No. 725,116. PATENTED APR. 14, 1903.

J. J. MOORE.

SAFETY GEAR AND SIGNAL SYSTEM FOR RAILWAYS.

APPLICATION FILED MAY 12, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

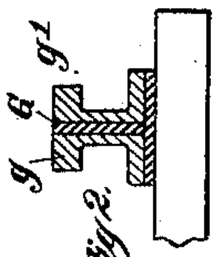

Fig. 2.

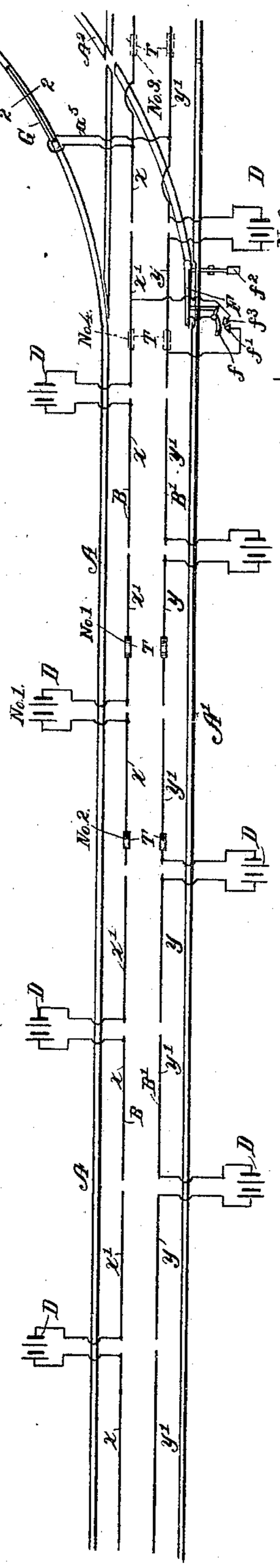

Fig. 1.

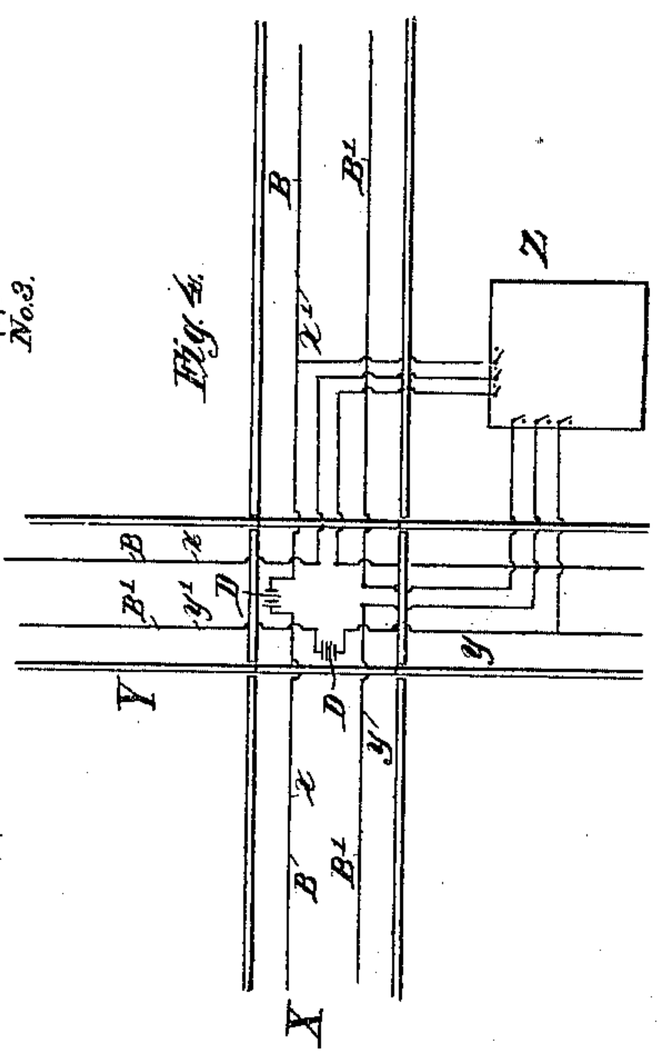

Fig. 4.

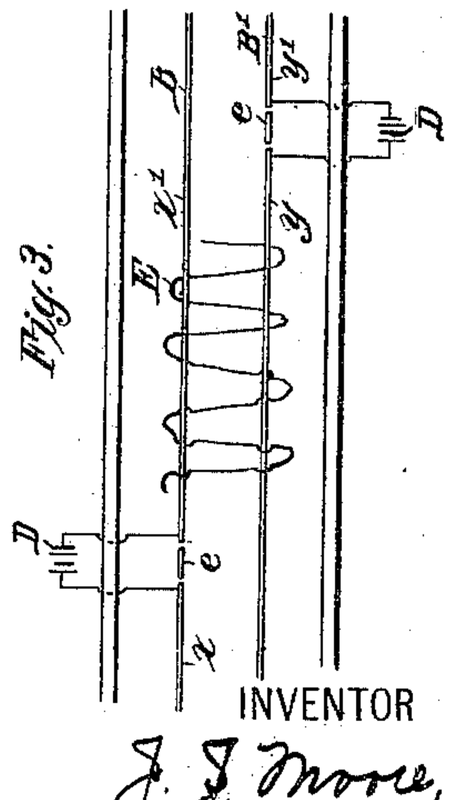

Fig. 3.

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 6

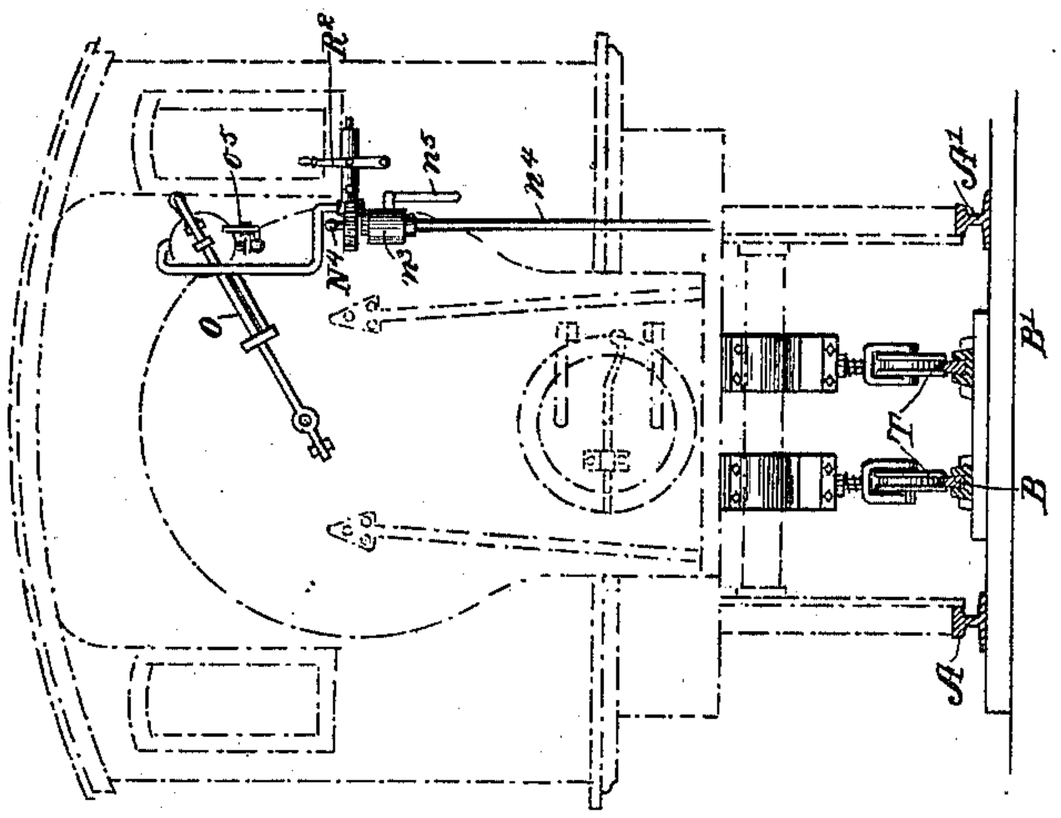
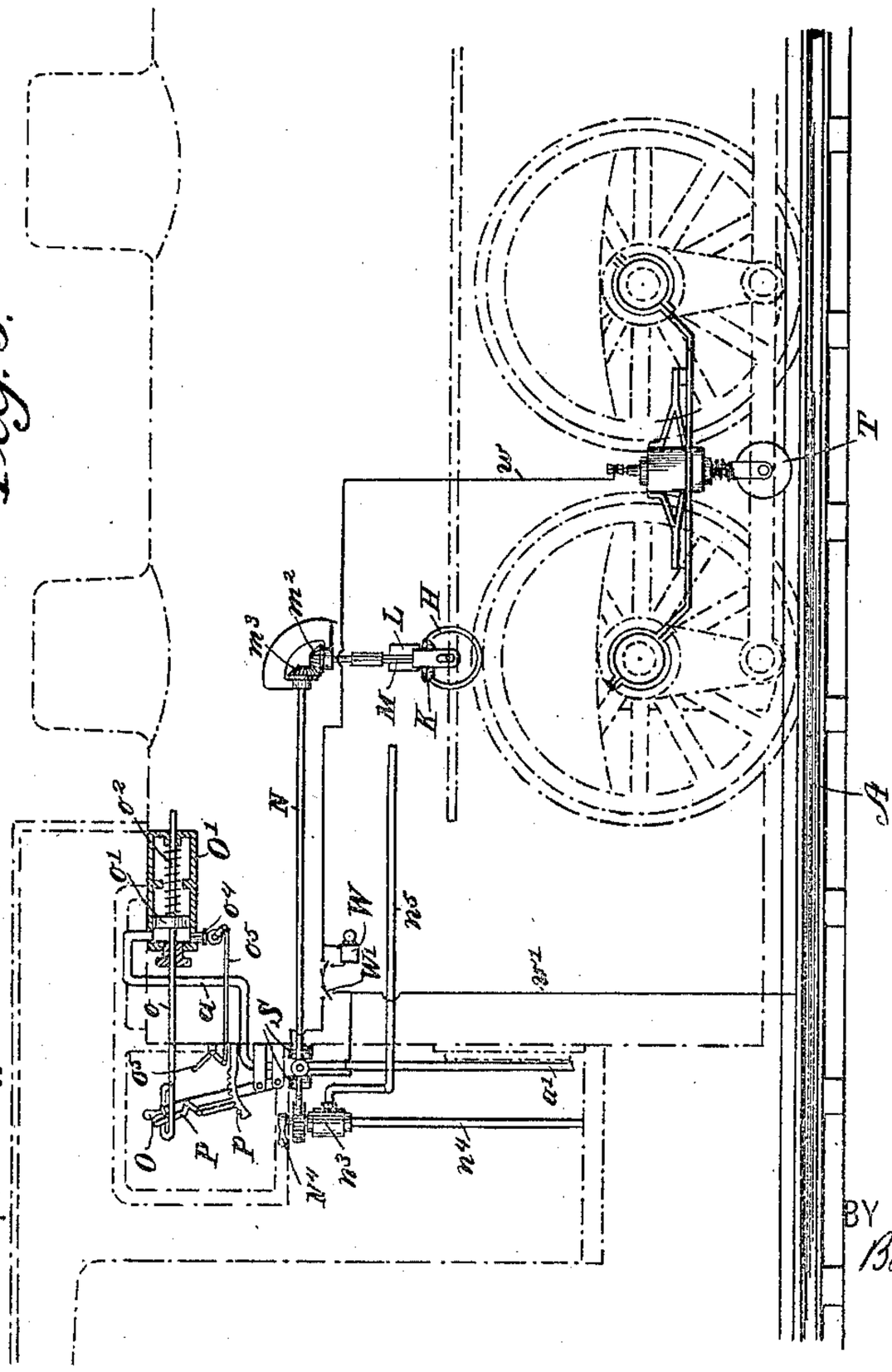


Fig. 5.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 10.

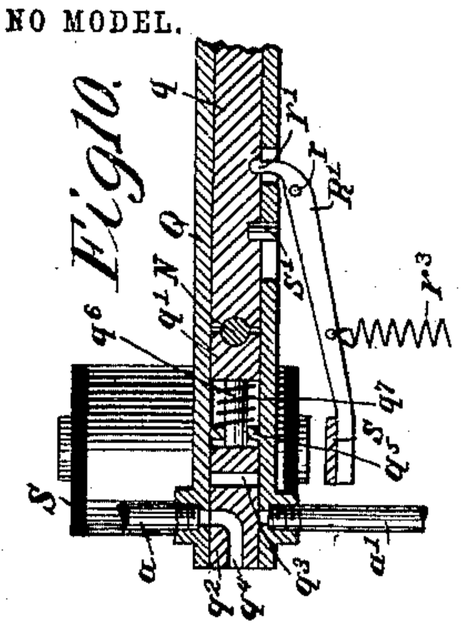


Fig. 9.

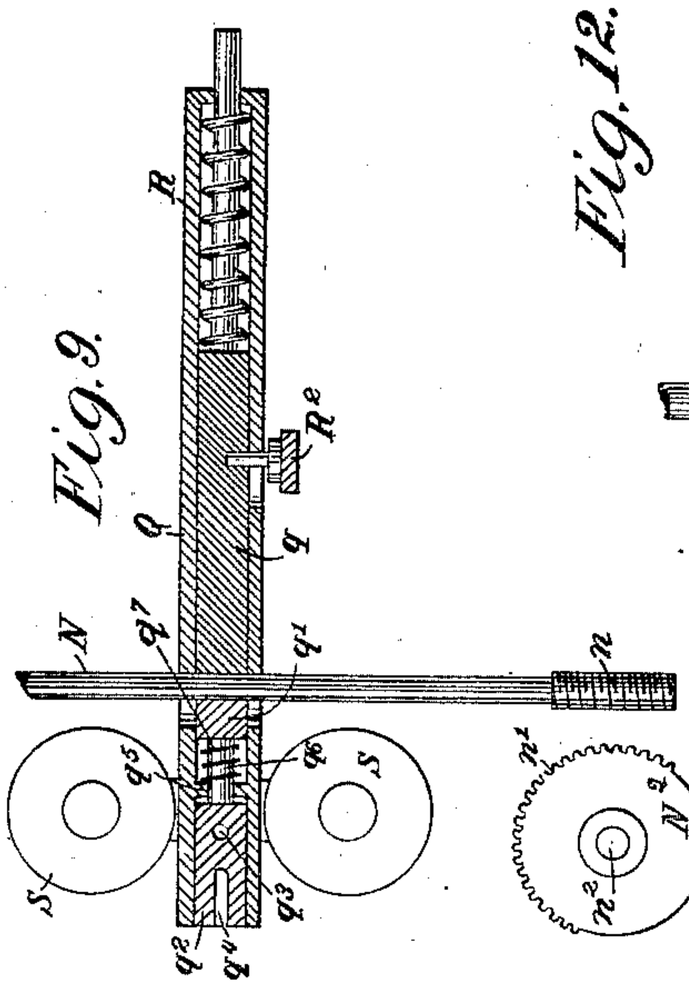


Fig. 12.

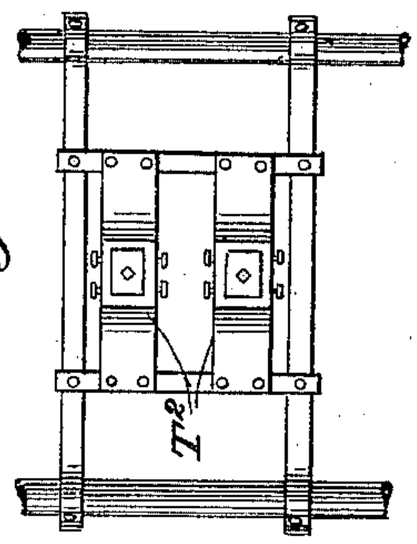


Fig. 13.

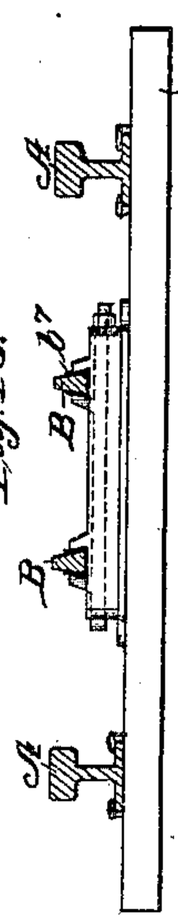


Fig. 14.

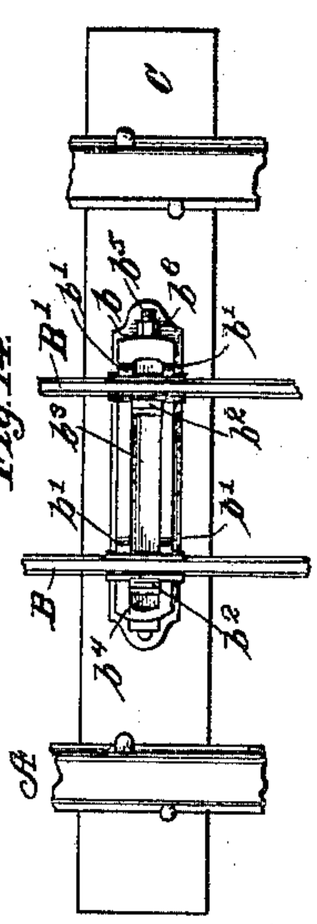


Fig. 11.

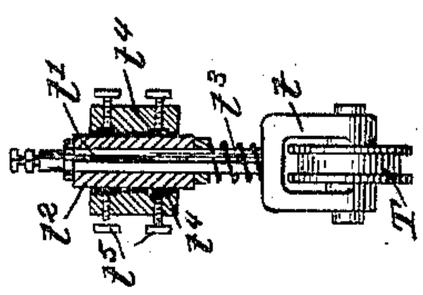


Fig. 7.

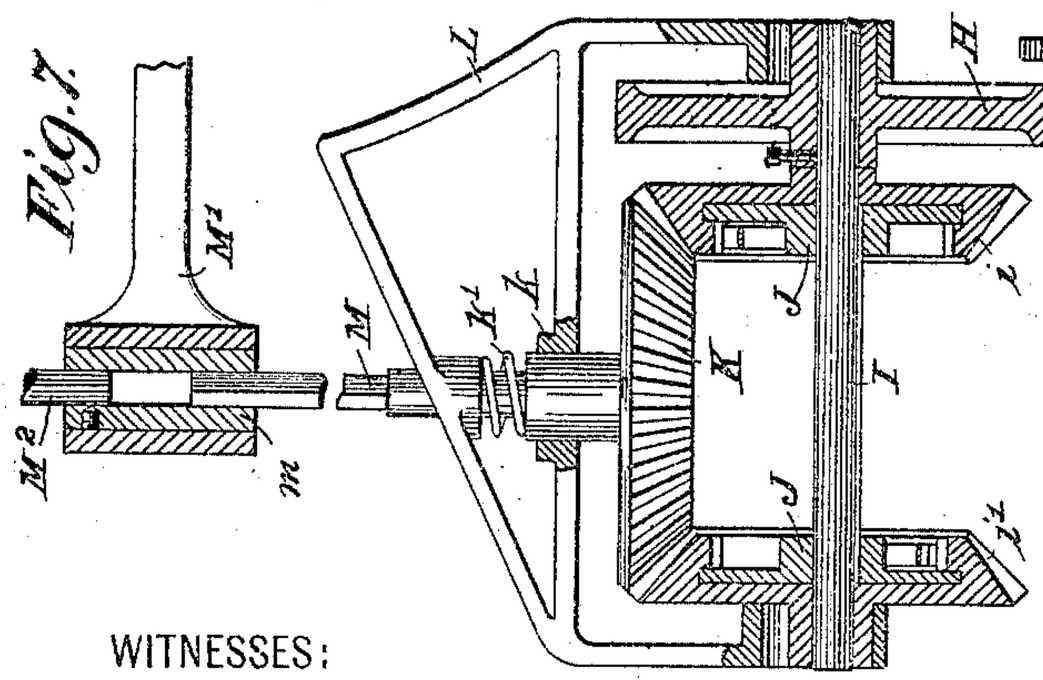
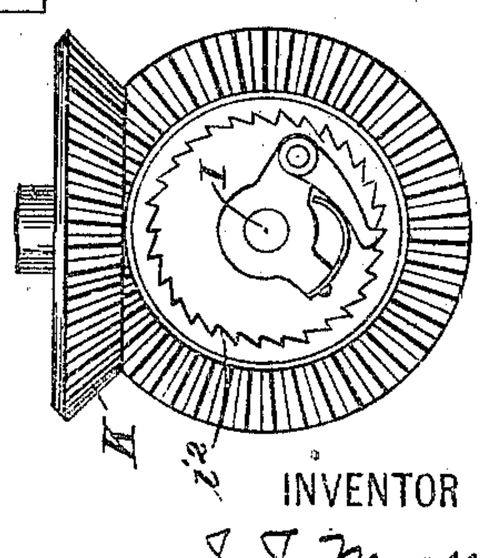


Fig. 8.



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UNITED STATES PATENT OFFICE.

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SAFETY-GEAR AND SIGNAL SYSTEM FOR RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 725,116, dated April 14, 1903.

Application filed May 12, 1902. Serial No. 106,927. (No model.)

To all whom it may concern:

Be it known that I, JESSE JOEL MOORE, a citizen of the United States of America, residing in St. Louis, Missouri, have invented certain new and useful Improvements in Safety-Gear and Signal Systems for Railways, of which the following is a specification.

My invention relates particularly to that class of apparatus in which a signal is automatically transmitted to a railway-train and in which the motive power is shut off and the brakes are applied whenever the occasion requires it, as where two trains simultaneously enter the same block. It is desirable that in such a system provision should be made for not only transmitting an audible signal from one moving train to another and for automatically applying the brakes of one or both trains and for shutting off the motive power when two trains enter the same block, but that means should also be provided for signaling a train, applying the brakes thereto, and shutting off the power whenever a switch is open or a switched train or car is not on the clear, or when a crossing track is given the right of way, or when a bridge or trestle is disabled. It is also desirable that the system should be operative to prevent head-on as well as rear-end collisions and that the system should be automatic in all respects, not requiring any action on the part of the engineman.

It is the object of my invention to provide for all these contingencies, and this I do most efficiently by a novel arrangement of conductors which are parallel with the track and are supplied with current in a new way, novel electromagnetic and pneumatic mechanism being carried by each engine which is operated at the proper times by current derived from the conductors that run parallel with the track and through which a closed circuit is established whenever there is danger of collision or danger of accident by the disablement of a bridge, trestle, or the like.

The railway is, as usual, divided into blocks, and parallel with the track-rails I arrange two lines of conductors, which are also divided into blocks, each block or section in each line being composed of two parts insulated from each other and from the earth. An electric battery is provided for each block, being connected to the two parts of the conductors composing the block, the circuit being normally open. The blocks of one line of conductors lap those of the other line, the arrangement being such that two trains a block apart can run freely; but when one train enters a block occupied by another train an electric circuit is closed through the mechanism on both trains for sounding an alarm, applying the brakes, and shutting off the motive power. Provision is made for grounding the circuits when a bridge or trestle is disabled, and when two tracks cross suitable conductors may be grounded for closing the line-circuits on the crossing track in such manner as to close the circuit through the electromagnetic devices of any train entering the block of the crossing track. At each switch the arrangement is such that when a switch is open the circuit is so diverted that the mechanism of the approaching train will be operated as soon as it enters the block where the switch is located, and each siding is provided with devices which so divert the circuits that should a car or a train not on the clear be located on the siding an approaching train will in due time be notified and stopped.

The best way now known to me of carrying out my invention is illustrated in the accompanying drawings, in which—

Figure 1 is a diagram illustrating the preferred arrangement of the circuits in connection with a railway-track and a siding. Fig. 2 is a detail view in cross-section on the line 2 2 of Fig. 1, showing the construction of a rail-section employed in the siding near the main track. Fig. 3 is a diagram illustrating a modified way of arranging the conductors and also indicating how the conductors may be grounded at a bridge, trestle, or the like. Fig. 4 is a diagram illustrating the arrangement of circuits at a crossing. Figs. 5 and 6 are diagrams illustrating the arrangement of the mechanism on a locomotive. Fig. 7 is a detail view, partly in elevation and partly in section, indicating the manner in which the mechanism for opening the brake-valve is operated from one of the engine-wheels. Fig. 8 is another view of some of the mechanism shown in Fig. 7. Fig. 9 is a detail view, partly in section and partly in top plan, of electromagnetic devices for con-

trolling the valve which admits air to the cylinder controlling the throttle-valve and for moving the brake-valve-operating mechanism into and out of operative position. Fig. 10 is another detail view of the mechanism shown in Fig. 9. Fig. 11 is a detail view, partly in front elevation and partly in section, of one of the contact devices secured to the locomotive and which runs on the conductors arranged between the tracks. Fig. 12 is a detail view of the frame which supports the contact-wheels. Figs. 13 and 14 are detail views indicating one way in which the conductors may be supported and insulated.

The track-rails A A′ may be of usual construction. They are arranged in the usual way and are not insulated from each other or from the ground. Parallel with the track-rails I arrange two lines of conductors B B′, which I call the "block-conductors." These may be arranged overhead or on the ground either between the tracks or at one side thereof, and they may be wires, rails, or other suitable conductors so long as they are adapted to make electrical contact with the brushes, wheels, or other suitable contact devices carried by the train or engine. Preferably the conductors B B′ consist of rails inserted in supports arranged on the road-bed between the track-rails. These supports are not shown in Figs. 1 to 4, inclusive, but are illustrated in Figs. 13 and 14, where the rails B B′ are shown as supported on a casting b, secured to a tie C, the rails being held between lugs b' on the casting and lugs b^2 on a sliding plate b^3, arranged in a recess b^4 in the casting. The lugs b^2 on the plate b^3 extend up through the top opening in the casting, while the lugs b' extend above the top of the casting, being arranged a sufficient distance apart to hold the rails b b' in proper position to be traversed by two contact-wheels carried by a train without interference with each other. At one end the plate b^3 is provided with a bolt b^5, having a nut b^6, by means of which the lugs b^2 may be drawn up against the rails on one side and clamp them against the lugs b' on the other side. Insulating material b^7 is interposed between the lugs and the rails. Similar supports are provided for the rails B B′ at suitable intervals along the track. Each block or section of the conductors in each line is composed of two parts, those on one side being indicated by the letters x x' and those on the other side by the letters y y'. It requires the two parts x and x' or y and y' to constitute one block. Each pair of conductors x x' or y y' has each member connected with a battery D, the connection being such, as clearly indicated, to provide a normally open circuit requiring connection in two places to close it. Each block x x' laps a block y y'. Preferably one laps the other one-half its length, whereby the greatest distance which a train may be protected on either front or rear is the length of the entire block and the least distance is half a block. As the battery of each block is connected at the middle of the block, a connection on either side of the battery would not close a circuit; but a connection on both sides at the same time would form a closed circuit and cause the signaling and other mechanism to be operated on one or both trains. If the conductors B B′ are grounded, the circuit on the block will be closed when a train enters the block. Hence I arrange at each bridge or trestle conductors E, as indicated in Fig. 3, which are normally out of contact with the conductors B B′, but which if the bridge is washed away or is burned will cause the conductors B B′ to be grounded at this point by either coming into direct contact with the conductors B B′ or by being brought into electrical connection therewith by the water or flame. In Fig. 3 I have shown a slight modification in which short sections of conductors e are located between the main conductors x x' and y y'. This is simply for the purpose of supporting the contact-wheels carried by the engines, as it is preferable to arrange the conductors x x' and y y' some distance apart.

At the switch I preferably provide the switch-point F with a contact device f, which when the switch is closed, as indicated in Fig. 1, breaks the circuit through the switch-point, but when the switch is open will close a circuit through the switch-point and through contacts f' and f^3, each connected with one of the conductors of the block system.

f^2 merely indicates a device for opening and closing the switch.

At each siding near the main track I preferably provide a divided rail-section G. This preferably consists, as indicated in Figs. 1 and 2, of a short length of rail divided into two parts g g', insulated from each other, from the ground, and from the other rails, each section g g' being connected to the two lines of conductors B B′.

In Fig. 4 I have illustrated the manner in which the conductors are arranged where two tracks cross. X may indicate the main track, and Y crossing track. Z may indicate a signal house or tower. The arrangement is such, as will be indicated by the manner in which the circuits are arranged, that when a crossing track is given the right of way the lever which operates the right-of-way signal automatically grounds the conductors of the crossing track or tracks, so that a train approaching the crossing will be signaled and stopped at the proper time.

Before describing the manner in which the signals are transmitted over the conductors along the tracks I will describe the construction and operation of the mechanism on the train, as in my system the circuit is always completed by one or more trains.

In Figs. 5 and 6 I have shown in outline by dotted lines so much of a locomotive-engine as is necessary to illustrate the application of the mechanism which I employ, and the details of this mechanism are shown on sheet

3 of the drawings. A wheel H, adapted to make rolling contact at all times with one of the wheels of the engine, is secured to horizontal shaft I, carrying two crown-wheels $i\,i'$, loose on the shaft I. Two pawl-carrying wheels J are secured to the shaft I, and the pawls thereof are adapted to engage with teeth i^2 on the wheels $i\,i'$. The wheels $i\,i'$ both gear with a crown-wheel K. The arrangement is such that in whichever direction the wheel H revolves the wheel K is revolved in the same direction, the pawl-and-ratchet mechanism being suitably arranged for this purpose. This mechanism is of well-known construction. It has been used in many connections and need not be further described. The mechanism is supported on a frame or bracket L, attached to some suitable part of the engine and provided with guides which allow the mechanism to rise and fall as the engine-body rises and falls on its springs. The hub k of the wheel K passes through a guide-opening in the frame L and bears against a spring k', which holds the wheel K in proper contact with the wheels $i\,i'$. A square or angular shaft M is attached to the wheel K and extends into a sleeve m, arranged in a bearing forming part of a bracket M', attached to the frame of the engine. The sleeve m is adapted to revolve in the bearing of the bracket M' and receives in its upper end a round shaft M^2, on the upper end of which is a beveled pinion m^2, gearing with a beveled pinion m^3 on a horizontal shaft N, which operates the brake-valve, as hereinafter set forth. The parts last mentioned are more clearly indicated in Fig. 5. The object of the construction just described is to transmit motion from a driving-wheel of an engine to a horizontal shaft and to provide for the up-and-down movement incident to the engine when in motion. Any other mechanism for transmitting motion from the wheels of the engine to the valve-operating rod may be employed. I do not limit myself to the details illustrated. The valve-operating rod N on its rear end is formed with a worm n, adapted to gear with the teeth n' on a disk or segment N^2, secured to a shaft n^2, connected with a valve n^3, located in the pipe system of the air-brakes, the arrangement being such that when the worm n is in contact with the teeth n' and the rod N is rotated a valve will be opened at n^3, which will cause the brakes to be applied throughout the train. The pipes n^4 n^5 in Figs. 5 and 6 indicate part of the pipe system of the brakes. The throttle-lever O is connected with a piston-rod o, secured to a piston o', located within a cylinder O'. The piston is normally pressed to the left, as indicated in Fig. 5, and held in such position by a spring o^2. The throttle-lever carries a catch P of usual construction having a detent engaging with a segment p. The arrangement indicated in Fig. 5 is such that if the piston o' is moved to the right it will first trip the catch P and will then move the throttle-lever to the right as viewed in Fig. 5, or in such direction as to shut off the supply of steam to the engine. The piston o' is moved to the right in the cylinder by means of compressed air in the manner presently described. The valve-operating rod N extends through mechanism by means of which it is thrown into and out of connection with the brake-valve, and this mechanism also opens and closes communication between the cylinder O' and the compressed-air supply. Such devices are indicated in Figs. 9 and 10, where Q indicates a casing containing two plugs or sliding blocks $q\,q'$, between which the rod N extends, and a valve-block q^2, provided with passages q^3 q^4. The passage q^4 is open to the atmosphere, and when connected with the pipe a opens the left-hand end of the cylinder O' to the atmosphere, and the piston is held by the spring o^2 in the position shown in Fig. 5, the throttle-lever being in such position as to hold the throttle-valve open. The passage q^3 is adapted to establish communication between the pipe a and the pipe a', which communicates with a supply of compressed air or similar fluid adapted to operate the piston o'. A partition q^5 is located in the casing Q between the block q^2 and the block q', and a spindle q^6, attached to the block q', and the block q^2 extends through the partition and is adapted to move back and forth through an opening therein. A spring q^7 is interposed between the block q' and the partition q^6. It will be observed that the rod N extends through elongated openings in the casing Q, which are of sufficient extent to allow the rod to move into and out of contact with the teeth n'. A spring R is interposed between the right-hand end of the block q and the end of the casing, and this spring normally tends to move the block q to the left, and thus press the rod N into engagement with the brake-valve. The block q is, however, normally held in the position indicated in Fig. 9 against the force of the spring R by means of a lever R', pivoted at r and having an end r' extending through an opening in the casing and engaging a recess in the block q. This lever is held in the position indicated in Fig. 10 by the spring r^3. The lever carries the armature s of an electromagnet S, which is operated in the manner hereinafter described. The block q also carries a stop-pin s', which limits the movement of the plunger in an obvious manner.

The operation of the mechanism thus far described will, it is thought, be clear. The spring q^7 tends to hold the valve-block in the position shown in Fig. 10, so as to connect the cylinder O' with the atmosphere and to hold the rod N out of engagement with the brake-valve. This is the normal condition of the apparatus when a train is running. The spring R is of greater force than the spring q^7, and when the spring R is free to act it will overcome the force of the spring q^7 and will shift the mechanism, causing the

rod N to engage the brake-valve and establishing communication between the cylinder O′ and the air-supply through the pipe a', the passage q^3, and the pipe a. The block q may be returned to its normal position to hold the spring under tension by means of any suitable mechanism, such as a lever R^2, (indicated in Figs. 6 and 9.) The cylinder O′ is provided with a drain-valve o^4, which may be opened and closed by means of the lever mechanism o^5. The brake-valve may be closed by means of a hand-lever N^4.

No batteries or other generators of electricity are carried by the train, but the current for operating the electromagnet S is derived from the conductors of the block system. For this purpose contacts, preferably contact-wheels T, are employed, although brushes or other suitable contact-making devices might be used. These wheels are mounted in bearings in yokes t, attached to rods t', extending through sleeves t^2, that are secured to but insulated from the supporting-frames. The rods t' are adapted to slide vertically in the sleeves without turning therein, springs t^3 being employed to press the wheels yieldingly against the conductors.

t^4 indicates insulation interposed between the sleeve t^2 and the frame t^4, and t^5 indicates set-screws for detachably connecting the parts.

The frame T^2, which supports the contact-wheels, may be of any suitable construction. The preferred construction is shown in Figs. 5, 6, 11, and 12; but as this is plain from the drawings and as the specific construction is not important further description seems unnecessary.

The upper end of each rod t' is connected to a circuit-wire w, which leads to the electromagnet S. Another circuit-wire w', connected to the electromagnet, connects with the frame of the engine and to the ground through the wheels.

W indicates an electric bell or other audible signal, and W′ indicates switches which may be employed. When an electric circuit is closed through the wires w w' and when the switches W′ are properly placed, the bell W will be sounded, the brake-valve will be opened, and the throttle-valve closed automatically. If the engineer desires to proceed ahead slowly, he may cut the electric circuit out from the magnet S and then reset the mechanism, so that he can open the throttle-valve and close the brake-valve. This he can do by properly manipulating the switches W′, while still allowing the bell W to ring and constantly remind him of the danger. The arrangement of the switches is such that he can also stop the bell from ringing if he desires to do so, though this is not usually desirable. The switches need not of course be arranged specifically as indicated in Fig. 5. Any other arrangement of the switches may be used when desired. The arrangement of the circuits in Fig. 5 is sufficiently clear from the drawings and the circuits need not be traced. The manner in which the mechanism operates when the circuit is closed has been sufficiently described, and it only remains to describe how the circuits are opened and closed on the blocks of the railway.

Referring to Fig. 1 and assuming that a train is on one of the blocks indicated at No. 1, it is obvious that the circuit from the battery No. 1 will pass from the positive pole to the conductor x', then to the contact-wheel T, and through the engine and to the rails A A′. If a train enters the block at No. 2, the current from battery No. 1, already traced to the rails, will pass from the track-rails A A′, through the apparatus at engine No. 2, and down through the contact-wheels T to the conductors x and through the conductor x to the negative pole of the battery, thus completing the circuit. In a similar way this circuit may be completed at any point along the line. If the block is grounded on one side of the battery, the entrance of a train on the other side of the battery will close the circuit and either stop both trains or stop one of them when the circuit is grounded by any other cause than that of a moving train, such as the burning or washing away of a bridge, for which provision is made, as indicated in Fig. 3. The manner in which the circuit may be grounded on one side of a battery in a block at a switch-point is indicated at the right-hand end of Fig. 1, and at this point is also indicated how the circuits run when a car is standing on the divided rail G. If the switch-point F is closed and a train enters at No. 3, the circuit will be from the negative pole of battery No. 3 to the conductor y, then to contacts f' and f to the switch-point F, where the circuit is grounded, and then through rail A′ to the train at No. 3, through the wheels thereof, and to the contact-wheel T to the conductor y' back to battery. If a car is standing on a siding and is not clear of the main track, one of its wheels will rest on the divided rail G and the circuit will be grounded, by means of the connections shown, through a wheel of the car resting on the rail G, its axle, and the opposite wheel and the track-rail on which it rests. Thus if a car is standing on the rail G and a train enters at No. 4 the circuit from battery No. 3 will be from the negative pole of the battery, conductor y, contact-wheel T, rails A A^2 G, wire a^5, conductor y', to battery.

It will be observed that whenever a block is grounded on one side of its battery the battery-circuit is always closed by an approaching train. Hence it is always easy to protect a train at any point. The circuits in Fig. 4 are arranged on this principle, and the operation will be clear from the drawings. Thus by my system I am enabled to protect two moving trains from rear-end, head-on, or crossing collisions and also to protect one train from accident by an open switch, a switched car not on the clear, or from a dis-

abled trestle, bridge, or the like. As the wheel H moves at a rate of speed corresponding to the speed of the engine, the brakes are applied rapidly or slowly, as the occasion requires, while the motive power is always shut off instantly.

It is obvious that many changes may be made in the general organization of the mechanism and in the details of construction without departing from the novel features of my invention.

I have illustrated the best way now known to me of carrying out my invention, but wish it understood that I do not limit myself to the precise arrangements shown.

I claim—

1. The combination with a railway-track, of a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator.

2. The combination with a railway-track, of a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator, and means for at times grounding one pole of the battery.

3. The combination with a railway-track, of a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and the adjacent ends of which are connected to opposite poles of an electric battery or generator.

4. The combination with a railway-track, of two parallel series of blocks of electric conductors, each of which blocks in each series is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator.

5. The combination with a railway-track, of two parallel series of blocks of electric conductors, each of which blocks in each series is divided into two parts insulated from each other, each part in each series being connected to one pole of an electric battery or generator, while the conductors of a block in one series lap the conductors of a block of the other series.

6. The combination with a railway-track, of a series of electric conductors divided into blocks and insulated from each other, and a conductor normally out of contact with the block-conductors, but adapted to ground them at times.

7. The combination with a railway-track, of a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator, and a conductor normally out of contact with the block-conductors, but adapted to ground them at times.

8. The combination with a railway-track having a switch, of a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator, and devices operated by the switch for grounding the battery of a block on one side.

9. The combination with a railway-track, having a switch or siding, and a divided rail in the siding near the main line, of a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator, and an electrical connection between one part of the divided rail and one pole of the battery of an adjacent block.

10. The combination of a railway-track having a switch or siding provided with a divided rail in the siding near the main line, of a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator, and electrical connections between the two parts of the divided rail and the poles of batteries in adjacent blocks.

11. The combination with two crossing railway-tracks, of a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator, and means for grounding one pole of a battery in an adjacent block where one track is given the right of way.

12. The combination with an electric conductor, of a support therefor having a laterally-projecting lug, a plate provided with a lug, insulating material for the conductors at its support, and means carried by the plate for drawing its lug against the conductor and clamping the latter against the lug carried by the support.

13. The combination of two electrical conductors, of a support therefor having laterally-projecting lugs, a plate provided with lugs, insulating material for the conductors at their support, and means carried by the plate for drawing its lugs against the conductors and clamping the latter against the lugs carried by the support.

14. The combination of an air-brake valve, a rod, gearing for connecting the rod with the valve, means for normally holding the rod out of operative connection with the valve, electromagnetic devices for moving the rod into operative connection with the valve, a friction-wheel engaging one of the supporting-wheels of the locomotive, a vertical rod geared with the first-mentioned rod and also with the friction-wheel and telescopic or expansible connections interposed in the connection between the air-brake-operating rod and the friction-wheel.

15. The combination with an air-brake valve, of a valve-operating rod, means for operating said rod from one of the wheels of the engine, sliding blocks between which the rod

extends, a spring moving said blocks in one direction, another spring moving said blocks in the opposite direction, a catch for holding the blocks in a given position, and electromagnetic devices for releasing the catch to cause the blocks to move and shift the valve-operating rod into operative connection with the brake-valve.

16. The combination with a brake-valve, of a valve-operating rod, gearing for connecting it with the brake-valve, means for rotating said rod, two sliding spring-actuated blocks between which the rod extends, a catch for holding the blocks in such position as to withdraw the valve-operating rod from connection with the valve, and electromagnetic devices for releasing the catch.

17. The combination of an air-brake valve, a valve-operating rod, gearing for connecting said rod with the brake-valve, two sliding spring-actuated blocks between which the rod extends, a catch for holding the blocks in one position, electromagnetic devices for releasing the catch, a stop for limiting the movement of the blocks, and a lever for resetting the mechanism.

18. The combination with the throttle-lever of a locomotive-engine, of a piston and piston-rod connected with the lever, a cylinder in which the piston works, an air-brake valve, means for opening it normally out of connection with it and operated by one of the driving-wheels of the engine, and electromagnetic devices for moving said valve-operating means into operative connection with the air-brake valve, and for operating a valve to admit air to the cylinder to close the throttle-valve.

19. The combination with the throttle-lever, and a brake-valve of a locomotive-engine, of a piston and piston-rod connected with the lever, a cylinder in which the piston works, a spring for moving the piston in one direction, means for supplying compressed air to move the piston in an opposite direction, a valve-operating rod adapted to connect with the brake-valve, means for revolving said rod, a valve controlling the passage to the compressed-air cylinder, and electromagnetic devices for causing said valve-operating rod to engage the brake-valve and for operating the valve which controls the admission of air to the compressed-air cylinder.

In testimony whereof I have hereunto subscribed my name.

JESSE JOEL MOORE.

Witnesses:
E. H. JUNOD,
LULU R. COLVIN.