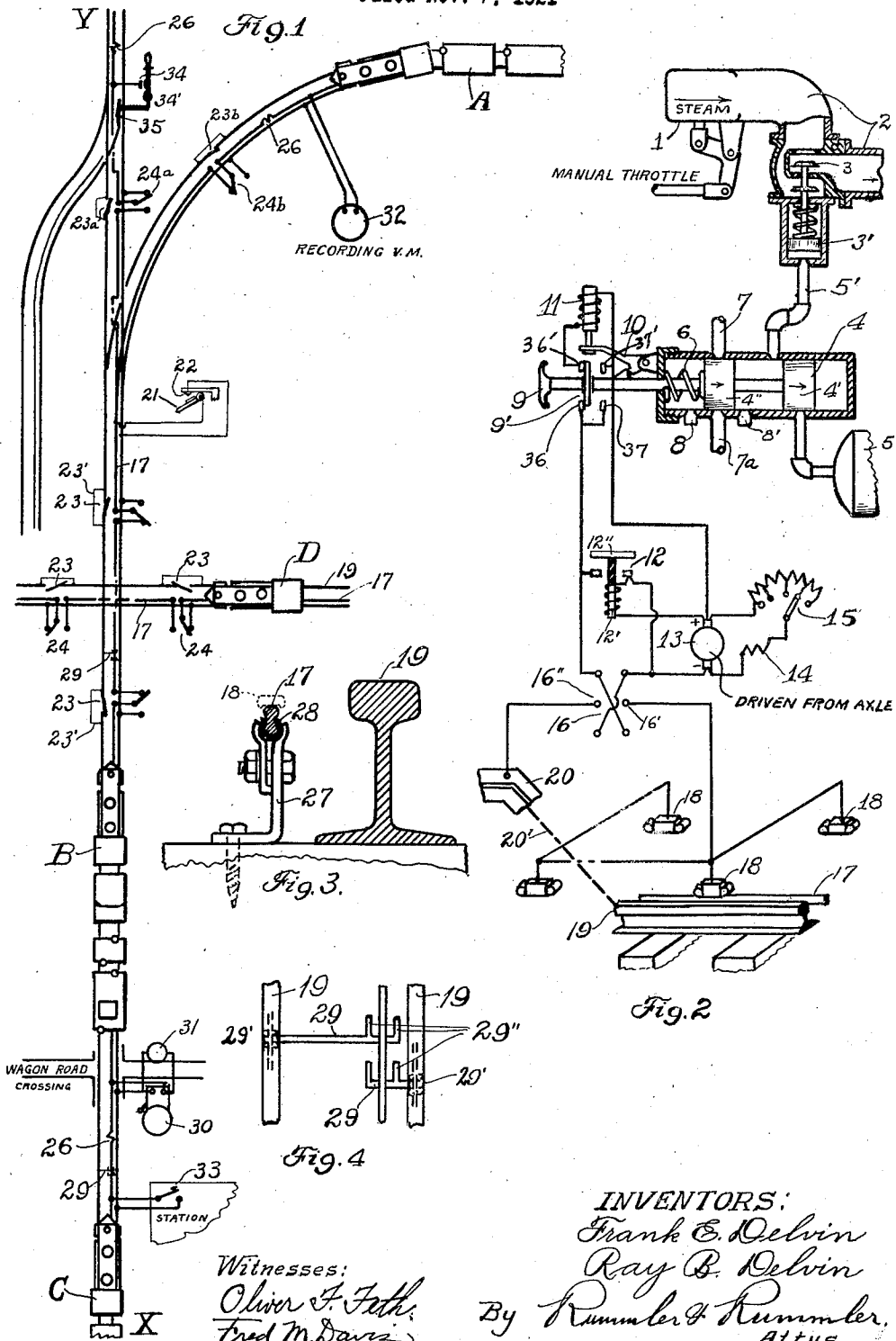
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F. E. DELVIN ET AL

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ELECTRIC AUTOMATIC TRAIN STOP SYSTEM

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UNITED STATES PATENT OFFICE.

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ELECTRIC AUTOMATIC TRAIN-STOP SYSTEM.

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To all whom it may concern:

Be it known that we, FRANK E. DELVIN and RAY B. DELVIN, citizens of the United States of America, and residents of Leslie, county of Ingham, and State of Michigan, and Evanston, county of Cook, and State of Illinois, respectively, have invented a new and useful Improvement in Electric Automatic Train-Stop Systems; of which the following is a specification.

This invention relates to the organization and application of electrical equipment in a manner not heretofore employed, for the purpose of automatically stopping trains, one or more, under various conditions, as for instance two trains approaching dangerously near to each other, whether on the same or on intersecting or branching tracks, and whether traveling in the same or in opposite directions and also whether both are in motion or one is standing still. It also embodies the application of other safety devices which tend to prevent accident and facilitate control.

The chief objects of the invention are to provide means of improved form and organization to prevent collision between trains; to prevent wrecks due to spreading of rails and to grade crossings; to enable a station attendant to stop a train as it approaches; to obtain graphic records of operation at desired points; and to provide means capable of either general or localized application.

We accomplish these results by the application and use of equipment as illustrated on the accompanying drawing, wherein—

Figure 1 is a plan of a track signal circuit and a track with trains thereon. It also shows the application of lights and bells to highway crossings, and also a recording instrument and other accessory devices.

Figure 2 is mainly a diagram of the electric circuit for a locomotive and adjacent track.

Figure 3 shows the relative size, shape and position of the track rail and "feeler."

Figure 4 is a diagram showing a rail spreading protector detail.

The system as a whole is shown in Figure 1 which includes a track system with trains shown in the various relative positions which might ordinarily result in collision.

The third and intermediate line in the track represents an electrical conductor, which may be a form of rail, insulated from ground and from the other rails. This safety rail is herein designated as the "feeler." It is energized only at a low potential, and owing to its resistance is effective only in the vicinity of a train equipped with a generator as herein described. The said rails (traction and feeler) and connections therefore constitute the track circuit. The feeler and either tread rail constitute such a pair of conductors as are necessary for a suitable track circuit.

Two trains approaching within a predetermined distance of each other react each on the other electrically, by reason of their generators and relays herein described, through the feeler, as will be fully explained, so as to cut off the steam from both engines and also apply the air brakes. But if desired for economic or other reasons, the steam control may be left to hand operation and the brakes only made automatic. When applied to electric trains an electrical tripping device applied to the train circuit breaker takes the place of the throttle control device or trip shown in Fig. 2. This view shows mainly how each engine is equipped and the method of operation. The equipment is all shown in the running position, as when the train is running at full speed.

The throttle valve at 1 in the dry pipe 2 has an auxiliary balanced valve 3 which is normally open and is closed only in an emergency by the means hereinafter described. The valve 3 is operated by compressed air from the tank 5, flowing past the automatic valve 4 and through pipe 5'. Valve 4 includes parts 4' and 4''. It is urged by compression spring 6 toward its effective position and when released and operated applies the air brakes by opening the main train pipe 7 and the engine service brake pipe 7^a to atmosphere through the exhaust port 8. Valve part 4'' also then closes the throttle control port 8'. Said port 8' normally connects the throttle control cylinder and pipe 5' to atmosphere, but when the piston 4 is released and moves to the right (see Fig. 2) it is closed and prevents air from tank 5 leaking on its way to pipe 5' for closing valve 3. At the same time the

part 4' admits air from tank 5 to valve piston 3'. Said valve 4 is restored manually (toward the left in Fig. 2) by means of the pull handle 9 whereby it is set, ready for the next release. It may be located either in the cab near the engineer or elsewhere in such a position as to necessitate stopping the train in order to enable the engineer to obtain access to it to reset it. That is, it may be located so that the operator will have to get on the ground to reset it. The handle is held with the valve in closed or running position by a latch 10 until released by the operation of the solenoid 11. The movement of handle 9 also operates switch 9' as will be explained. Relay 12 controlling solenoid 11 has its contacts closed as by gravity when the engine is stationary or moving slowly, but they are open at normal speeds by reason of the solenoid 12' which raises the bar 12'' and opens the switch as the generator voltage rises.

Direct current potential is supplied by the generator 13 which is driven from an axle of the engine, not shown, or its equivalent as will be understood, and its field 14 is controlled by rheostat 15 which may be operated either manually or automatically, as for instance by a centrifugal governor, not shown.

The two-pole double-throw switch 16 is for the purpose of reversing the polarity of the potential applied to the rails and the feeler 17, this switch being in one position on trains traveling from terminal X to terminal Y on Fig. 1, and reversed on trains traveling from Y to X. It is intended that said switch 16 shall be locked in its proper position before leaving the terminal. A special automatic reversing switch may be provided for switch engines, as will be understood.

One side of the engine circuit is carried from switch post 16' to the feeler 17 through one of the four collector shoes 18. These collectors permit running the engine in either direction, and also permit locating the feeler on either side of the track and bridging gaps at highways. The other side of the circuit, from post 16'', is grounded to the main rails 19 through the frame 20 and wheels of the engine, as indicated by the dotted line 20'.

In order to insure against a train passing a signal set against it, as for instance a semaphore, electrical connections are made from the track and feeler, as illustrated in Fig. 1, where the semaphore arm 21 is arranged to close a circuit through a fixed contact 22 and so make a short circuit between said feeler and one of the rails.

In any case of intersecting or branching tracks, mechanically interlocked derailleurs 23 are used, so arranged that when those in the track having the right of way are closed,

those in the other track are open. Each derailer in opening or closing operates a contactor 24 connected as in Fig. 1. When the derailer is closed the feeler 17 is connected straight through without any break and trains A and B are protected against each other. When the derailer is open as at 23^a the feeler 17 is open and grounded to the main rail, thus stopping any train approaching from that direction. A similar derail and stop installation is made in the case of track crossings. In the situation depicted in Fig. 1, engine D has been stopped to allow train B to pass, and trains A and B will both be stopped before colliding.

The feeler rail 17 must be large enough to be mechanically rigid and durable and so has a rather high conductivity. In some instances it is desirable to increase the effective resistance of the feeler, and for this purpose some or all of the feeler joints may be provided with a connector 26 having sufficient resistance to accomplish the desired result.

Feeler supports 27 each having insulation 28 are distributed along the track to hold the conductor 17 in due relation to the rails 19, as shown in Figure 3.

Rail spreading detectors of the general character shown by Figure 4 may to advantage be distributed along the track. For this purpose forked bars 29 are disposed transversely of the track between the rails, the outer ends being fastened to the corresponding rails respectively as at 29' and the inner ends having the laterally turned fork arms 29'' disposed to contact with the feeler when and only when the bar 29 is moved lengthwise by displacement of a rail 19.

An alarm bell 30 or the like and a light 31 of such voltage rating as to be operated by an approaching train are provided at dangerous grade crossings on public highways. These are bridged across between the feeler 17 and the adjacent rail, but are of too small current capacity to cause actuation of the train stop relay 11.

A recording instrument 32, usually some form of voltmeter adapted to furnish a graphic record, is provided at certain vital points where graphic operating data is desired concerning the performance of trains and equipment. This instrument takes only a very small current, the influence of which on relay 11 is negligible.

The station control switch 33 enables any authorized person, as for instance a station operator, to stop a train known to be in danger, or for any good reason.

Figures 1 and 4 also illustrate the following accessory features at once available in connection with the above train and track equipment.

Detail 29 is a forked bar attached to either rail at any point where spreading or

other dislocation is apt to occur. In this event a short circuit is formed which will stop an approaching train.

In order to insure stopping of any train approaching an open siding switch, a grounding contact 34 (of Fig. 1) is mounted on the rail switch control stand 34' and is automatically closed when the siding switch 35 is open.

It is to be noted that when two oppositely moving trains are approaching each other their generators 13 are normally connected in series through the track and feeler 17. The rail circuit is completed past the derailers 23 by connectors 23'. This circuit includes the switches 9', one in each engine. Each switch 9' is the equivalent of a single-pole double-throw switch, and includes contacts 36 and 36' on one side and contacts 37 and 37' on the other side, the contacts 36 and 37 being connected together and connected to the relay 12. Contacts 36' and 37' are connected to relay 11 and contact 37' is also connected to generator 13.

Some of the main features of operation may be summarized as follows. In the case of trains A and B shown in Fig. 1, if it is assumed that both are in motion and that each is equipped as in Fig. 2, one having its switch 16 upwardly and the other downwardly, as viewed in Fig. 1 so as to connect the control circuits of both engines in series as the distance between them decreases, more current will flow through the feeler and through parts 11, 13, 16, 18, 20, 36, and 36' of both trains, until on one or the other of the engines (assuming that the devices are not in precisely the same degree responsive to a gradually increasing current) the solenoid 11 trips the lever 10 releasing the valve 4 which moves under pressure from the spring 6. This subjects valve 3 to air pressure from tank 5, shuts off the steam, and opens pipes 7 and 7^a to atmosphere through port 8 thus applying the brakes, and stopping the train. As valve 4 operates, contactor or switch 9' opens at 36 and closes at 37, thus cutting out the coil of the solenoid 11 and applying the full potential of both generators to the tripping circuit on the other train, thus stopping it. It is conceivable that both solenoids might trip at once, but practically this is not likely to occur.

When the speed of one train is below a predetermined rate its relay 12 is closed due to low voltage which in effect short circuits the feeler and rail and thus opposes minimum resistance to the operation of the equipment on the other train. This is also the case when one train, e. g., B of Fig. 1, is standing still and train C is moving. The use of relay 12 permits the design of

solenoid 11 so that it will not operate when the train is running slowly as into a siding or in starting up.

Where conditions warrant it, as where close running of trains is permissible or desirable, the resistance units 26 may be inserted in series with the feeler at predetermined distances apart such that two or three in the circuit would prevent the operation of either solenoid, but when incidentally to the proximity of the trains only one unit 26 remained in circuit the extra voltage applied to the solenoids would insure their operation.

Although but one specific embodiment of this invention is herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

We claim:

1. Automatic stopping means for railway trains, comprising a pair of conductors disposed along the track, and on each train a direct current generator the speed and voltage of which varies with the train speed, brake applying means responsive to electric current, a reversing switch arranged to control the polarity of connections to said conductors, a switch normally open in use and responsive to decrease in voltage to short the circuit leading to said conductors, and circuit means connecting said generator, brake applying means, reversing switch and conductors in series.

2. In a system of the character described a railroad track, a feeler conductor extending lengthwise thereof between the rails, a vehicle on said track and transversely disposed conductors spaced apart along the length of the track, part connected to one rail and part connected to the other, and each formed to make contact with said feeler conductor in case of appreciable lateral movement of the corresponding rail, said vehicle having control means electrically responsive to such spreading.

3. In a system of the character described, a vehicle, and a controlled relay thereon, in combination with a rail spreading detector including a feeler and conductors extending laterally from the rails to provide electrical connection to said feeler, said conductors each having a U-shaped part disposed normally out of contact with said feeler and having arms extending on each side thereof to electrically engage said feeler in case of rail spreading.

Signed at Chicago this 3rd day of November, 1921.

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