No. 867,329. PATENTED OCT. 1, 1907.

F. C. WILLIAMS.

BLOCK SIGNAL APPARATUS.

APPLICATION FILED JULY 17, 1905.

3 SHEETS—SHEET 1.

Fig. 4.

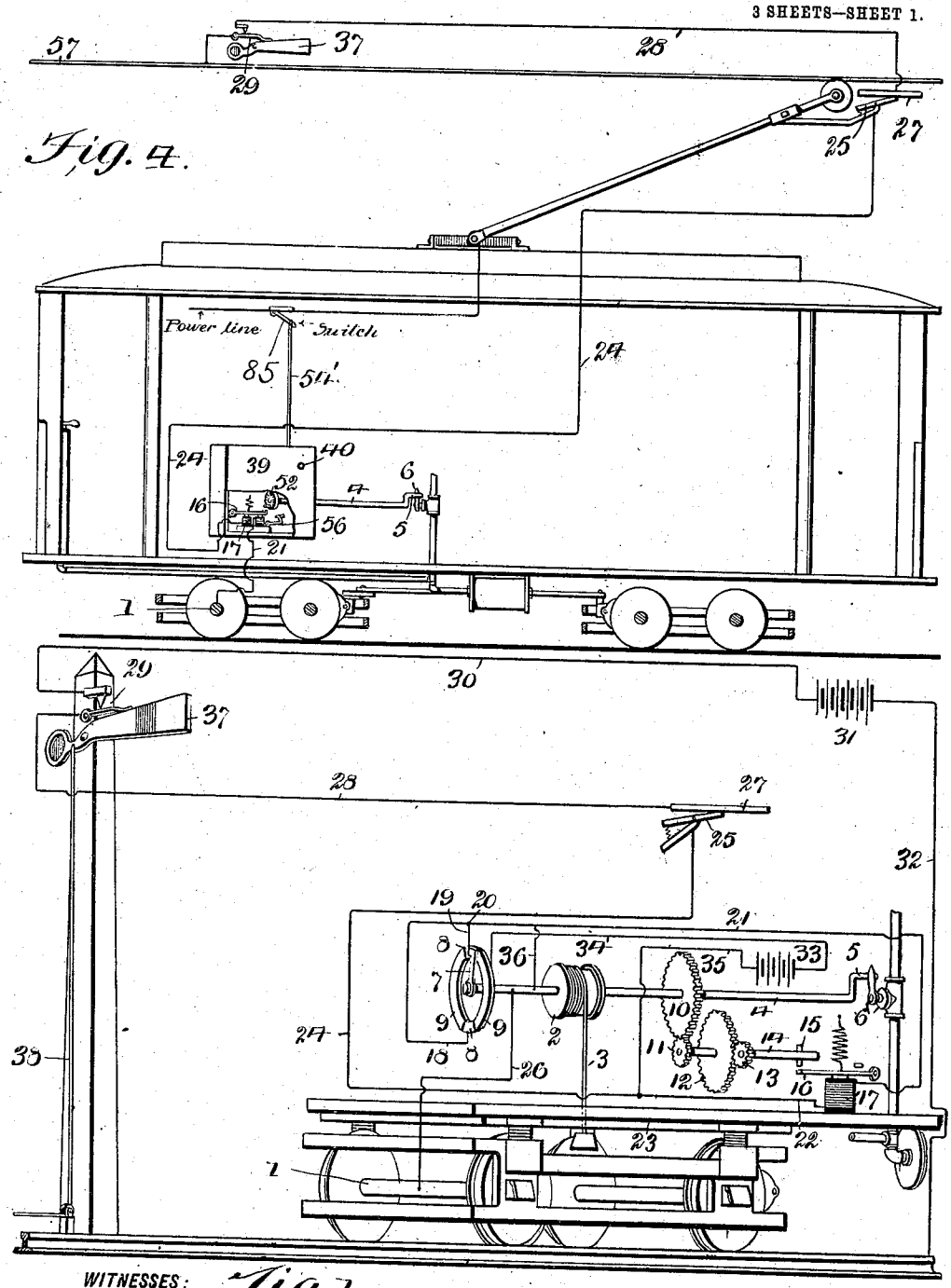

Fig. 1.

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3 SHEETS—SHEET 2.

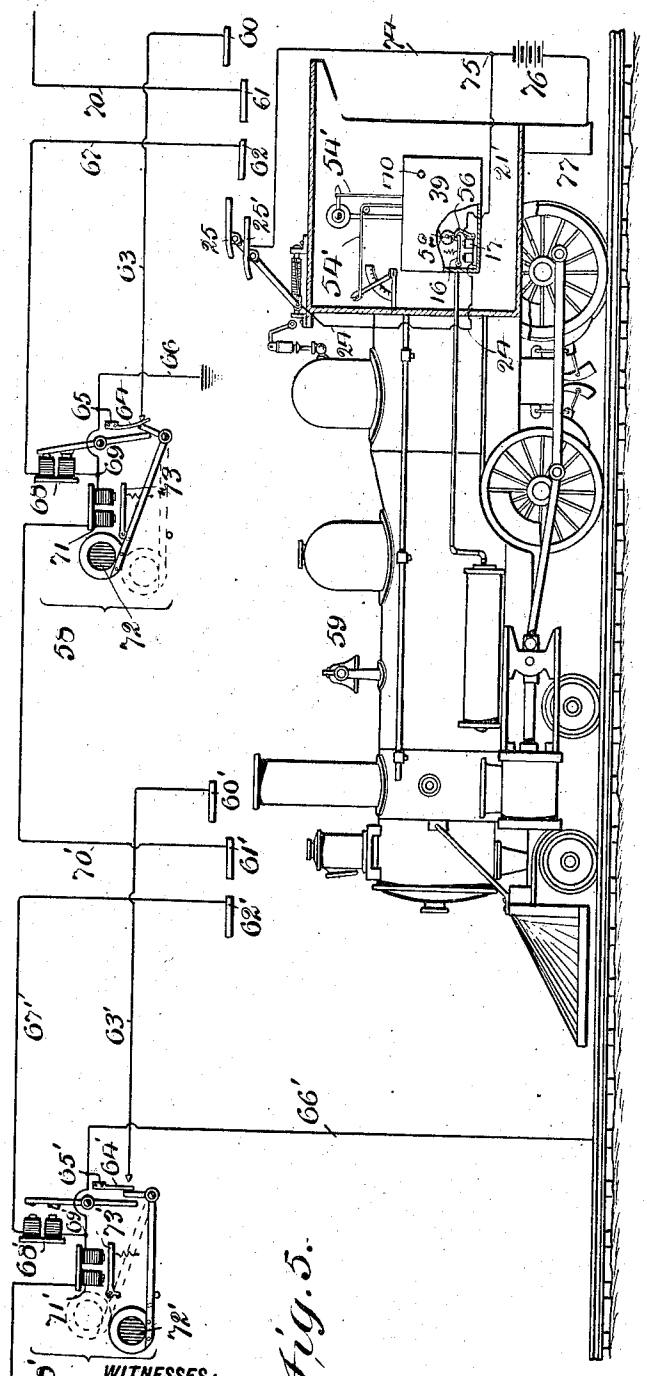

Fig. 5.

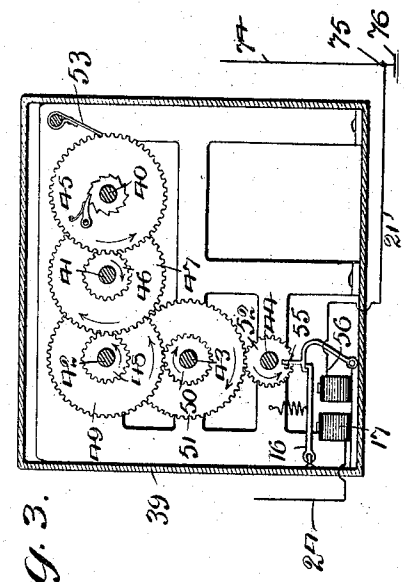

Fig. 3.

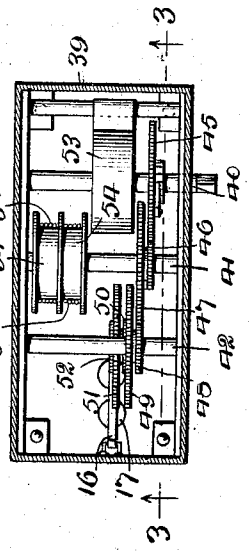

Fig. 2.

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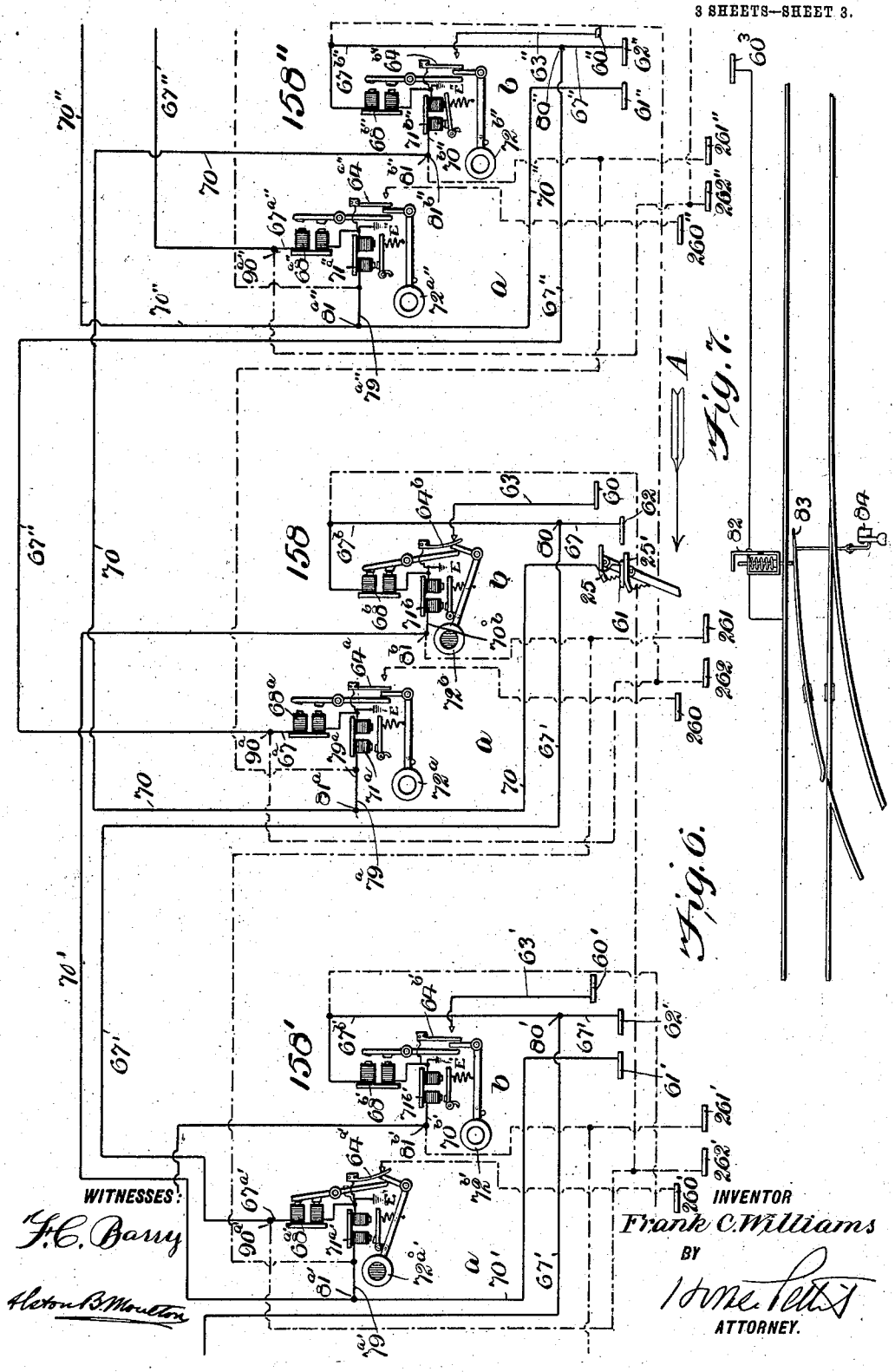
BLOCK SIGNAL APPARATUS.

APPLICATION FILED JULY 17, 1905.

3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

FRANK C. WILLIAMS, OF PHILADELPHIA, PENNSYLVANIA.

BLOCK-SIGNAL APPARATUS.

No. 867,329. Specification of Letters Patent. Patented Oct. 1, 1907.

Application filed July 17, 1905. Serial No. 270,134.

To all whom it may concern:

Be it known that I, FRANK C. WILLIAMS, a citizen of the United States, and a resident of the city of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Block-Signal Apparatus, of which the following is a full, clear, and complete disclosure.

The object of my invention is to provide means in connection with the operating mechanism of a locomotive, electric car, or other similar vehicle, which will automatically bring the said vehicle to a stop at the proper time, without attention from the engineer or motorman of said vehicle.

A further object of my invention is also to provide a system of signals in connection with said stopping mechanism, which will indicate the presence of other trains or cars upon the track, either in advance or to the rear of a particular train or car.

A further object of my invention is to operate the signals from the vehicle itself, by means of contacts with which a part carried by the vehicle engages to complete the signal circuit.

A further object of my invention is to arrange the apparatus and circuits so that a minimum of electric force or energy is required to be available or to be used.

A further object of my invention is to provide a system for signaling and for stopping trains without disturbing the road equipment now generally used in railroad systems.

A further object of my invention is to so locate the various parts of my apparatus that the same will not be interfered with by rain, sleet or snow.

Briefly, my invention comprises connecting with the throttle valve or air brake, or the controller of an electric car, means for automatically operating these parts, depending upon the condition of a circuit, part of which is located upon the vehicle, and part upon an external stationary line carried adjacent to the track, the completion of the circuit depending upon the position of certain switches, signals, or positions of other trains upon the same track.

For a full, clear and exact description of different forms of my invention, reference may be had to the following specification, and to the accompanying drawings forming a part thereof, in which

Figure 1 is a diagrammatic view of one form of my improved stop device applied to a vehicle having an air brake or steam control valve located thereon; Fig. 2 is a plan view partly in section of the preferred form of my stop mechanism; Fig. 3 is an elevation of the same, the casing being shown in section on the line 3—3 Fig. 2; Fig. 4 is a view of my improved stop device applied to an electric trolley car; Fig. 5 is a diagrammatic view of my improved stop mechanism applied to a locomotive and used in connection, or in combination, with my improved system of electric automatic signals, applied to a railroad or electric road in which the trains travel in the same direction on the same track; Fig. 6 is a diagrammatic view similar to Fig. 5, but showing a system applicable to a single track road, or a road on which the cars travel in both directions; Fig. 7 shows the arrangement whereby my stopping mechanism is adapted to be thrown into operation by the opening or closing of a switch on the track.

Referring to the drawings, 1 refers to the axle of a truck of a car which carries the operating mechanism for my improved stopping device. This consists primarily of a suitable motor mechanism, in this instance indicated as a drum 2, having a weighted cord 3 wound thereon. The drum 2 is carried on a shaft 4, one end of which is provided with a suitable crank or arm 5, which engages and operates an air or throttle valve 6. The opposite end of the shaft carries a contact arm or trailer 7, which engages a segmental ring composed of two short segments 8 and two long segments 9, the said segments being thoroughly insulated from each other, and from the shaft 4 upon which said segmental ring is mounted. The shaft 4, is also connected through suitable gears 10, 11, 12 and 13, to a shaft 14, provided with one or more pins or stops 15, which are adapted to revolve in the path of an armature 16, operated by an electro-magnet 17. The segments 8 are connected by suitable branch leads 18 and 19 to a point 20 thence by lead 21 to the electro-magnet 17, thence by lead 22 to point 23, to lead 24 connected with the yielding contact 25 located upon the car in any suitable manner. The trailer 7 is connected through shaft 4 and lead 26 with car axle 1.

Placed at suitable positions above the tracks are contact plates 27 connected by leads 28 with a switch 29, which when closed by the lifting of the signal 37 to the "danger" position, forms a circuit from the car axle, electro-magnet 17, yielding contact 25 and switch 29, lead 30, main battery 31 and earth lead 32.

From the above it will be seen that when the yielding contact 25 engages a stationary plate 27, and the external circuit has been closed by signal 37 through the switch 29, a circuit will be closed through the electro-magnet 17, and the armature 16 will be withdrawn from engagement with the lugs 15, permitting the shaft 4 to revolve under the influence of the weight on the cord 3, and in revolving to operate the valve 6 controlling the air supply for the brakes. Also carried by the car is a supplemental or local battery 33, one of the poles of which is connected by lead 34 with one or both of the larger segments 9 of the segment wheel, while the other pole is connected by lead 35 to point 23. Connecting the shaft 4 and lead 21 is a shunt 36. Since the engagement between the yielding contact 25 and stationary plate 27 is but momentary the armature 16 would, unless suitable provisions were made for continuing to hold the same out of contact with the pins 15, immedi-

ately be released from said magnet, and would prevent a sufficient rotation of the shaft 4 to effect the closure of the valve 6. To permit the shaft 4 to revolve sufficiently to perform this function I have provided the supplemental battery 33 and its connections as above set out, so that during the momentary contact of the yielding contact 25 and stationary contact 27, the trailer 7 will have moved from its position in contact with this short segment 8 into contact with the larger segment 9, whereby the local circuit from the battery 33 will be closed from the battery 33, lead 34, segment 9, trailer 7, shaft 4, shunt 36, lead 21, electro-magnet 17, lead 22 point 23 and lead 35 back to battery 33. The armature 16 being thus held down out of contact with the pins 15, permits the shaft 4 to revolve, carrying with it the trailer 7, until the trailer has passed from the long segment 9 to the next short segment 8.

The above arrangement provides a means whereby the consumption of electrical energy from the main battery 31 is reduced to a minimum since no current is drawn from the said battery except during the momentary contact of the yielding contact 25 with the plate 27, and not then unless the signal 37 has been raised to the "danger" position through suitable connections 38.

In Figs. 2 and 3 I have shown a preferred form in which I have dispensed entirely with the supplemental battery and its connections. In said figures, 39 indicates a suitable casing in which are mounted shafts 40, 41, 42, 43, 44 which carry gears 45, 46, 47, 48, 49, 50, 51 and 52. On the shaft 40 is a suitable coiled spring 53 for operating the said train of gears; on the shaft 41 is a drum adapted to be connected by suitable cords 54′ with either throttle valve, the air brake valve or both, while the gear 52 mounted on shaft 44, carries a suitable pin 55 for engagement with a pivoted hook or latch 56 secured to the casing. This hook is adapted to be engaged by the armature 16 of releasing battery, and when the magnet is deënergized, to prevent the rotation of the train of gears by its engagement with the pin 55. When, however, the magnet is energized the armature is drawn downwardly out of engagement with the hook or latch 56 the said latch falls away from the pin 55 and the train of gearing is permitted to revolve under the influence of the spring 53, and the cords 54′ wrapped around the drums 54 will close the throttle valve and apply the air brakes to effect the stopping of the train.

In Fig. 4 I have shown my improved device as applied to a trolley car or electric locomotive receiving current from an outside line wire or feeder, the current for operating the stop mechanism being also supplied by the said outside line or feeder. The arrangement of this form of my invention is similar to that shown in Fig. 1, the exception being that the external circuit, which is controlled by the signal switch 29, takes its current from the trolley wire 57, the current passing from the trolley wire through switch 29 to the stationary contact 27, and thence to the stop mechanism carried by the car, which in this instance in addition to being connected with the air brake valve 6 is also connected to the main car-switch 85 in the power circuit, whereby the power current is automatically cut off and the brakes are applied when the stop mechanism is actuated. In the form of invention shown in Figs. 1 and 4 the signals 37 may be operated in any manner usual in the use of block signals.

In Figs. 5 and 6 I have shown systems of signals which are especially adapted to operate and to be combined with my improved stop mechanism. In Fig. 5 I have shown diagrammatically a system of signals especially adapted for one track of a double track road, or a road in which trains travel in the same direction on the same track. The signals in this system are so arranged that the train on entering a block sets a target or signal to a "stop" position to prevent the train behind from entering the block while the first train is in that block; and when the first train passes out of that block, it resets the said signal to "clear" or "safety".

In Fig. 5, 58 represents a semaphore located in a block which has been just entered by a train 59, and 58′ the signal located at the beginning of the next block ahead of the train. In this form of my device I have located or placed the main battery upon the engine or train itself, and have dispensed with any battery whatever on the external part of the circuit. For each block I have arranged three plates 60, 61, and 62. The plate 60 is connected by lead 63 with switch 64; the switch 64 being connected with and through the point 65 and lead 66, to earth. The plate 62 is connected by lead 67 with electro-magnet 68. From magnet 68 a lead passes to point 69, and thence through point 65 and lead 66 to earth. The plate 61 is connected by lead 70 to the resetting magnet of the block through which the train has just passed. In connection with the signal 58′ the connections and mechanisms are identical with those shown in connection with signal 58, the corresponding parts being indicated by the same numerals characterized by the sign (′). The lead from the plates 61′ is connected back to the resetting magnet 71 from which magnet the wire extends to point 69, to point 65, and thence to earth. The armature of the magnet 68 is adapted to raise the target 72 to the "danger" position when the yielding contact 25′ carried by the car engages the plate 62; and the armature 73 of the magnet 71 will permit the target 72 to drop to "safety" when the yielding contact plate 25′ touches the plate 61′. In this form of my device part of the circuit leading from the yielding contact 25′ and carried by the train comprises the contact 25′, lead 74, to point 75, to battery 76, to the framework of the trucks 77, and thence to earth through the wheels. As the train passes each block the signal 72 of the block which is just being entered is raised to the "danger" position and the signal at the beginning of the block which has just been left is set to "safety". Also carried by the train is a second contact plate 25, adapted to engage the contact plates 60, 60′, etc., connected by lead 24 with the electro-magnet 17 thence by lead 21 to point 75, connected to battery 76, said plate operating the stop mechanism shown in Figs. 2 and 3. When, therefore, the target 72 is raised to the danger position, and the plate 60 is touched by yielding contact 25, the following circuit will be established, earth wire 66 to point 65 to switch 64 through lead 63 to stop plate 60, through contact plate 25, lead 24, electro-magnet 17, lead 21 to point 75, to battery 76, to truck 77, to earth, and the train will be stopped.

In Fig. 6, I have shown a modification which is adapted for a use on a single track road, over which trains pass in both directions. In this form of my device, when the train passes a block or signal station, it comes into engagement with a set of two signal operating plates whereby (1) the signal at the beginning of the block in which the train is, is set at "danger" for the following train; (2) the signal at the beginning of the block just passed is re-set to safety or "clear" (3) the signal at the signal station of the block next in advance of the train is raised to "danger" to prevent a train coming in the opposite direction from entering the block in which is the first mentioned train; (4) the signal at the beginning of the block just entered, (which signal had been set at "danger" when the train entered the block just passed,) is re-set to safety or "clear." In addition to manipulating the signals as aforesaid, I have arranged secondary circuits, whereby, when a target is raised to its "danger" position and a train contacts with a stop plate, said secondary circuit will be closed through said connected stop plate and the train, and my improved stop mechanism, described in the preceding part of this specification, will be set into operation. To this end I have shown three signal stations, one at 158, one at 158′, and one at 158″. Each signal station is provided with two sets of setting and resetting magnets, the set on one side of each station being designated by *a*, and the set on the other side by *b*, each set being similar to the others and to the one shown by me in Fig. 5. Each target is provided with setting magnets 68^a, 68^b, and resetting magnets 71^a, and 71^b. Since the arrangement of parts and connections for each signal or block station are identical with those for the adjoining station, I will refer to similar parts at the two adjoining stations by the same numeral, characterized, however, by a (′) or a (″) as may be needful.

Connected with each block or signal station are six contact plates, three for trains going in one direction, and three for trains passing in the opposite direction, those plates for the trains going in the direction of the arrow A at station 158, being 60, 61, and 62 and for trains passing in the opposite direction 260, 261, and 262. For the sake of clearness, however, I will merely describe the signals and connection for the plates 60, 61, and 62, it being sufficient to state that the signals are merely operated in the reverse direction by trains passing in the direction opposite to that of the arrow, through the plates 260, 261, and 262.

61 indicates the resetting plate at the station 158, connected by lead 70 with the resetting magnets $71^{b''}$ of the signal station 158″, through the point 81^a, lead 70, the point $81^{b''}$, the lead $70^{b''}$, by the passage of a current through which, the target $72^{b''}$ is brought to the lowest or "safety" position. The point 81^a on the lead 70 is connected through a lead 79^a and the resetting magnet 71^a with the earth. Thus by the closure of the circuit through the plate 61, the targets $72^{b''}$ and 72^a are dropped to "safety" position.

62 is a plate connected through point 80 by leads 67^b to setting magnets 68^b, from which a lead runs to the earth. From the point 80 on the lead 67 the wire 67′ extends to point $90^{a'}$ and thence through lead $67^{a'}$ to the setting magnet $68^{a'}$, of the next station in advance and from said magnet a wire leads to earth, and a closure of the circuit by the train through plate 62, sets to "danger" targets 72^b and $72^{a'}$.

60 indicates a stop plate connected by leads 63 with the switch 64^b opened or closed by the position of the target 72^b.

The operation of my device is as follows:—A train, carrying contact plates 25 and 25′ upon reaching the station 158 passes under, and makes contact with, the plates 60, 61 and 62. If the signal 72^b is raised to the "danger" position, the contact 25 establishes a circuit from the train through the contact plates 60 and switch 64 to earth E and sets in operation a stopping device similar to that shown by me in Figs. 2, 3, 4, and 5, and the train will be brought to a stand-still. When the plate 25′ contact with the plate 62, two circuits are established; one from plate 62, lead 67, and lead 67^b, through setting magnet 68^b to earth, thus raising or setting to "danger" the signal 72^b to prevent a train from behind from following too closely, and the second circuit through the said plate 62 is through lead 67 to point $90^{a'}$, and lead $67^{a'}$ at station 158′, by the action of which the target $72^{a'}$ is raised to the danger position and a train on the same track approaching the first mentioned train is signaled and also brought to a stop by means of the closure of a stopping circuit through switch $64^{a'}$.

When the yielding plate 25′ carried by the train engages the plate 61, two other circuits are established, (first) through the leads 70, point 81^a, lead 79^a, to signal resetting magnet 71^a, whereby the signal 72^a, which has been raised to danger position when the train contacted with plate 62″ of station 185 is dropped to the safety position. The second circuit is established from plate 61, to lead 70, through point 81^a to point $81^{b''}$, lead $70^{b''}$, magnet $71^{b''}$ to earth, and operates to reset the target $72^{b''}$ which had been set to the danger position when the train closed the circuit through the plate 62″.

260, 261, and 262 are three similar contact plates arranged at each station for coöperation with the train passing in the direction opposite to the direction of the train just described and the connections for the same are similar but reverse in operation to those just described, the circuits connected to said plates being merely indicated in dotted lines.

By means of the above described arrangement, the circuits at three adjoining stations are at all times under the control of and operated by a train passing in either direction and by the operation of which a second train following a first train is warned of the presence of the train ahead and if an attempt is made to enter the same block as the train ahead, my automatic stop device is thrown into operation, the train is brought to a stop independent of the engineer. Moreover since the signal of the station in advance of the train, and also the stop circuit controlled by said signal, is put into operation by the first train, a third train, approaching the first train from the opposite direction is warned of the approach of the first train and if the warning is not heeded, is automatically brought to a stop. It will also be seen that the first train is informed of the presence of a train ahead of it, and it is brought to a stop if it approaches nearer than a block.

In Fig. 7, I have shown a modification of my device in which a stop plate 60^a is connected with a suitable switch or circuit closer 82, operated by the position of

the rail 83 of the switch 84. When the switch is closed as in the position shown, a train carrying my stop device and the contact plate to coöperate with the plate 60^3, is permitted to pass by said switch, but if the switch is open, then the rail 83 closes the circuit closer 82 and the train will be brought to a standstill automatically, before it reaches the said switch.

As will be seen from the above description, my improved signal and stop mechanism does not require a great deal of electrical power to operate it, since the current is required for an exceedingly short interval of time, or only so long as the contact carried by the train or car is in engagement with the stationary plate, and since the current only traverses a distance equal to but two blocks of the signal system. As has been shown, I prefer to locate my source of electrical energy on the train itself, although, of course the employment of a battery or other source of electrical energy at suitable intervals along the line is contemplated as shown in Figs. 1 and 4. By locating the stationary contacts above the tracks, there is no danger of the contacts becoming so covered with sleet or snow or becoming submerged in water, the result of which would be to render the system inoperative, and by locating the battery upon the train the same can be readily placed in such a position that the same will not be liable to freeze.

My improvement is especially applicable to trolley or tram cars for which the motive power is derived from a trolley wire. In this form of my invention no separate signal battery or stop battery is required, the plates for both the signals and stop mechanism being supplied with the necessary current from the said trolley wire.

Having thus described my invention, what I claim and desire to protect by Letters Patent of the United States, is:

1. In a signaling system for cars, a signal station, magnets for throwing signals to a danger or safety position, stationary plates arranged along the track and electrically connected to the signal, a yielding contact carried by the train adapted to engage said plates as the car passes by them, and an independent stop circuit adapted to be closed by the signal when the signal is thrown to the danger position and a second yielding stop carried by the train for contacting with said stop plate whereby when the train passes said plates and the signal is set at danger, the train will be automatically stopped.

2. The combination in a railroad car, of an air brake or throttle lever, of a stop mechanism, an electric magnet for controlling said stop mechanism, means for actuating said stop mechanism when released by said electro-magnet, a yielding contact carried by the car, and electrically connected with said yielding contact and said magnet, stationary contacts elevated above and placed at suitable intervals along the track and connected by an electrical conductor with a signal, a circuit closer closed by the setting of said signal, and a source of electrical energy carried by the car whereby when the signal is set to a danger position and the yielding and stationary contacts become disengaged, the stop mechanism will be permitted to continue to operate to close the throttle or apply the brakes to bring the cars to a stand-still.

3. An electrical signaling and stop system for trains, comprising an external partial circuit, a signal and a contacting plate in said circuit, a second external partial circuit, a contact plate and a circuit breaker included in said second circuit, said breaker being closed by said signal, a car, a battery carried by said car, a partial circuit carried by the car and passing through said battery to the earth, a yielding contact carried by the car and adapted to engage said first mentioned plate, a stop mechanism and a second yielding contact carried by the car, a second partial circuit carried by the car and including said stop mechanism and said battery and said second yielding contact, said plates being situated at intervals upon the track and in position to be engaged by said yielding contacts.

4. An electrical signaling and stop system for trains, a signal, a magnet for throwing said signal, an elevated contact plate, a lead from said plate through said magnet to the earth, a magnet for re-setting said signal, a second elevated contact plate and a lead from said second plate through said re-setting magnet to the earth, a circuit breaker controlled by said signal, a third elevated contact plate, a lead from said third circuit plate through said circuit breaker to the earth, a car, a battery carried by the car, a yielding contact carried by the car and adapted to coöperate with the said first and second plates, a lead from said yielding contact through the battery to the earth, a second yielding contact adapted to coöperate with said third plate, an electric magnet stop mechanism, and a lead from said second yielding contact through said stop mechanism and battery to the earth.

5. A block signal system having each station provided with an electro-magnet for throwing a signal to danger, the said magnet being located in a circuit which is closed by a passing train, a second electro-magnet located in a circuit which is closed by a passing train when the signal is set to danger, a motor located on the car for shutting off the power and operating the air brake the said motor being set in operation by the last mentioned magnet, and a further circuit in which is included a magnet at the preceding station corresponding to the first mentioned magnet, the latter circuit being arranged to be closed by the passing of a train at the first mentioned station.

6. A block signal system having each station provided with an electro-magnet for throwing a signal to danger, the said magnet being located in a circuit which is closed by a passing train, a second electro magnet located in a circuit which is closed by a passing train, only when said signal is set to danger, a motor located on the train for bringing the latter to a full stop, said motor being arranged to be set in operation by the last mentioned magnet, and a further circuit in which is included a corresponding magnet for throwing a signal at the preceding station, the latter circuit being arranged to be closed by the passing of a train at the first mentioned station, to reset the signal at the preceding station.

7. A block signal system having each station provided with an electro-magnet for throwing a signal to danger, the said magnet being located in a circuit which is closed by a passing train, a second electro-magnet located in a circuit which is closed by a passing train only when the signal is set to danger and a motor set in operation by the last mentioned magnet, and located on said train for bringing the latter to a full stop when said last mentioned circuit is closed.

8. Mechanism for stopping rail-way cars comprising a controller located on the car, a motor arranged to be thrown into and out of operation by an electro-magnet for actuating said controller, a contact located on the car, a stationary contact located above the track, an electric circuit including said electro-magnet and both contacts, and a signal operating to close said circuit when set to danger position.

9. Mechanism for stopping rail-way cars comprising a controller located on the car, motor operated means for actuating said controller, an electro-magnet for throwing said means into and out of operation, a contact located on the car a stationary contact located above the track, means for generating an electric current externally to the car, a circuit including the electro-magnet and both contacts, a signal arranged to close said circuit when set to danger position, means for generating another electric current on the car, the said means being so arranged that the current will pass through the electro-magnet after the first mentioned circuit has been broken and will continue until the controller has reached its final position.

10. Means for stopping rail-way cars comprising a controller located on the car, a train of mechanism including a shaft operated by a motor for actuating said controller,

an electro-magnet for throwing said mechanism into and out of operation, a contact located on the car, a stationary contact located above the track, means for generating an electric current externally to the car, an electric circuit including said electro-magnet and contact plates, a signal arranged to close said circuit when set to its danger position, means for generating a second electric current located upon the car, said means being so arranged that the current will pass through the electro-magnet after the first mentioned circuit has been broken and will continue until the controller has reached its final position and contact segments alternately arranged to rotate with said shaft for transferring the magnet from one circuit to the other and for grounding said circuits.

11. A block signal system having each station provided with an electro magnet for throwing the signal to danger, the said magnet being located in a circuit which is closed by a passing train, a second electro magnet which is closed by a passing train only when the signal is set to danger, a controller located upon the train and a motor for actuating said controller, the said motor being thrown into and out of operation by the last mentioned magnet.

In witness whereof, I have hereunto set my hand this 15th day of July, 1905.

FRANK C. WILLIAMS.

Witnesses:

ALEXANDER PARK,

ALSTON B. MOULTON.