June 12, 1923. 1,458,616

A. V. T. DAY

TRAFFIC CONTROLLING SYSTEM

Filed July 10, 1911 7 Sheets-Sheet 1

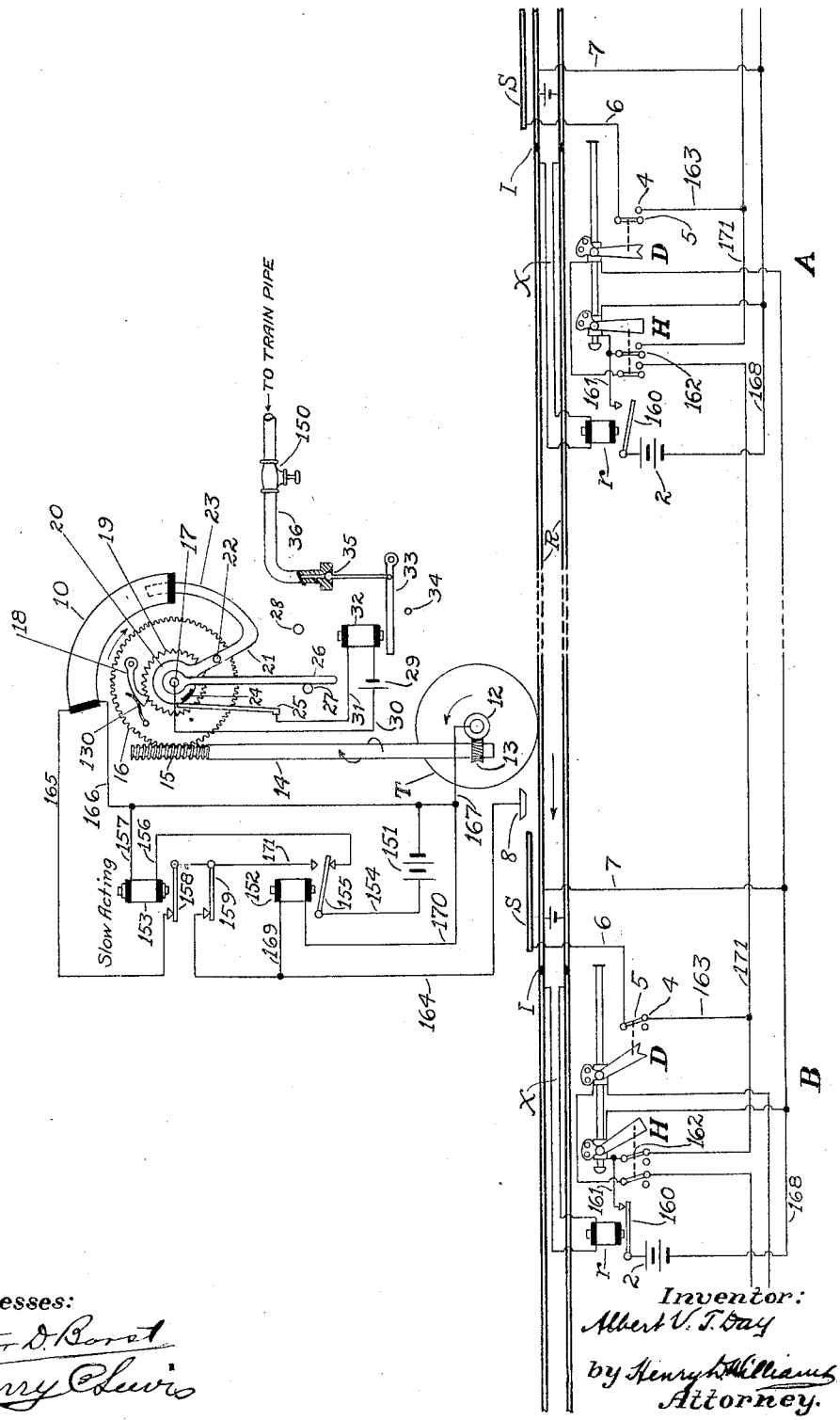


Fig. 1.

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TRAFFIC CONTROLLING SYSTEM

Filed July 10, 1911 7 Sheets-Sheet 2

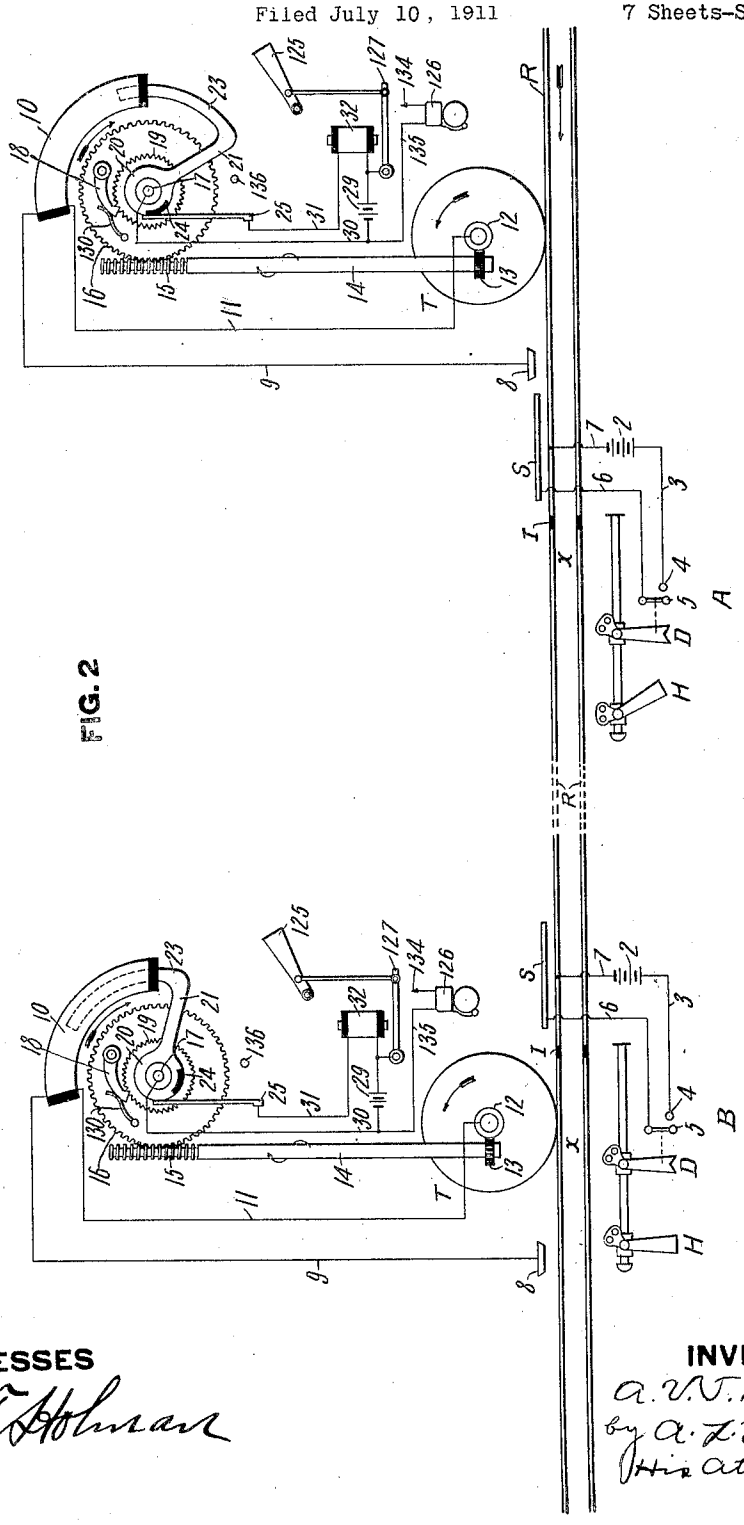


FIG. 2

WITNESSES

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TRAFFIC CONTROLLING SYSTEM

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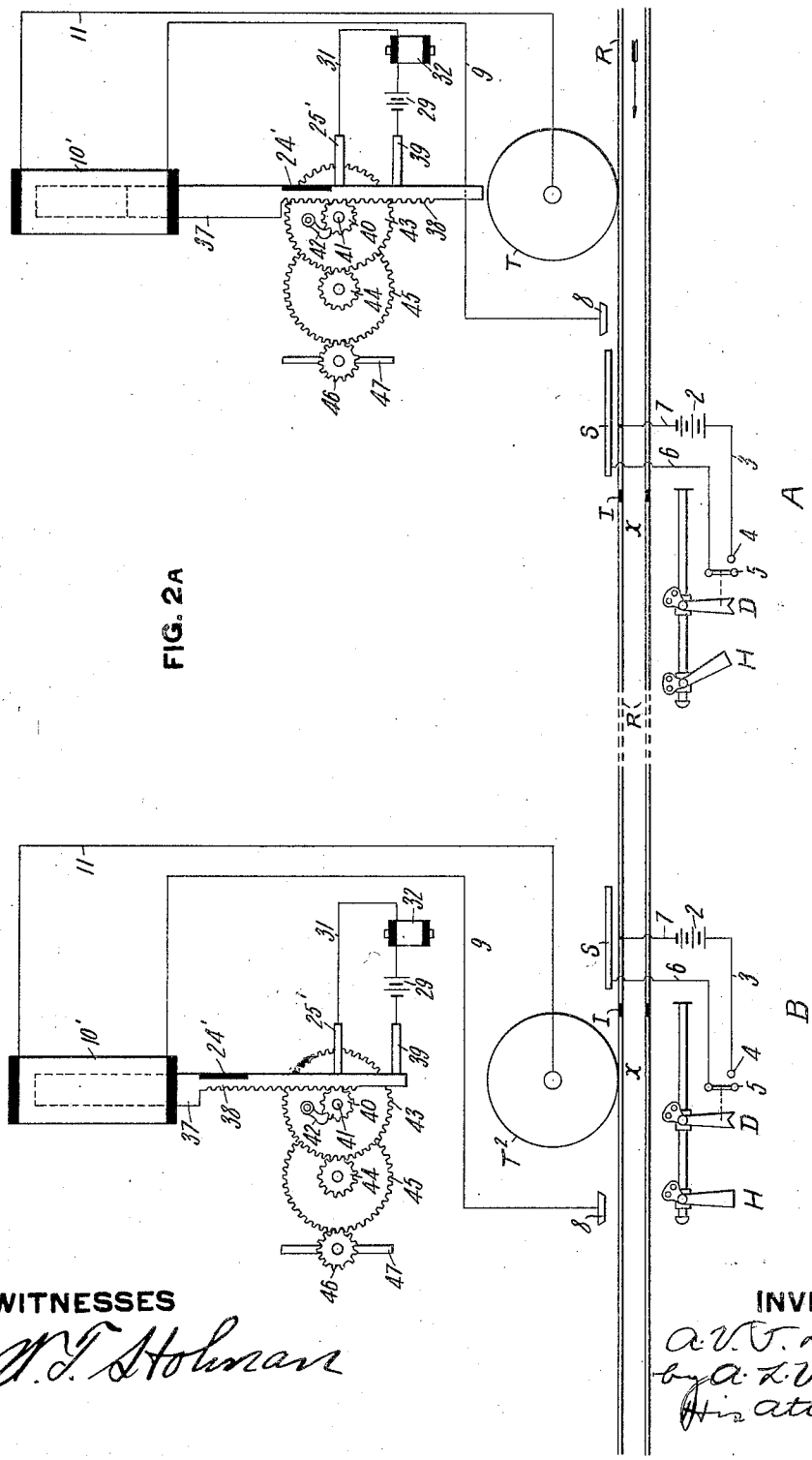


FIG. 2A

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TRAFFIC CONTROLLING SYSTEM

Filed July 10, 1911 7 Sheets-Sheet 4

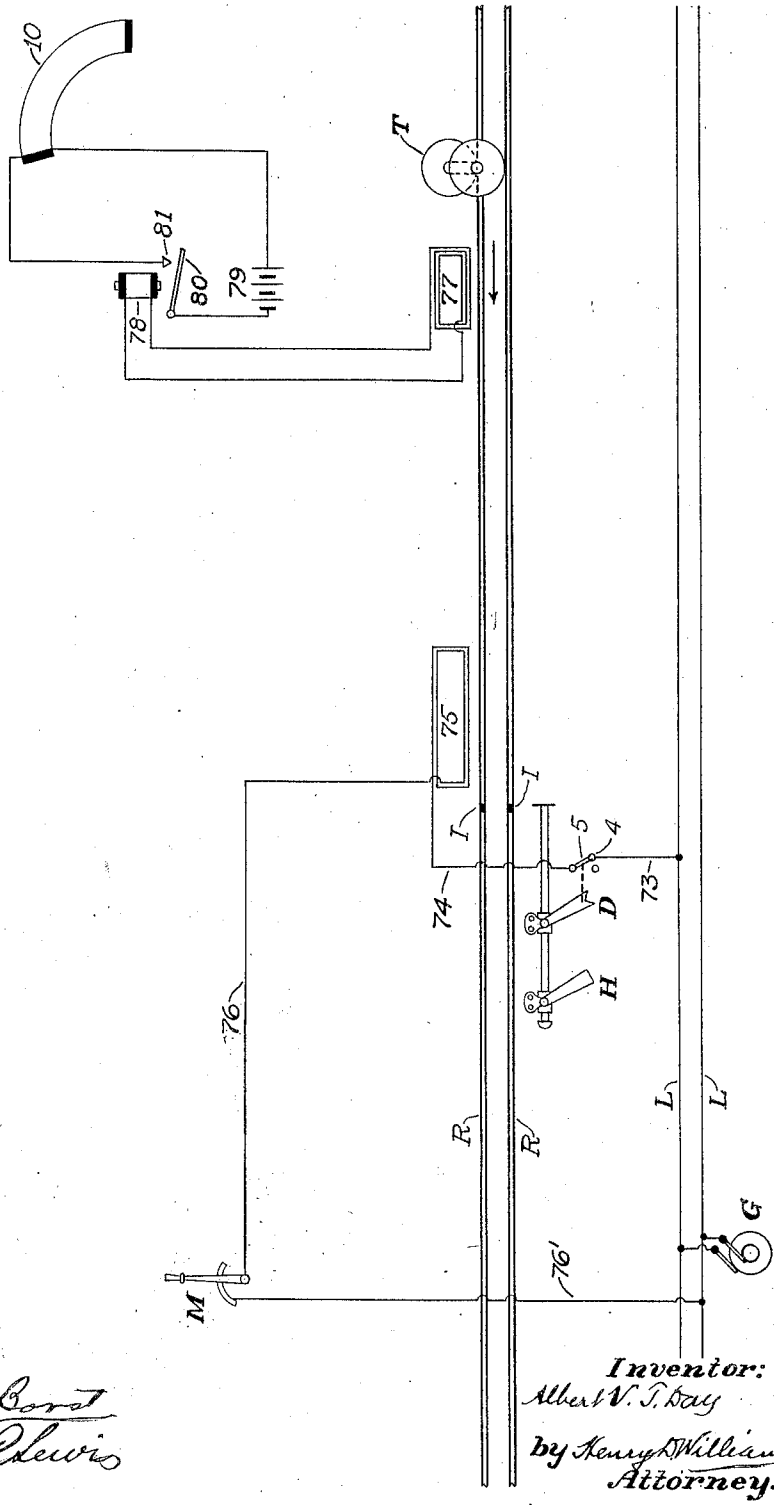


Fig. 3

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TRAFFIC CONTROLLING SYSTEM

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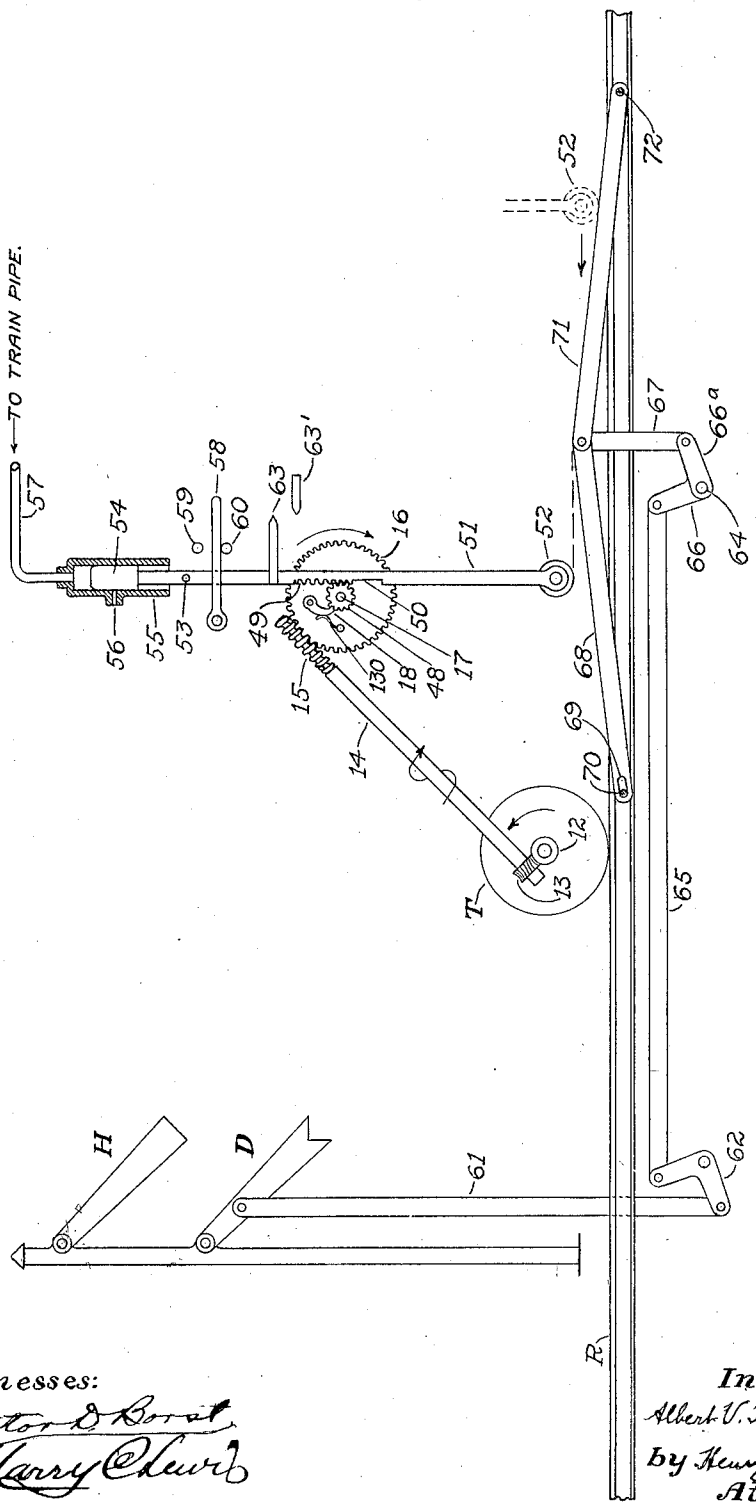


Fig. 4

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TRAFFIC CONTROLLING SYSTEM

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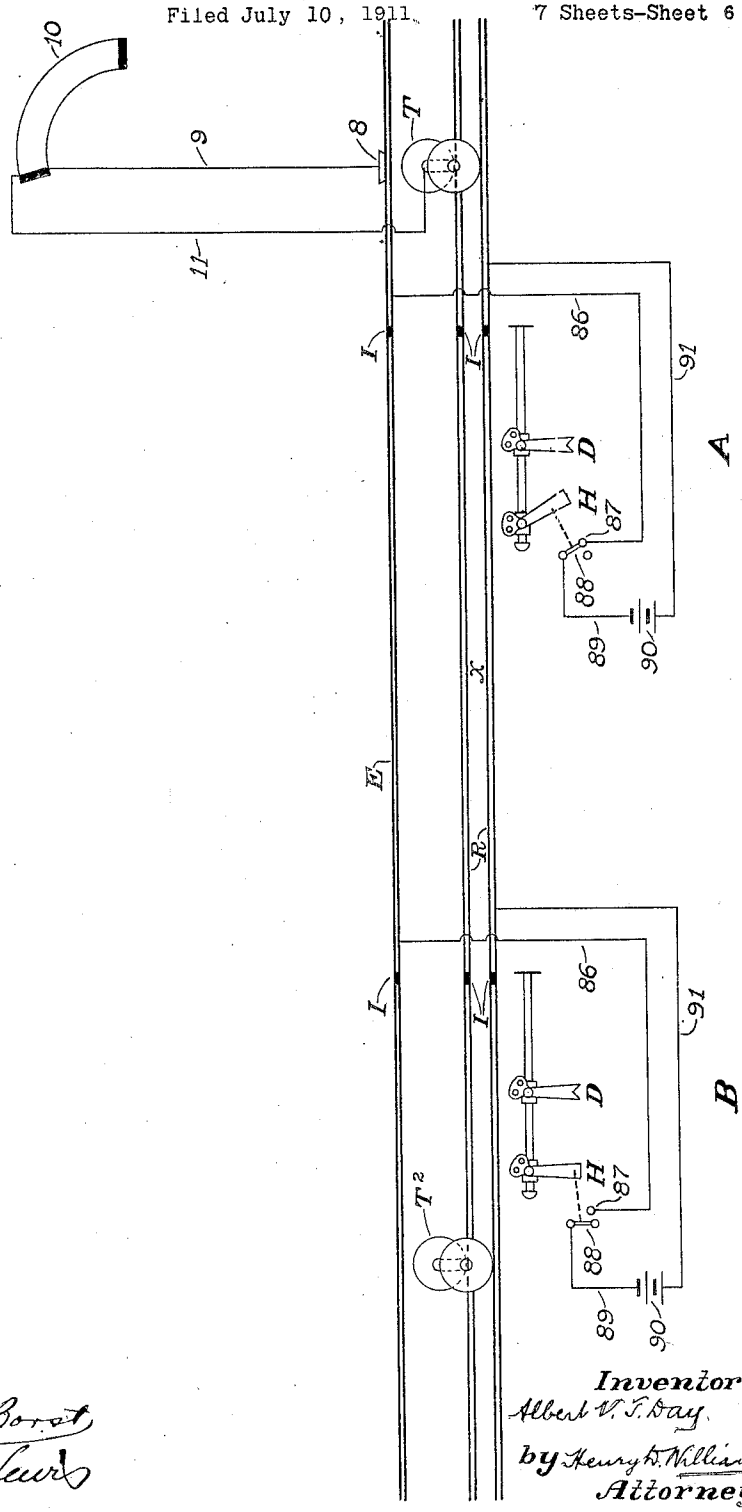


Fig. 5

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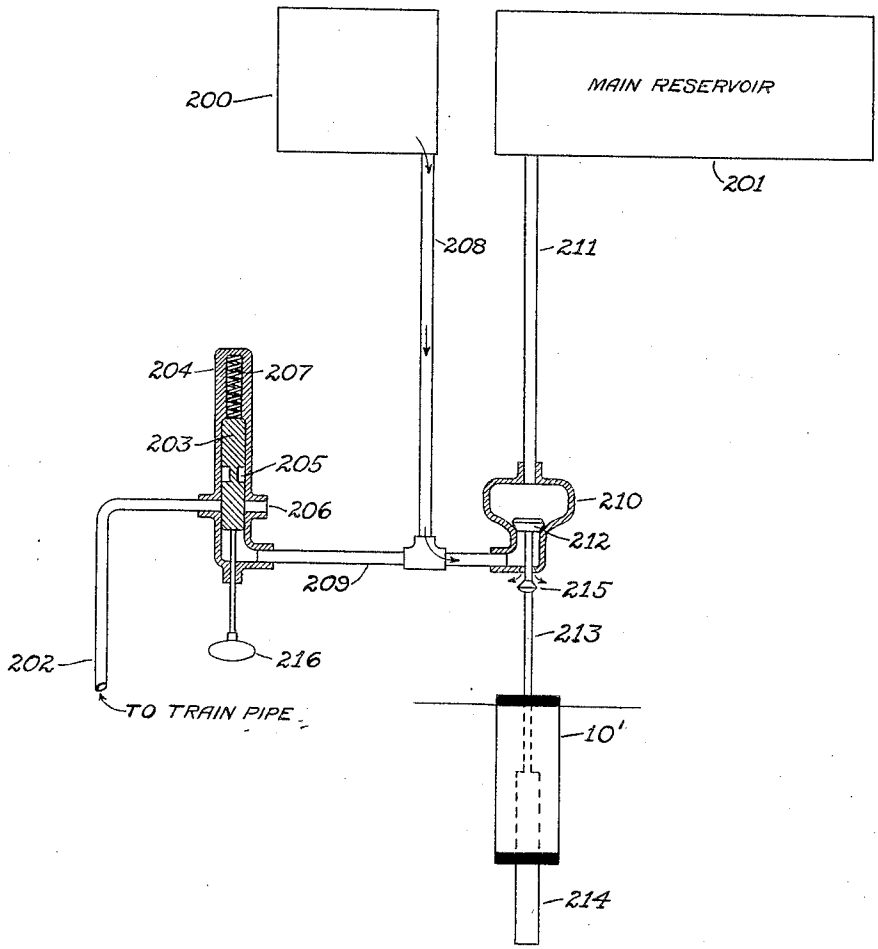
June 12, 1923. 1,458,616

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TRAFFIC CONTROLLING SYSTEM

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Fig. 6



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Patented June 12, 1923. 1,458,616

UNITED STATES PATENT OFFICE.

ALBERT V. T. DAY, OF NEW ROCHELLE, NEW YORK, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TRAFFIC-CONTROLLING SYSTEM.

Application filed July 10, 1911. Serial No. 637,773.

To all whom it may concern:

Be it known that I, ALBERT V. T. DAY, a citizen of the United States, residing at New Rochelle, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Traffic-Controlling Systems, of which the following is a specification, reference being had therein to the accompanying drawings, forming part thereof.

My invention relates to railway traffic controlling apparatus carried on a train or railway vehicle, such as automatic train retarding or train stopping apparatus, visual and audible train signals, and the like.

The objects of my invention are reliability of operation, simplicity and economy of construction, and various more particular objects which will be apparent in the light of the following specification and accompanying drawings, wherein I have described and illustrated several of the many forms in which the broader features of my invention may be embodied. In these drawings:

Fig. 1 represents a train-retarding or train-stopping system combined with an automatic block signal system and including electrical means of communication between the train-retarding apparatus carried on the train or railway vehicle, and the controlling apparatus on the railway.

Fig. 2 represents a train signal system similar to the train-retarding system shown in Fig. 1.

Fig. 2^a is a view showing a modification of the systems shown in the preceding views.

Fig. 3 represents a modification of said electrical means of communication included in the system of Fig. 1.

Fig. 4 represents automatic train signal and train retarding apparatus combined with railway block signals and including mechanical means for communicating control from the apparatus on the railway to the apparatus carried on the train or car.

Figs. 5 and 6 represent other modifications of my invention.

One feature of my invention is the provision of traffic-controlling apparatus carried on a train or vehicle and tending automatically to retard the train or to operate a signal after the train has progressed for a limited interval of time or distance during which the apparatus does not receive actuation by extraneous means.

In the drawings the diagram of home and distant signals, H and D, adjacent the insulated joints I dividing the rails R into distinct sections is a conventional representation of an ordinary block signaling system. In Fig. 1, in which one track is represented and in which two signal stations A and B are shown, together with the intermediate block and portions of the adjacent blocks, the signals at A are both at danger since a train T is present on the block A—B, and the track relay r, which controls the signal circuits at A, is shunted thereby. The signals at B are both at clear, thereby indicating that the two blocks in advance of A—B are unoccupied. The usual signal circuits are shown in which each home signal H is controlled by the track relay at its station and each distant signal D is controlled by the home signal of the station in advance.

The train-retarding apparatus which is carried on train T of Fig. 1 consists of means operated by the movement of the train and tending, after a predetermined interval to open a valve and permit the escape of air from the train pipe and thus apply the brakes.

The pipe 36 which leads to the train pipe has a valve seat in the open end thereof and a valve 35 co-operates therewith to control the escape of air from the pipe 36. The valve 35 is opened and closed by a controlling magnet 32, the valve stem being attached to the armature 33 of the magnet 32, as indicated. When the magnet 32 is energized and the armature 33 attracted, the valve 35 closes against its seat; but when the magnet 32 is deenergized, the armature 33 falls by gravity or other retractile force against the stop 34 and opens the valve 35.

The magnet 32 is energized by a battery 29 through a circuit under control of train-controlled apparatus tending after a predetermined movement of the train to open the circuit and deenergize the magnet 32. The train-controlled apparatus is operatively connected to one of the wheels of the train, preferably one of the drive wheels of the locomotive, by means of a shaft 14 and

worm 13 thereon, which meshes with a worm 12 on the axle of the wheel T.

As the train advances, the shaft 14 is rotated in the direction indicated by the arrow, and a worm 15 thereon rotates a worm-wheel 16 in the direction indicated. The worm-wheel 16 is fixed on a shaft 17, and carries a detent 18 which is yieldingly held by a spring 130 in the teeth of a toothed wheel 19, loosely mounted on the shaft 17. From the hub 20 of the toothed wheel 19 extends a traveler consisting of an arm 21 on the outer end of which is an arcuate magnetic core 23 moving in an arcuate solenoid 10.

It is apparent that when the solenoid 10 is energized, it will draw the core 23 up into the solenoid, the detent 18 riding idly over the teeth of the wheel 19 as the wheel is rotated in this direction, and when the solenoid is deenergized the core 23 and the arm 21 will tend to fall both by gravity and by the friction drag of the shaft 17 and the detent 18. This movement, however, will not occur any faster than the rotation of the worm-wheel 16 will permit, due to the engagement of the detent 18 in the teeth of the wheel 19.

The circuit in control of the magnet 32 is completed as follows: from the left pole of the battery 29, through wire 30, shaft 17, hub 20, wiper or brush 25 which engages the hub 20, wire 31 and magnet 32, back to the right pole of the battery 29. In the periphery of the hub 20, however, is inserted an insulation 24, and when the brush 25 engages this insulation 24, the circuit of the magnet 32 is broken and the armature 33 drops, opening the valve 35 as previously explained. A manually controlled valve 150 is provided in the pipe 36 to permit regulation of the escape of air when the valve 35 is opened, and ordinarily it will be so set that a service application of the brakes will be made. The parts of the apparatus are so designed that the distance which a train will be permitted to run after the apparatus has been reset, and until the insulation 24 breaks the circuit of the magnet 32, is one complete block and to the point x in the block ahead, which point is a sufficient distance back from the advance end of said second block, to insure that the train will be stopped before the end of that block is reached.

At the entrance to each block extraneous means are provided for resetting the apparatus, in case the distant signal is at clear, that is, for energizing the solenoid 10, and thus drawing the core 23 up to the starting point. A contact finger 5 is mechanically connected to the distant signal D and is operated thereby so that it engages a contact point 4 when the distant signal D is at clear, and opens this contact when the distant signal is at danger. A contact rail S is situated near the entrance to the block A—B in position to be engaged by a contact shoe 8 on the train T, and a local battery 2 is connected by the wire 7 to one rail R of the track, and by the wire 6 to the contact rail S when the distant signal D is at clear, through a circuit which will be hereinafter explained.

That portion of the electrical means for resetting the train-retarding apparatus, which is carried on the train includes a battery 151, a quick acting magnet 152, and a slow acting magnet 153. The magnet 152 is normally deenergized, so that its back contact is normally closed, and the slow acting magnet 153 is normally energized through the following circuit: from the left pole of battery 151, through wire 154, contact finger 155 controlled by the quick acting magnet 152, the back contact, wire 156, magnet 153 and wires 157 and 166 back to the right pole of the battery.

Two contact fingers 158 and 159, controlled by the slow acting magnet 153, are, therefore, normally held up and close their front contacts, as shown in the drawings.

As illustrated, the train T is at the advance end of the block A—B, and the brush 25 is about to wipe on to the insulation 24, which will occur when the train reaches the point x in the block next in advance, unless the solenoid 10 is energized before the train reaches that point.

When the shoe 8 engages the contact rail S, since the distant signal D is at clear, the solenoid 10 will be energized through the following circuit: from the local battery 2, through contact finger 160, wire 161, contact finger 162, wires 171 and 163, contacts 4, 5, wire 6, contact rail S, shoe 8, wire 164, contact fingers 159 and 158, wire 165, solenoid 10, wires 166 and 167, axle and wheel T, rail R, wire 7, and wire 168 back to the battery 2. At the same time the magnet 152 is connected in this circuit in multiple with the solenoid by way of wire 169, magnet 152 and wire 170, which form a branch circuit between wires 164 and 167. The contact finger 155 is, therefore, raised and closes its front contact and thus connects the battery 151 in multiple with the local battery 2, into the solenoid circuit as follows: from the left pole of battery 151 through wire 154, contact finger 155, its front contact, wire 171, contact finger 158, wire 165, solenoid 10 and wire 166 back to the right pole of the battery 151. The solenoid 10 now attracts its core 23 and completely resets the apparatus very quickly, and before the slow acting magnet 153, (whose circuit is broken when the finger 155 is attracted away from its back contact) permits the fingers 158 and 159 to drop and break the solenoid circuit. When, however, the magnet 153 does release the fingers 158 and 159, the solenoid circuit

is broken and the train-retarding apparatus is rendered operative to begin its movement from non-retarding to retarding position or condition. In other words this train-retarding apparatus is responsive to the engagement between the shoe and contact rail to begin the gradual movement from non-retarding condition to retarding condition.

It will be noted that the slow acting magnet 153 serves to permit the use of a short contact rail, since all the extraneous energization of the train-carried apparatus that is needed is enough to energize the quick acting magnet 152, which is sufficiently quick acting to require but substantially an instantaneous contact of the shoe 8 with the rail S. When the finger 155 is picked up, a local circuit is established through the magnet 152 as follows: from battery 151 through wire 154, finger 155, wire 171, finger 159, wires 164 and 169, magnet 152, and wires 170 and 166 back to the battery. Therefore, the finger 155 is held up against its front contact and the solenoid 10 is energized by the battery 151 as long as the slow acting magnet 153 holds up its contact fingers, and the magnet 153 is made sufficiently slow acting to hold the circuit through the solenoid closed long enough to insure that the core 23 will be completely drawn up into the solenoid. Hence the length of time required to reset the apparatus is entirely independent of the duration of contact required between the shoe 8 and the contact rail S.

Since the distant signal D at station B is at clear, the contact is closed at point 4 and the train-retarding apparatus will be reset at station B as above described.

Assuming, now, that the signal D is at danger and that the apparatus is not reset at station B, the brakes will be applied at point x in the block in advance of the block A—B, as previously explained. To enable the operator to run the train through this block after passing a caution signal, while at the same time compelling him to be at his post where he can keep the train under control, a manual hold-out is provided for partially resetting the apparatus and permitting the train to proceed a short distance. This hold-out consists of a hold-out arm 26 which serves as a hand lever and is pivoted on the shaft 17 and swings freely between two stop-pins 27 and 28, and in the path of a pin 22, on the arm 21 of the arcuate core 23. The arm 26 hangs by gravity against the back stop-pin 27, and the parts are so designed that with the arm 26 against the stop 27, the pin 22 on the arm of the movable core strikes the hold-out arm 26 just after the insulation 24 breaks the circuit of the relay 32 and applies the brakes. By swinging the hand lever 26 forward against the front stop-pin 28, due to the engagement of the pin 22 with the hand lever 26, the hub 20 will be rotated until it assumes substantially the position shown in Fig. 1, where it may be held by the hand lever as long as the operator remains at his post. Should he release the hold-out lever, his train could run but a comparatively short distance before the brakes would be automatically applied, the amount of this limited unretarded train movement being determined by the amount of back set imparted to the hub 20, depending on the position of the stop 28. Hence the headway permitted by the normal reset may be but fifty or one hundred feet, allowing the operator a short instant to turn away from his post, while his train is moving slowly, without incurring an automatic application of the brakes, but not giving him any appreciable time to leave his post without causing an automatic application of the brakes, when his train is running at high speed.

It will be apparent that the automatic reset could be dispensed with altogether and reliance be had entirely upon the manual hold-out to prevent the apparatus from stopping the train, thus always requiring the operator to be at his post to prevent accidents except for the brief intervals of unretarded train movement permitted after the apparatus is thus manually reset.

This manual hold-out becomes very important in case of a failure of the apparatus to receive the impulse at a clear distant signal, due to accidental derangement of the impulse producing apparatus, such as the breaking of the circuit. The system above described is what is termed a safe failure system, which means that the apparatus depends upon the establishment of circuit and the proper operation of the extraneous means, to keep the train going, instead of depending on such integrity of the system to retard the train when required. If for any reason the resetting impulse is not received as the train passes a clear distant signal, the operator, by using the manual hold-out, can proceed through the block to the next signal station, with no greater inconvenience than the requirement to remain at his post through the block.

It is apparent that in case the train is run backward, the apparatus will be turned back as a unit until the arm 21 of the solenoid core strikes the solenoid 10, when the arm is held against further movement and, consequently, the spring 130 will yield and the detent 18 will ride idly over the teeth of the toothed wheel 19 as the worm wheel 16 is rotated further by the backward movement of the train.

In Figure 2 I have shown two trains T and T^2, the first one approaching the block A—B and the second one in the block in advance of the block A—B, the signal cir-

cuits being omitted. Both signals at station B are at danger and at station A the home signal is at clear while the distant signal is at danger. Therefore, the train T will not get the resetting impulse at station A, since the solenoid energizing circuit is broken at contact point 4. In this instance the energizing circuit is somewhat different than that illustrated in Figure 1 and is as follows: from the battery 2, through wire 3, contact point 4, contact finger 5, wire 6, contact rail S, contact shoe 8, wire 9, solenoid 10, wire 11, axle and wheels of the train T, rail R and wire 7 back to the battery 2.

The circuit controlling apparatus on the train for controlling the energization of the magnet 32 is operated by the movement of the train in precisely the same manner as that shown in Figure 1. However, in this instance the traffic-controlling means which is operated by the magnet 32 is what is known as a cab signal, that is, a signal carried in the cab of the locomotive or elsewhere on the train. Both a visual and an audible signal are shown, the visual signal being a semaphore 125 and the audible signal being an electric bell 126. The semaphore 125 is a so-called upper quadrant signal and is mechanically connected to the armature 127 of the magnet 32 so that when the armature is held up by the magnet it raises the semaphore to clear position, as shown.

When the brush 25 wipes on to the insulation 24, and the magnet 32 is consequently deenergized, the armature 127 falls down by gravity or other retractile force against the contact point 134 in the bell circuit and the bell 126 is energized through the following circuit: from the battery 29, through the armature 127, contact point 134, bell 126, and wire 135 back to the battery. The bell, therefore, rings and the operator is apprised both by the ringing of the bell and by the indication of the semaphore 125 that he has passed a caution signal.

As in Figure 1 the parts are so designed that the insulation 24 will reach the brush 25 and the warning signals will be given as the train reaches the point x in the block A—B, and the operator is continuously warned to keep the train under control, until the apparatus is reset by an impulse received at a station at which the distant signal is at clear. If desired, a cut-out may be provided to disconnect the bell and prevent it from continuing the ring in case of a long delay.

In the illustrated apparatus the manual hold-out is dispensed with and a stop 136 is provided in the path of the arm 21 of the solenoid core 23. This stop 136 is so located that the arm 21 engages it just as the brush 25 wipes on to the insulation 24 and the signals are given, and the arm 21 and hub 20 are held against further rotation, the spring 130 yielding to permit the detent 18 to ride idly over the teeth of the wheel 19.

I have illustrated in Figure 2^a a somewhat different embodiment of the circuit controlling apparatus governing the energization of magnet 32. In this instance the apparatus is designed to run down and apply the brakes or give a warning signal or both after a definite interval of time, which is the time within which the train at its maximum speed will proceed one block and to the point x in the block in advance. In speaking of interval hereinafter, I mean either an interval of movement or the interval of time required to make the movement, it being apparent that the two are interchangeable. The traffic-controlling apparatus controlled by the magnet 32 may be a cab signal, such as is shown in Figure 2, or it may be an automatic stop, such as is illustrated in Figure 1, or any other suitable traffic-controlling apparatus.

The solenoid 10′ is energized from the battery 2 in precisely the same way as the solenoid 10 in Figure 2. The solenoid 10′ is, however, vertically arranged and the core 37 thereof will fall out by gravity when the solenoid 10′ is deenergized. From the lower end of the core 37 projects a rack 38 of electrically conductive material, shown as formed integral with the core. This rack 38 is connected through a train of multiplying gears to a retarding fan 47, which train consists of a pinion 40, with which the rack 38 meshes, the gear wheel 43, pinion 44, gear wheel 45 and pinion 46 to which the retarding fan 47 is fixed. The pinion 40 is connected to its gear wheel 43 by a pawl 42 and by means of this pawl rotates the train and the retarding fan when the pinion 40 is rotated as the rack descends, but when the rack moves upward and the pinion 40 is rotated in the opposite direction, the pawl 42 rides idly over the teeth of the pinion 40 and the multiplying train and fan are stationary.

Two brushes, 25′ and 39, in the circuit of the magnet 32, engage the rack 38, and the circuit of the magnet 32 is completed as follows: from the battery 29 through brush 39, rack 38, brush 25′, wire 31, and magnet 32 back to the right pole of the battery 29. On the back of the rack, however, at the upper end thereof, is inserted an insulation 24′ in position to be engaged by the brush 25′ and break the circuit of the magnet 32, thus operating the traffic-controlling apparatus.

When the shoe 8 engages the contact rail S and the solenoid 10′ is energized, the core 37 and rack 8 are drawn up into the solenoid to the position shown on train T^2 in Figure 2^a. As soon as the contact between the shoe 8 and the contact rail S is broken and the

solenoid 10 is consequently deenergized, the core 37 and rack 38 begin to fall by gravity, and the rate of fall is regulated by the retarding fan 47 as above described. The parts are so designed that at the maximum rate of speed, the train will travel but one block and to the point x in the next block between the resetting of the apparatus and the breaking of the circuit of the magnet 32.

It will be understood that my invention is not limited to a mechanical engagement between the train carried apparatus and the co-acting extraneous apparatus, and in Figure 3 I have shown a somewhat different embodiment of the impulse-creating apparatus disposed at each signal station, and one in which the mechanical engagement is dispensed with, and also a modified form of electrical communication to the vehicle-retarding apparatus. In this case the communication between the extraneous apparatus and that carried on the train is inductive instead of conductive. A long coil 75 is provided adjacent to the track and is energized by an alternating current generator G when the distant signal D is at clear. A manually controlled switch M may be provided in the coil circuit to permit an agent to stop a train, irrespective of the position of the distant signal, by merely opening the switch and thus preventing the train from getting the resetting impulse. If the contact is closed at contact point 4 and the switch M is closed, the coil 75 is energized through the following circuit: from the generator G through one line wire L, wire 73, contact point 4, contact finger 5, wire 74, coil 75, wire 76, switch M, wire 76′ and the other line wire L back to the generator.

On the train T is a coil 77 carried in position to sweep over the coil 75 in inductive relation thereto as the train passes the signal station: the circuit of the coil 77 is closed through a relay 78, and a current is induced in the coil 77 and the relay 78 is energized when the coil 77 is in inductive relation to the coil 75, provided the circuit is closed through the coil 75 as previously explained. Relative movement between the two coils is not necessary to the induction of a current in the coil 77 and relay 78, since the relay 78 is energized by an alternating current, and consequently the relay 78 will be energized even though the train should stop with the coil 77 over the coil 75.

The relay 78 controls the circuit through which the solenoid 10 is energized; when the contact finger 80 is held up and the contact closed at contact point 81 the circuit from the battery 79 through the solenoid 10 is closed and the traffic-controlling apparatus is reset. This apparatus may be such as illustrated in Figures 1, 2 or 2ª, or any other suitable apparatus.

In Figure 4 I have shown another modification of my invention, both in the controlling apparatus carried on the train and in the means of communicating a resetting impulse at intervals to the controlling apparatus on the train. In this case the communicating means are entirely mechanical, and since these mechanical means are shown as in the center of the track, the ties and the rail nearer the observer are omitted in the diagram.

The controlling apparatus on the train comprises a train stop operated by the movement of the train to open a vent connecting with the train pipe and apply the brakes. The escape of air from a pipe 57, which leads to the train is controlled by a piston valve consisting of a valve cylinder 55 on the end of the pipe 57 having an opening 56 in the side thereof which is adapted to be opened and closed by the movement of a piston 54 in the cylinder 55. The piston 54 is provided with a long downwardly extending piston rod 51 on the lower end of which is a wheel 52 which is adapted to be engaged by the mechanical resetting means in the track and pushed up thereby when the piston is depressed, as will be described hereinafter. The piston tends to fall by gravity but is restrained from falling except with a speed proportionate to the movement of the train, through means connected to a wheel of the train similar to that described in reference to Figures 1 and 2. The shaft 14 is rotated in the direction indicated by the arrow through the worms 12 and 13, and the worm 15 on the shaft 14 rotates the worm wheel 16. On the shaft 17 of the worm wheel 16 is loosely mounted a pinion 48 in the teeth of which a detent 18 on the worm wheel 16 engages and this detent is pressed into the teeth of the pinion by a spring 130 with sufficient force to cause the pinion to be rotated when the worm wheel is rotated, while the spring will yield to permit the pinion to be rotated independently of the worm wheel.

On the piston rod 51 is formed a rack 49 with which the pinion 48 meshes, and as the worm wheel 16 is rotated in the direction indicated by the arrow, the pinion 48 is rotated in the same direction, due to the engagement of the detent 18 in the teeth of the pinion, with the result that the piston 54 and rod 51 are permitted to fall gradually. The parts are so designed that after the apparatus is reset, the train will run one block and a slight distance into the next block to a point equivalent to the point x in Figures 1 and 2, when the pinion 48 will have rotated sufficiently to permit the piston 54 to open the vent 56 and a service application of the brakes will be made.

The mechanical means for resetting the train-retarding apparatus comprise two

toggle links, 68 and 71, in the middle of the track, arranged in the path of movement of the wheel 52 on the end of the piston rod 51. The link 71 is pivoted to the track rails by the pivot 72, and a corresponding pivot 70 passes through a slot 69 in the end of the link 68, thus permitting the toggle to be raised and lowered. The toggle is thus moved by the distant semaphore D through the mechanical connection shown. A rod 65 beside the track is connected to the semaphore blade D by a bell-crank lever 62 and a rod 61, and is rigidly connected to a transverse shaft 64 by a link 66. One end of a lever 67 is also pivotally connected to an arm 66^a rigidly connected to the inner end of the rod 64, while the other arm of the lever 67 is connected to the toggle joint. When the semaphore D falls, therefore, it raises the toggle joint through the connections just described, and when the semaphore is at danger the toggle is depressed. When the train reaches the signal station the piston 54 has fallen so that the wheel 52 is in the position shown in dotted lines. It is now apparent that if the toggle is elevated, the wheel 52 will ride up the link 71, pushing the rod 51 and piston 54 up and resetting the apparatus, while if the toggle is depressed the wheel 52 will pass it without being reset. When the rack 49 is thus raised, the spring 130 yields and permits the pinion 48 to rotate idly on the shaft 17.

Below the rack 49 is a cut-out portion 50, and when the train is run backward the pinion 48 will elevate the piston 54 until the pinion runs off the rack 49 on to space 50, after which the piston will not be raised further but the pinion 48 will rotate idly in the space 50 and no damage can result.

A manual reset 58 is provided similar to the reset 26 of Figure 1. The pin 53 on the rod 51, engages the hold-out arm 58 substantially at the time that the brakes are applied, and the arm 58 may be oscillated between the back stop 60 and front stop 59 and thus partially reset the apparatus and permit the train to run a short distance between each manual reset, precisely as explained in reference to Figure 1. The circuits for operating the signals are not shown, and it is manifest that the signals may be either manually or automatically operated.

In order that the operator may always know the position of the traveler, or movable piston and piston rod, and so be enabled to ascertain how long a time remains before the brakes will be applied, a pointer or index 63 is attached to the traveler and arranged to cooperate with a stationary pointer 63′, the two pointers being so arranged that they will become alined just as the piston 54 opens the vent 56.

In Figure 5 I have shown still other means of communication between the extraneous controlling apparatus and that carried on the train. Instead of receiving a temporary resetting impulse at intervals, as in the embodiment previously described, the train-retarding apparatus in this instance is responsive to clear traffic conditions to be continuously held at non-retarding position. In the particular embodiment which is illustrated in Figure 5, the extraneous controlling means include a third rail E which is divided into separate sections or blocks by insulation I co-extensive with the blocks into which the track rails are divided, and each circuit includes a section of the third rail E and of the track rails R and is controlled by the home signal H. Two signal stations A and B are shown and a train T is approaching the station A and a train T^2 is in the block in advance of the block A—B, while the block A—B is clear. The signals at B are, therefore, both at danger and at station A the home signal H is at clear while the distant signal D is at danger. A contact finger 88 is mechanically connected to the home signal semaphore H and operated thereby to close the circuit through the third rail at the contact point 87 when the home signal is at clear. Referring to the train T, the solenoid 10 is energized through the following circuit: From the battery 90 through wire 91, rail R, axle and wheel of the train T, wire 11, solenoid 10, wire 9, shoe 8, third rail E, wire 86, contact point 87, contact finger 88, and wire 89 back to the battery. As long, therefore, as the home signal of the block is at clear, the solenoid 10 on a train in that block will be energized, due to the continuous engagement of the shoe 8 with the third rail.

The solenoid 10 may control any suitable train-retarding apparatus, and the traveler will be held up to non-retarding position as long as the solenoid is energized. As soon as the solenoid becomes deenergized the traveler commences to move to retarding position, and it is apparent that this occurs when the train passes on to a block in rear of an occupied block. When, therefore, the train T enters the block A—B the circuit through the solenoid 10 will be broken since the home signal H at station B is at danger and the third rail circuit is broken at contact point 87. Hence the train-retarding apparatus will immediately start to move from non-retarding to retarding position, and the parts are so designed that the brakes will be applied at the point x in the block A—B and the train will be stopped before it enters the next block. This construction is particularly adapted for use in long blocks so that the train may run a long distance into the block before the brakes are automatically applied and still leave a safe stopping distance in the block. This construction is also

an example of the adaptability of my invention for use at grade crossings. The fact that the third rail is discontinued for a short distance where the other line crosses has no effect on the operation of the apparatus, for it is apparent that when the train passes the crossing the deenergization of the solenoid is only momentary and does not continue long enough to permit the traveler to move to retarding position, and that the apparatus is reset again as soon as the shoe 8 engages the third rail E on the other side of the crossing.

It will be seen from the foregoing that my invention comprehends signaling or train-retarding apparatus which has an automatic tendency to change from clear or non-retarding condition to danger or retarding condition during an interval of time or train movement, but is prevented from assuming such danger or retarding condition by clear traffic conditions of the track, while in the event of danger or retarding traffic conditions of the track, the apparatus proceeds uninterrupted in its change to danger or retarding condition. I employ the expressions clear or non-retarding traffic conditions to mean those conditions of track permitting unretarded movement of an approaching train, for instance conditions such as would ordinarily cause the display of a clear signal to an approaching train. By retarding or danger traffic conditions I mean the conditions of the track which require an approaching train to be retarded, for instance, conditions such as would ordinarily cause the display of a danger or caution signal to an approaching train. Likewise I employ the expressions clear or non-retarding conditions to designate that condition of a train-carrier signal or retarding means which permits unretarded movement of the train or vehicle, and which is maintained during clear or non-retarding condition of the track ahead. Also I employ the terms danger or retarding condition to mean that condition of the train-carrier retarding apparatus or signal which retards the train or gives warning that it should be retarded, and which occurs when the track ahead is in danger or retarding condition.

I have also, in the illustrated embodiments of my invention thus far described, shown the signaling or train-retarding apparatus as including a traveler or movable member which changes its mechanical position, but it will be readily understood from Fig. 6 hereinafter explained that the traveler is not essential to my invention broadly, and hence I refer to a change from non-retarding to retarding conditions as meaning any change of condition which may be assumed with or without change of mechanical position, that is, the word condition is used to cover a state as well as position.

In Figure 6 I have shown an embodiment of my invention in which there is no traveler or other movable member, but in which the traffic-controlling apparatus undergoes a change of state in changing from non-retarding to retarding condition. The apparatus is controlled by pressure of compressed air contained in an auxiliary reservoir 200 which is charged from the main reservoir 201 of the train, when the apparatus receives its impulse at the signal stations. The escape of air from a pipe 202, which connects with the train pipe, is controlled by a piston valve 203 which slides vertically in a cylinder 204, and which has an annular or circumferential recess 205 which permits the escape of air from the pipe 202 when the recess 205 is alined with the opening of the pipe 203 in the cylinder and with a vent 206 in the cylinder 204, which vent is diametrically opposite the pipe opening. A light spring 207 in the cylinder above the piston bears on the top of the piston 203 and tends to press it down to open position.

A pipe 208 connects the auxiliary reservoir 200 with a pipe 209 which leads into the cylinder 204 below the piston 203, and consequently pressure from the reservoir will be communicated to the under side of the valve and, when it is sufficient, will hold the valve in the closed position shown in Figure 6. The other end of the pipe 209 opens into a valve chamber 210, into the upper end of which leads a pipe 211 which connects with the main reservoir 201. A poppet valve 212 controls the escape of air from the main reservoir to the pipe 209, and this poppet valve is under the control of the solenoid 10′ which may be controlled by any suitable energizing means, such, for example, as that illustrated in Figure 2ª. The valve stem 213 is either attached to or made integral with the core 214 of the solenoid 10′, and when the solenoid is deenergized, the core falls by gravity or other retractile force and holds the valve 212 closed, and prevents the escape of air from the main reservoir 201 past the valve 212 and into the auxiliary reservoir 200.

When the solenoid is energized and draws up the core 214, the valve 212 is opened thereby and air rushes out from the main reservoir and charges the auxiliary reservoir. A small vent surrounds the entrance for the valve stem 213 into the valve chamber 210, and is closed by a valve 215 on the stem 213. This vent permits the gradual escape of air and hence the lowering of the pressure in the auxiliary reservoir. As the train passes a clear distant signal the solenoid 10′ is energized and the valve 212 is opened long enough to permit the charging of the auxiliary reservoir. As long as the pressure from the auxiliary reservoir is greater than that of the spring 207, the valve 203 will be held closed, but when sufficient air has es-

caped through the vent 215 to sufficiently lower the pressure and permit the spring 207 to overbalance the pressure from the auxiliary reservoir, the valve is opened.

The parts are so designed that the interval between the recharging of the auxiliary reservoir and the opening of the valve 203 is the interval of movement of the train at its maximum speed through one complete block, and to a point in the block in advance equivalent to the point x in Figure 1. The core 214 is also sufficiently heavy to hold the valve 212 down on its seat against the upward pressure of the air from the auxiliary reservoir on the under side of the valve 212.

A manual hold-out 216 is provided to enable the operator to prevent the application of the brakes, as explained with reference to the hold-out in constructions previously described.

From the foregoing it will be apparent that my invention includes the application of a broadly new principle in that class of traffic-controlling system wherein the train or railway vehicle carries a train signal or train retarding apparatus which is controlled by means placed along the railway at intervals, as distinguished from an extensive contact rail like that of Fig. 5, or other means for effecting a substantially continuous control of the apparatus on the train. Heretofore such traffic-controlling means for the train or vehicle has permitted unretarded movement of the car, until engaged by a mechanical trip, or other controlling means placed at intervals along the railway, and such an engagement has been necessary to give warning or stop or retard the car. I employ self-acting signaling or retarding apparatus carried on the car and automatically tending to give warning or to retard the car after it has progressed for a limited time or distance without extraneous control, and I employ extraneous controlling means co-acting with the apparatus on the car to prevent its automatic warning or retardation of the car, when not required. I expect to generally employ extraneous means located on the railway at intervals less than the limited distance of unretarded progress permitted by the self-acting signaling or retarding apparatus without extraneous control.

However, my invention is not limited to extraneous means which shall control signaling or retarding apparatus on the vehicle, at intervals only, since signaling or vehicle-governing means constructed and arranged to permit a limited free movement of the vehicle after cessation of extraneous control, may be equally well employed with an extraneous control which is normally continuous, as in Fig. 5.

It is obvious that various other modifications than those shown in the drawings and above particularly described could be made within the principle and scope of my invention defined in the following claims.

I claim:

1. A railway traffic-controlling system comprising a single vehicle carried traffic governing means which at all times and under all conditions effects the automatic control of the vehicle, said means having a non-retarding condition permitting unretarded movement of the vehicle under clear traffic conditions in advance and a retarding condition tending to retard the vehicle under dangerous traffic conditions in advance, and said means being constructed and arranged to assume retarding condition upon the completion of a limited movement of the vehicle whereby to automatically retard the vehicle after a limited travel, and controlling means located in the trackway and governed by traffic conditions in advance and constructed and arranged to restore the traffic-governing means away from retarding condition, whereby to prevent said automatic retardation of the vehicle when not required.

2. A railway traffic-controlling system comprising automatic vehicle-governing means carried on a railway vehicle and having a non-retarding condition permitting unretarded movement of the vehicle and a retarding condition tending to retard the vehicle, and said means being constructed and arranged to assume retarding condition upon the completion of a limited movement of the vehicle whereby to automatically retard the vehicle after a limited travel, means constructed and arranged to restore the vehicle-governing means away from retarding condition, whereby to prevent said automatic retardation of the vehicle when not required, and manually operable means for also preventing said automatic retardation of the vehicle.

3. A railway traffic-controlling system comprising automatic vehicle-governing means carried on a railway vehicle and having a non-retarding condition permitting unretarded movement of the vehicle and a retarding condition tending to retard the vehicle, and said means being constructed and arranged to assume retarding condition after a limited movement of the vehicle whereby to automatically retard the vehicle after a limited travel, and means located in the trackway and responsive to clear traffic conditions of the track in advance of the vehicle to restore the vehicle-governing means away from retarding condition at intervals of vehicle movement less than said limited travel after which the vehicle-governing means would assume retarding condition as aforesaid, thereby permitting continuous unretarded movement of the vehicle so long as

clear traffic-conditions prevail on the track ahead.

4. A railway traffic-controlling system comprising a single automatic traffic-controlling means carried on a railway vehicle which at all times and under all conditions effects the automatic control of the vehicle, said means having a retarding condition and a non-retarding condition, and said means being constructed and arranged to assume retarding condition within a limited interval, and means located in the trackway and responsive to clear traffic conditions of the track in advance of the vehicle to restore the traffic-controlling means away from retarding condition.

5. A railway traffic-controlling system comprising a single automatic train stop carried on a railway vehicle which at all times and under all conditions effects the automatic control of the vehicle, said train stop having a retarding condition under dangerous traffic conditions in advance and non-retarding condition under clear traffic conditions in advance and arranged when in retarding condition to automatically apply the brakes and retard the vehicle, the train stop being constructed and arranged to assume retarding condition within a predetermined interval, and means located in the trackway and responsive to the clear traffic conditions of the track to restore the train stop away from retarding condition.

6. A railway traffic-controlling system comprising a single automatic train stop including a valve in control of an air vent in the train pipe for governing the train in accordance with traffic conditions in advance, apparatus which at all times and under all conditions effects the control of said train stop and which constantly tends automatically within a predetermined interval to assume a condition in which it will open the valve, and extraneous controlling means disposed at intervals along the track and responsive to clear traffic conditions to reset the apparatus away from such condition.

7. A railway traffic-controlling system comprising an automatic train stop including a valve in control of an air vent in the train pipe, valve-opening apparatus which at all times and under all conditions effects the control of said train stop, said apparatus having a non-opening and opening position and constantly operated by the movement of the train to move gradually from non-opening to opening position during a predetermined movement of the train, and extraneous controlling means disposed at intervals along the track and responsive to clear traffic conditions to reset the valve-opening apparatus away from opening position.

8. Railway traffic controlling apparatus comprising a single vehicle-governing means carried on a vehicle which at all times and under all conditions effects the automatic control of the vehicle, said means having a non-retarding condition permitting unretarded movement of the vehicle and a retarding condition tending to retard the movement of the vehicle, said means being operated by the movement of the vehicle to gradually change from the non-retarding condition towards the retarding condition in accordance with movement of the vehicle and to reach said retarding condition upon the completion of a limited movement of the vehicle, and means located at intervals along the trackway and controlled by traffic conditions in advance for restoring the vehicle-governing means towards the initial non-retarding condition in order to prevent retardation of the vehicle when not required, said means being adapted to automatically resume its change towards retarding condition after each restoration.

9. In combination, a railway track, a vehicle adapted to travel thereon, governing means on said vehicle for governing the vehicle in accordance with traffic conditions in advance, a single controlling means on said vehicle which at all times and under all conditions effects the control of said governing means, said controlling means being capable of a clear traffic condition in which it operates to prevent said governing means from affecting the progress of the vehicle and also capable of a dangerous traffic condition in which it does not operate to prevent the governing means from affecting the progress of the vehicle, said controlling means having a tendency to assume the last-mentioned condition in accordance with the space traveled by the vehicle, and means located along the trackway and controlled by traffic conditions in advance for restoring said controlling means away from its last-mentioned condition.

10. In combination, a railway track, a vehicle adapted to travel thereon, means on the vehicle driven in accordance with the movement of the vehicle along the trackway and capable of an operative condition towards which it is constantly driven, devices located at intervals in the trackway and adapted to coact with the said means to reset it away from said operative condition under clear traffic conditions in advance, and apparatus on the vehicle controlled by the said means when the latter reaches said operative condition for governing the vehicle in accordance with traffic conditions in advance, said apparatus and said means constituting jointly a mechanism which at all times and under all conditions effects the automatic control of the vehicle.

11. In combination, a railway track, a vehi-

cle adapted to travel thereon, apparatus on the vehicle operatively connected with a wheel thereof to be driven constantly towards an operative condition as the vehicle proceeds along the track, devices located at intervals along the trackway each controlled by traffic conditions in advance and each capable of an operative and an inoperative condition according as said traffic conditions are clear or dangerous, each device being adapted when operative to coact with the vehicle carried apparatus to reset the latter away from its operative condition and means on the vehicle controlled by the said apparatus when the latter reaches its operative condition for governing the vehicle in accordance with traffic conditions in advance, said means and said apparatus constituting jointly a mechanism which at all times and under all conditions effects the automatic control of the vehicle.

12. In combination, a railway track, a vehicle adapted to travel thereon, apparatus on the vehicle having a controlling condition and a non-controlling condition, means operated by the vehicle for constantly changing said apparatus from non-controlling condition towards controlling condition, devices located in the trackway and controlled by traffic conditions in advance and adapted to initiate a movement of said apparatus away from its controlling condition under clear traffic conditions, and means on the vehicle controlled by said apparatus, said apparatus and said last-mentioned means constituting jointly a mechanism which at all times and under all conditions effects the automatic control of the vehicle.

13. In combination, a railway vehicle, apparatus on the vehicle capable of an initial condition and an ultimate condition and adapted to automatically change its condition by degrees progressively approaching the ultimate condition, means extraneous to the vehicle controlled by traffic conditions in advance and adapted under clear traffic conditions to restore said apparatus from any position or degree of said progressive change to a position or degree more remote from ultimate condition, said apparatus being adapted to automatically resume the progressive change towards ultimate condition after each restoration, and means on the vehicle controlled by said apparatus, said apparatus and said last-mentioned means constituting jointly a mechanism which at all times and under all conditions effects the automatic control of the vehicle.

14. In combination, a railway vehicle, means thereon arranged to change gradually towards an ultimate condition in accordance with the progress of the vehicle along the track, apparatus controlled by said means for governing the vehicle, said means and said apparatus constituting jointly a mechanism which at all times and under all conditions effects the automatic control of the vehicle, and devices located in the trackway and controlled by traffic conditions in advance for causing said means to be restored away from said ultimate condition under clear traffic conditions, said means being adapted to automatically resume its change towards ultimate condition after such restoration.

15. In combination, a railway vehicle, means thereon arranged to change gradually towards an ultimate condition, brake-applying apparatus controlled by said means for governing the vehicle, said means and said apparatus constituting jointly a mechanism which at all times and under all conditions effects the automatic control of the vehicle, and devices located in the trackway and controlled by traffic conditions in advance for causing said means to be restored away from said ultimate condition under clear traffic conditions, said means being adapted to automatically resume its change toward said ultimate condition after such restoration.

16. In combination, a railway vehicle, means thereon arranged to gradually approach an ultimate condition and to reach said condition upon the completion of a limited interval, apparatus controlled by said means for governing the vehicle, and devices located in the trackway and responsive to clear traffic conditions for restoring said means to a condition more remote from said ultimate condition at intervals less than said limited interval within which said means would reach its ultimate condition.

17. In combination, a railway vehicle, means thereon arranged to gradually approach an ultimate condition in accordance with the progress of the vehicle along the track and to reach said condition upon the completion of a limited movement of the vehicle, apparatus controlled by said means for governing the vehicle, and devices located in the trackway and responsive to clear traffic conditions for restoring said means to a condition more remote from said ultimate condition at intervals of vehicle movement less than said limited movement within which said means would reach its ultimate condition.

18. In combination, a track divided into blocks, a train carried magnet, means in each block for controlling said magnet, an arm carrying an armature adapted to be turned by the magnet, a brake valve controlled by the arm and a geared device operated by train movement, said geared device yieldingly turning said arm.

19. In combination, a track divided into blocks, a train carried magnet, means in each block for controlling said magnet, and an arm carrying armature adapted to be turned by the magnet, an electric circuit including a second magnet and controlled by the arm, a brake valve operated by the second magnet, and a train operated device constantly tending to move the arm away from the first mentioned magnet.

In testimony whereof I have affixed my signature in presence of two witnesses.

ALBERT V. T. DAY.

Witnesses:
VICTOR D. BORST,
BERNARD COWEN.