

1,369,880.

Patented Mar. 1, 1921.

5 SHEETS—SHEET 1.

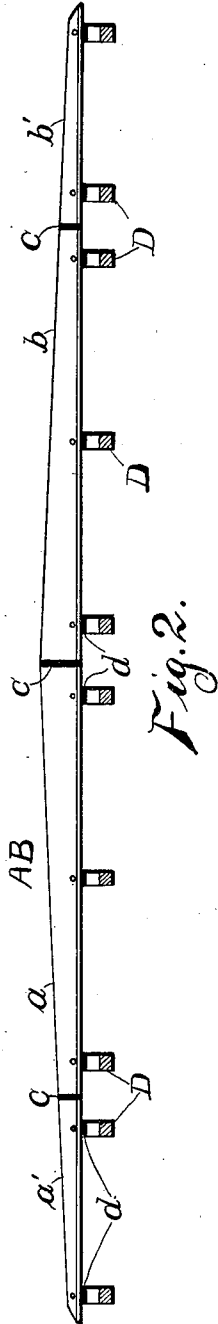


Fig. 2.

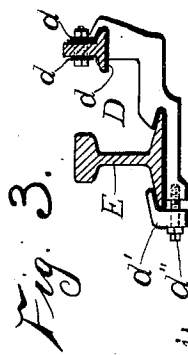
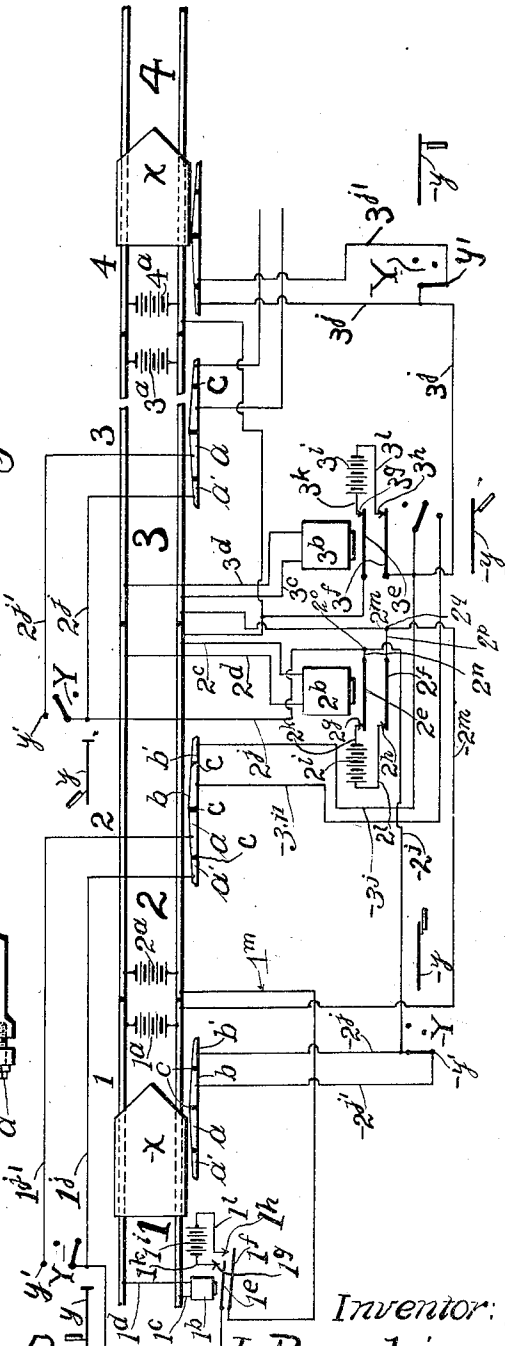


Fig. 3.

Fig. 1.



Witness:
 E. J. Jucker

Inventor:
 Andrew J. Brookins;
 By Charles Turner Brown, Atty.

A. J. BROOKINS.
 TRAIN CONTROL APPARATUS.
 APPLICATION FILED MAR. 6, 1918.

1,369,880.

Patented Mar. 1, 1921.
 5 SHEETS—SHEET 2.

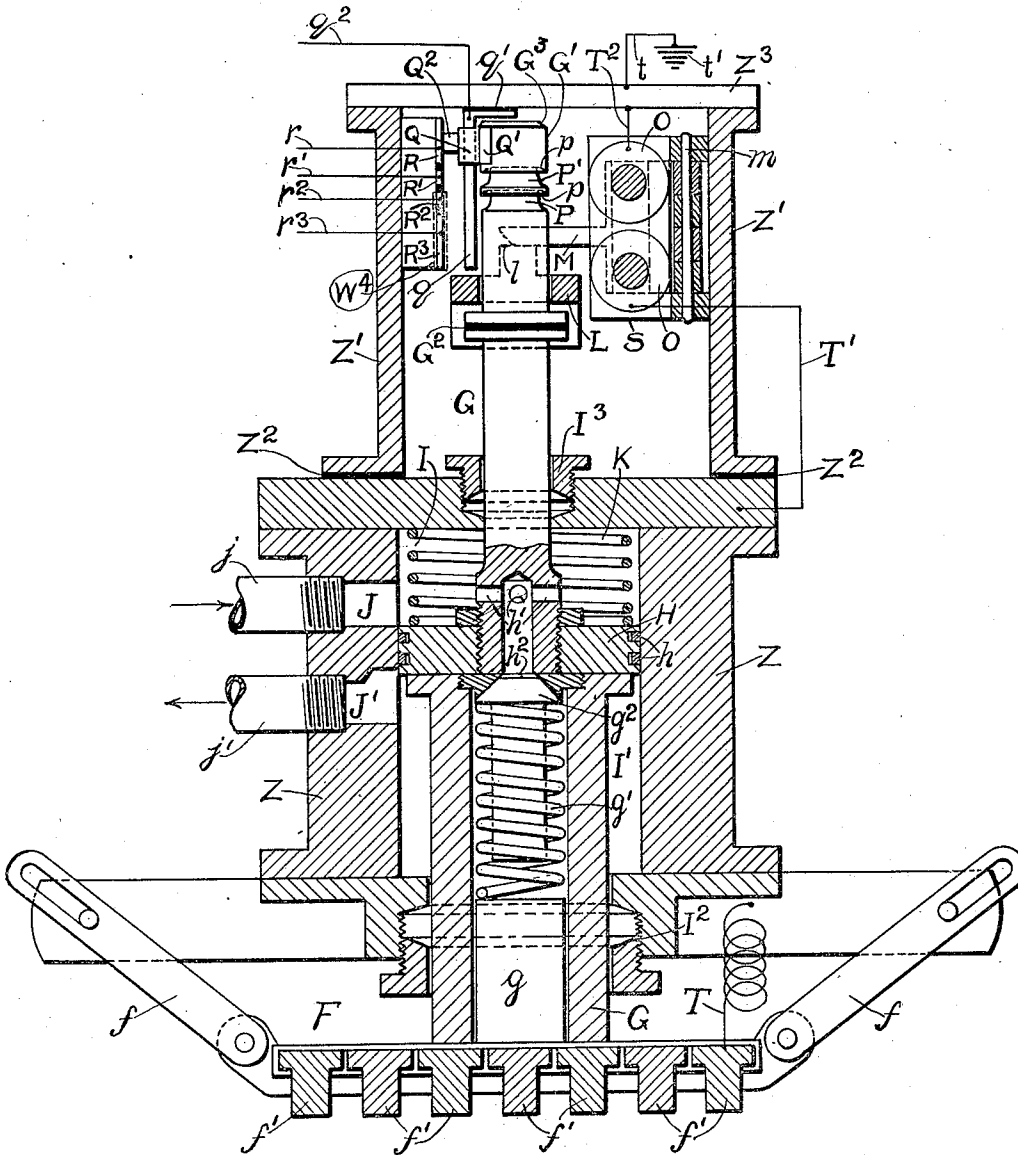


Fig. 4.

Witness:

E. Jaeger

Inventor:

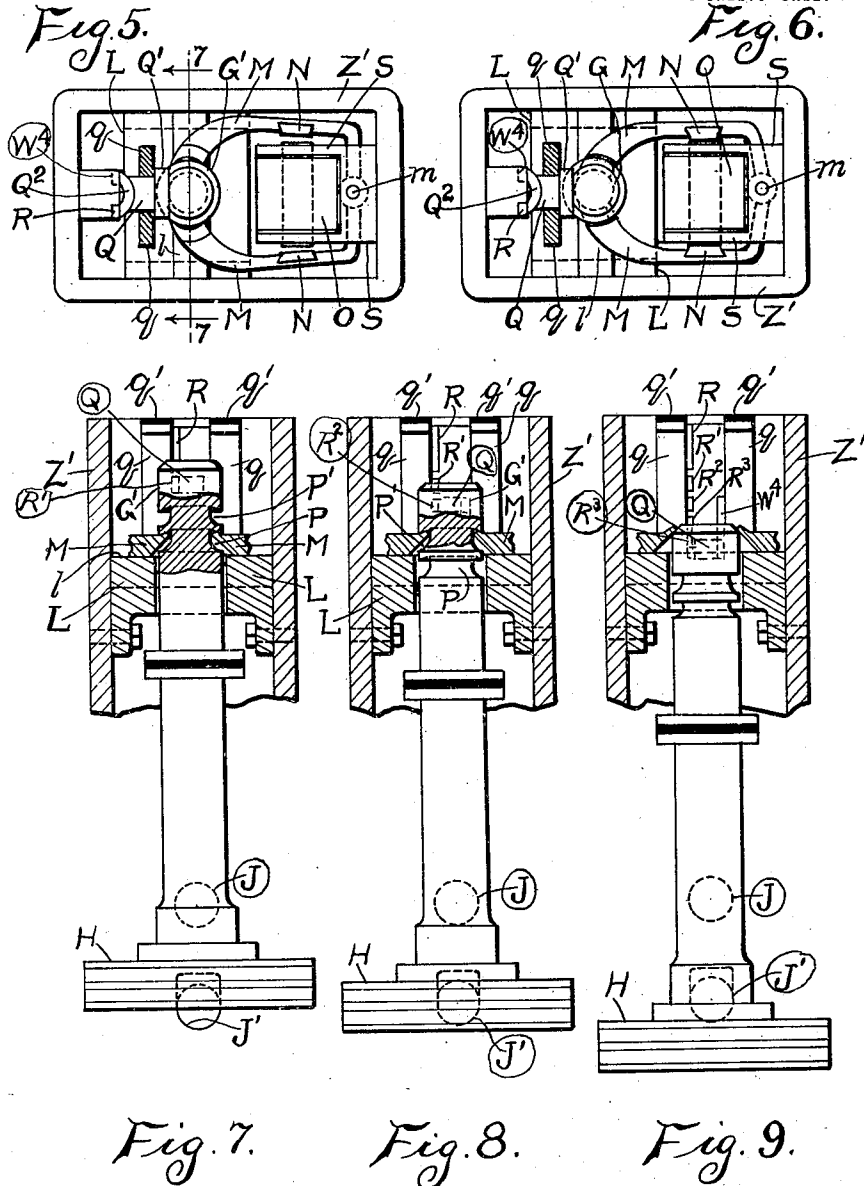
Andrew J. Brookins,
 By Charles Turner Brown, Att'y.

A. J. BROOKINS.
 TRAIN CONTROL APPARATUS.
 APPLICATION FILED MAR. 6, 1918.

1,369,880.

Patented Mar. 1, 1921.

5 SHEETS—SHEET 3.

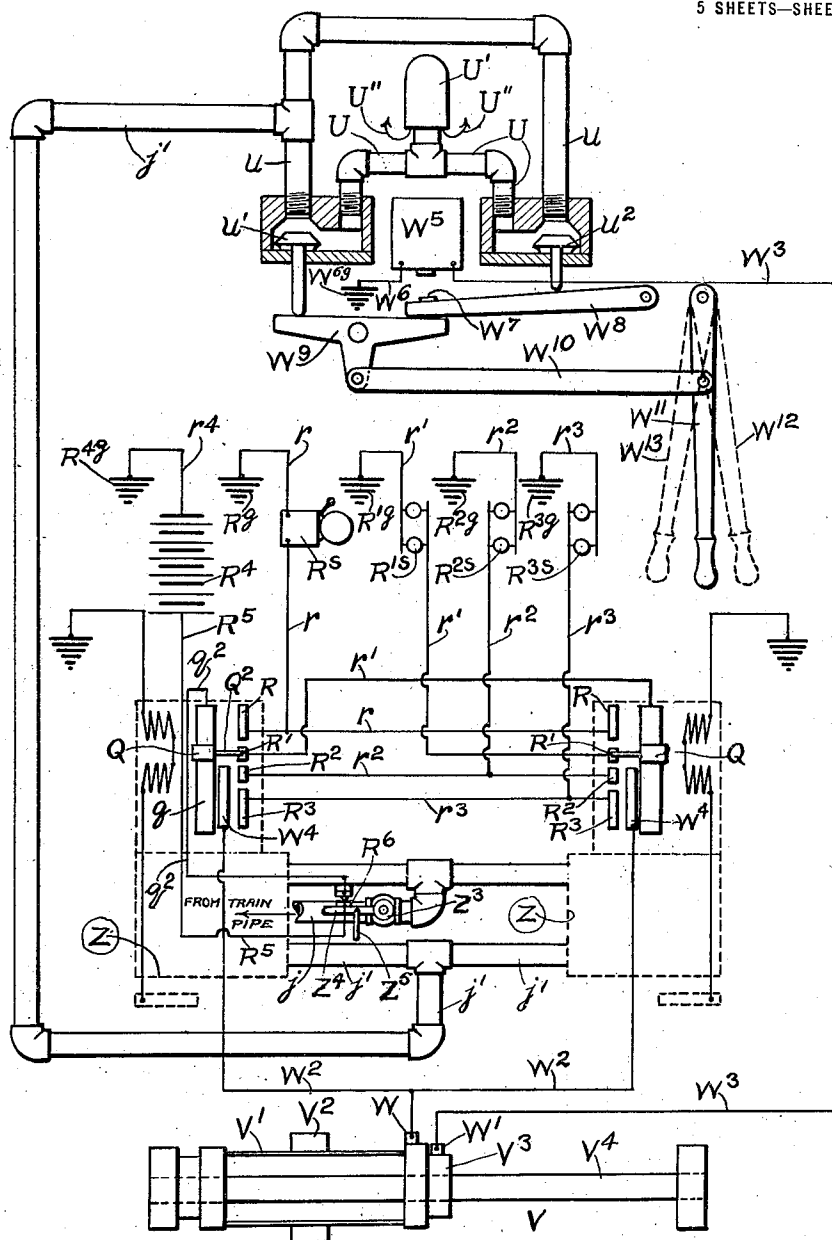


Witness:
E. Jaeger

Inventor:
Andrew J. Brookins,
 By *Charles Turner Brown,*
 Att'y.

1,369,880.

5 SHEETS—SHEET 4.



Witness:

E. G. Jacker

Inventor:

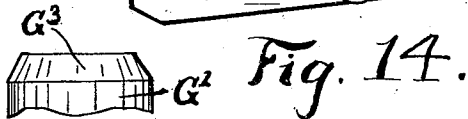
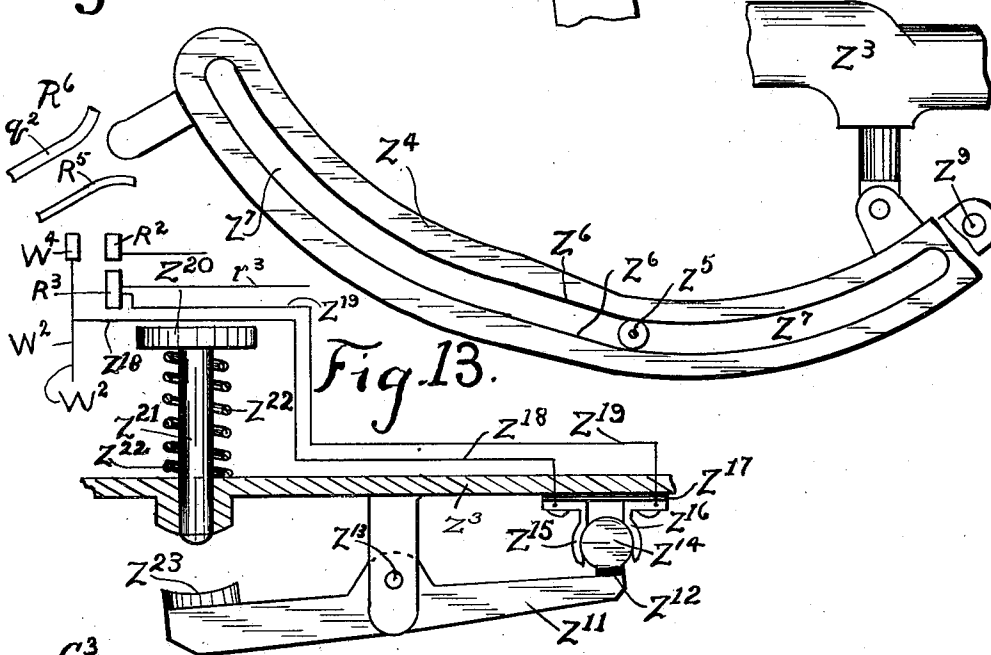
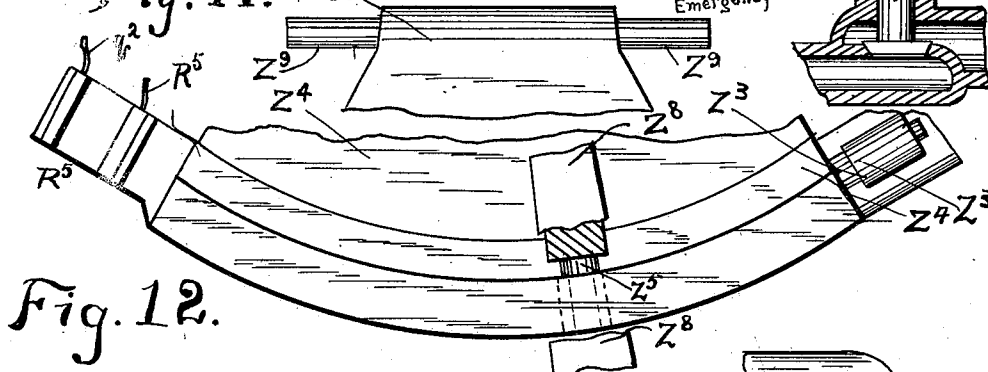
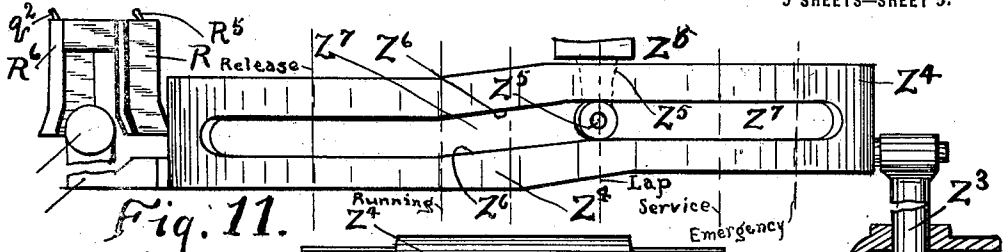
Andrew J. Brookins,
By Charles Turner Brown,
Att'y.

A. J. BROOKINS.
 TRAIN CONTROL APPARATUS;
 APPLICATION FILED MAR. 6, 1918.

1,369,880.

Patented Mar. 1, 1921.

5 SHEETS—SHEET 5.



Inventor:
 Andrew J. Brookins:
 By Charles Turner Brown
 Atty.

UNITED STATES PATENT OFFICE.

ANDREW J. BROOKINS, OF BUXTON, IOWA.

TRAIN-CONTROL APPARATUS.

1,369,880.

Specification of Letters Patent.

Patented Mar. 1, 1921.

Application filed March 6, 1918. Serial No. 220,729.

To all whom it may concern:

Be it known that I, ANDREW J. BROOKINS, a resident of Buxton, in the county of Monroe and State of Iowa, and a citizen of the United States, have invented certain new and useful Improvements in Train-Control Apparatus, of which the following is a specification.

This invention relates to apparatuses having signals located in the cab of a locomotive or motor car in position to be observed by the engineer or motor man, with energizing means, also located in said cab or motor, and co-acting with and operated by mechanical and electrical installations including and alongside the rails of a railroad track which is divided into blocks by suitable insulation.

Among the objects of this invention are, to obtain improved, automatically actuated, signal devices which continuously exhibit to a person in the cab wherein it is located, the condition, (relative to its being clear or occupied), of the track of the block on which the cab or car is about to enter, or entering, and also the said condition of the next block in advance of said one entered, or about to be entered, upon; to obtain an improved device of the kind named which requires no considerable change in the track installation already in use in what is known as block system of automatic electric signals; to obtain a device which, under determined conditions hereinafter set forth, automatically applies brakes to a train; which is applicable to a single track, on which trains are operated in opposite directions, and a device which is certain in operation, not liable to be broken or to get out of order, and which, if not in operative condition, will not give a "clear" signal.

Additional objects are disclosed in the drawings, specification and claims hereof.

In the drawings referred to,—

Figure 1 is a diagrammatic view of several blocks or sections of a railway, track and track side installations.

Fig. 2 is a side elevation of one of the duplicate ramps which are elements of the installation indicated in Fig. 1, on an enlarged scale; and

Fig. 3 is an end elevation of said ramp, a side elevation of an attaching clamp, and a cross sectional view of a rail of the track.

Fig. 4 is a vertical section of a signal and air pipe controlling device which is mounted on a motor car, or engine cab, and mechanically operated by the sliding contact of the shoe thereof with a ramp.

Fig. 5, is a top plan view of the controlling device which is illustrated in section in Fig. 4, with the jaws carrying the armatures of the electromagnets which are elements of the device, in mechanically placed position, (by the raising of the plunger), and the coils of the said magnet not energized.

Fig. 6, is a view similar to that in Fig. 5, with the coils of the electromagnet energized and the jaws carrying the armature of said magnet engaged with said plunger.

Fig. 7, 8, and 9, respectively, illustrate different positions of the plunger of the device, as controlled by the jaws carrying the armature of the electromagnets, and

Fig. 10, is a diagrammatic view of the several elements and electric circuits and an elevation of the several mechanical elements of the device adjacent thereto.

Fig. 11, is an end view of the lever of an engineer's brake valve and of a link connecting said lever to an air valve and electric switch which form elements of a construction which embodies this invention, showing said valve in section.

Fig. 12, is a top plan view of said link.

Fig. 13, is a plan view of a modified form of the link illustrated in Figs. 11 and 12 and of a lever of an engineer's brake valve, showing an electric switch and an air valve (in horizontal section) controlled by said link; and

Fig. 14, represents in side elevation a manually operated switch which, particularly in passenger service, forms an element of the mechanism illustrated in Fig. 4.

A reference character applied to designate a given part indicates said part throughout the several figures of the drawing wherever the same appears.

Co-acting with the installations embodying this invention are the usual track installations, which respectively comprise the rails of a block, the coils of an electromagnet which is arranged to normally hold its armature in a pre-determined position, and thereby control the position of a movable

conductor, and a battery or other means to energize the circuit formed by said rails, said coils and said energizing means. The several elements of the track installations are, as usual, so related that when a body which is provided with suitable electric connecting members, (as wheels and axles which are electric conductors,) moves on to the rails of the track the coils of the electro-magnet are shunted, and when shunted are not of sufficient force to hold the armature thereof in its normal position. Said circuit is also arranged so that said holding of said armature in normal position requires electric continuity in the rails of the block, and energizable condition in said battery (or other electric generator).

In an embodiment of this invention, the track side installation which is required to co-act with the herein illustrated and described installation on the engine, motor car, or other track riding moving body, comprises a four part rail in each section or block of the railway, which rail is secured alongside the track to serve as a ramp rail, or ramp, as it is usually termed. The several parts or sections of each ramp are insulated from each other, as well as from the ground, and the upper (operative) faces of said sections from the ends of the ramp as they approach the center, in whatever direction said moving body is traveling, are positioned in upwardly inclined planes, so that, as the co-acting shoe which is mounted on a moving body traveling over the rails of the track comes in contact with a ramp it will be raised by said ramp until it arrives midway thereof, after which it will descend until, as it leaves the ramp, it will be in the same position as when it entered thereon, relative to the mechanism on said moving body which is adjacent to said shoe.

Said trackside installations respectively comprise a generator, conductors, (which include the descending sections of ramps), movable conductors, (which are controlled by the armatures of the electro-magnets in the track circuits), and additional elements which are illustrated in the drawings and hereinafter described.

The movable conductors are normally in electric continuity with and form a part of the trackside conductors, being arranged to be moved and break said continuity on the movement of said armatures, as by a spring or weight, then said electro-magnets are shunted.

The installations in the bodies which are movable on the rails of a block of the track, hereinafter termed the cab installations, illustrated in the drawings and hereinafter described, respectively include shoes adapted to be mechanically actuated by con-

tact with the sections of said ramps, being raised by the ascending sections and permitted to descend by the descending sections, conductors from said shoes, and certain mechanisms which are in mechanical and electrical connection with said shoes and conductors.

The trackside installations thus include generators and electric conductors, (comprising ramps and movable conductors), which are adapted to become elements of electric circuits that include cab installations; the trackside conductors of said circuits being continuous so long as the coils of the electro-magnets of the track circuits are not shunted, and broken when said coils are shunted; and, said trackside conductors being continuous, said circuits are closed and energized when a shoe which is an element of a cab installation arrives at and moves on the descending sections of a ramp.

From the foregoing named installations it occurs that the track and the trackside installations are so constructed that the electrical conditions of the descending sections of a ramp which is about to be engaged by a shoe of a moving body are controlled by the conditions, (as to being in "good order," "clear" or "occupied") of determined blocks in advance of said ramp. And that, in a single track system a plurality of ramps are so installed that from whichever end of said block a moving body is approaching, the electrical conditions of the descending sections of said ramp is controlled by the "good order," "clear" or "occupied" conditions of said blocks, in advance of the moving body.

By the hereinafter described installations and mechanisms, under "clear" conditions of given blocks, in a double track system, the descending sections of a ramp not less than two blocks from said given blocks, (on the opposite end thereof from which the train is designed to approach), are elements of trackside installations of which the electric conductors are continuous; and in a single track system the descending sections of ramps positioned at both ends or sides of said given blocks, and not less than two blocks therefrom, are elements of trackside installations of which the trackside conductors are continuous; and hence, said descending sections of said ramps and the cab installations of an approaching moving body, will be in a closed and energized circuit as and when the shoe of said cab installation contacts with and moves on said sections.

Under "caution" conditions of said given blocks, and under the last above named conditions of an approaching moving body, the one of said descending sections of said ramp (or ramps), which is nearest the sum-

mit thereof will not, and the remaining descending section thereof will, be in a closed and energized circuit.

Under "danger" conditions of said given blocks, neither descending section of said ramp (or ramps) will be in an energizable condition, and no element of the cab installation will be electrically energized.

Briefly, in a double track system installation, under signal conditions of given blocks, the descending sections of a ramp which is in advance of a moving body approaching said blocks from a determined direction, and in a single track system installation the descending sections of an additional ramp on the opposite ends of said blocks and in advance of a moving body approaching said opposite ends of said blocks, are in electrical condition to be energized by trackside batteries, as shoes of the cab installation of a moving body contact therewith. That is, in a single track system installation, blocks controlling the electrical condition of opposite halves of two ramps, (said halves comprising descending sections only), are arranged so that, from whichever direction a body on the rails of the track approaches said blocks, the signal conditions control the electrical condition of the descending and operating sections.

To permit trains in both directions to be operated under this apparatus, both the ascending and the descending sections of the several ramps are electrically controlled by the trackside installation; but with a train moving in a given direction on the track it is immaterial whether the ascending sections are energized or not, as said ascending sections are for the purpose of mechanically operating the shoe and, when said shoe has come into contact with the lower end of the plunger, of mechanically operating the plunger.

Signals are given (lamps and bells), by cab carried circuits for the purpose of indicating to the engineer the position of the plunger upon leaving a ramp; and that position is determined by track signal conditions existing at the time the shoe is on the descending side of a ramp. As the shoe moves over the ascending face of a ramp the plunger is forced up by said shoe from the position in which it is when the train approaches the ramp to "attention" position. If the plunger is on "danger" the "caution" lamp becomes the first "attention" signal. The clear lamp becomes an additional "attention" signal; and the whistle as the shoe reaches the apex of the ramp becomes a third "attention" signal. If the track is in normal condition, which is "clear," and the signal "clear" is displayed as the train approaches a ramp, the "attention" signal will simply be a brief sound on the whistle; because the

plunger is suspended above the shoe and is only raised as the shoe passes over the apex of the ramp, to be again suspended above the shoe as said shoe follows the ramp and descends.

One of the fundamental purposes of the invention is to destroy any and all previous signal indications at each ramp, and a plurality of rapid lightings and extinguishings of lamps as a ramp is passed, (occurring when a danger or caution signal is displayed prior to arriving at a given ramp), gives positive assurance that the apparatus is functioning properly.

By the raising of the shoe as it travels on the ascending face of a ramp the face of said shoe in contact with the ramp becomes cleaned, so that good electrical contact between said shoe and ramp occurs as said shoe moves down the incline from the highest point of said ramp.

AB indicates a ramp comprising sections a, a^1, b, b^1 , which are separated by insulating material C, and are mounted on clamps D, (see Figs. 2 and 3), from which they are electrically separated by insulation d . In each section, or block, the clamp D is secured to the rail E, as by the movable jaw d^1 and bolt d'' , (see Fig. 3), so that the relative and parallel position of the ramp AB and the rail E is obtained. As is usually done, each block of the railroad track (indicated by numerals 1, 2, 3 and 4, respectively, in Fig. 1), are provided with batteries which are indicated and lettered $1^a, 2^a, 3^a$, and 4^a , respectively.

The several parts of the track and trackside installation which are diagrammatically illustrated in Fig. 1, are indicated by numerals which designate the block in which the element or member is located, and an index letter to said numerals, respectively, which designates said element, it being understood that the same elements are installed in every block and designated with the same index letter applied to a numeral designating the block.

In each block of the track installation a relay comprising an electro-magnet is installed, such magnet, in block 2 being indicated by the character 2^b , and in blocks 1 and 3 by the characters 1^b and 3^b , respectively, as above suggested, and the coils of these magnets are connected to the rails of the track by conductors, which are indicated in blocks 1, 2 and 3 by the lines designated by the characters $1^c, 1^d, 2^c, 2^d$, and $3^c, 3^d$. The coils of these electro-magnets are energized when a block is "clear," by the batteries 1^a , etc., and are shunted, or short circuited, when a motor, engine or body which is provided with a metal conductor in contact with both rails of the track, is on said blocks.

Co-acting with said electro-magnets are

movable electroconductors which are mounted on or connected to the armatures of said magnets. Such devices being well known in the art and in common use in automatic signal systems as now constructed, they are diagrammatically indicated in Fig. 1 of the drawings, and are not otherwise illustrated. In blocks 1, 2 and 3 these movable conductors, controlled by armatures, as recited, are indicated by reference characters 1^a , 1^f , 2^a , 2^f , and 3^a , 3^f . When the magnets are energized by the track batteries of the block in which they are positioned, these movable conductors form members of electric circuits which are broken on the shunting of the coil of the said magnet, or the removal of a rail of said block.

The circuits last above referred to, in which the movable conductors 1^a , 1^f , in block 1; 2^a , 2^f , in block 2; and 3^a , 3^f in block 3, and so on, are members; are respectively adapted to energize a ramp, as in previously made trackside installations, but in the trackside installations required in the embodiment of this invention, each ramp being, (as hereinbefore stated), formed of four parts or sections, two thereof ascending and two descending, relative to an approaching body, the said circuits are arranged to energize the descending sections of a ramp, (relative to said approaching body), which are positioned in a block in advance of the blocks by which said magnets are controlled. It is immaterial whether the ascending sections of a ramp are energized, as said ascending sections mechanically operate the shoe traveling thereover, and, said sections being energized, the only effect thereof is to draw, or attract, the armatures of cab carried electro-magnets, and the ascent of said shoe and plunger mechanically forces said armatures from said electro-magnets. When the coils of electromagnets positioned in blocks in advance of an approaching train, or body, are energized sufficiently to attract the armatures thereof, said members (say 2^a , 2^f ,) are in contact with contact points 2^g , 2^h , respectively; and 2^i represents a battery which is adapted to energize the track side circuits of which said members are elements. 2^n , Fig. 1, indicates a conductor which connects movable conductor 2^a with station 2^o , and 2^j , represents a conductor from station 2^o electrically connecting movable conductor 2^a and section a^1 of the ramp of block 3. Tapped into this conductor 2^j is the circuit controller Y, operated by a signal, (y) and from a point (y^1) in said controller Y, conductor 2^{j1} extends to section a of said ramp in block 3. This circuit controller Y, provided with a signal, (y) and point or terminal (y^1), is well known and in common use in automatic block signal systems, and is diagrammati-

cally indicated in Fig. 1, not being otherwise illustrated.

Also, illustrated as electrically connected to movable conductor 2^a , (by tapping into station 2^o) is conductor -2^j , electrically connecting said movable member 2^a to section b' of the ramp in block 1. Tapped into the conductor -2^j , is the controller $-Y$, operated by mechanism of signal $-y$, and from a point ($-y^1$) in said controller $-Y$, conductor -2^{j1} extends to section b of said ramp in block 1. When either of said signals assumes the "caution" aspect, its circuit controller (Y, or $-Y$), is operated by the signal mechanism, to open the electric circuit controlled thereby.

1^k , 2^k , and 3^k , respectively, represent conductors which are connected at one end to contact points 1^g , 2^g , 3^g , and at the other end to the positive sides of batteries 1^i , 2^i , 3^i ; and 1^l , 2^l , 3^l , respectively, represent conductors which are attached at one end to the negative side of said batteries and at the other end to contact points 1^h , 2^h , and 3^h of movable conductors 1^f , 2^f , 3^f . 2^p indicates a conductor which connects movable conductor 2^f with station 2^a .

Tapped into station 2^a are the conductors 2^m , and -2^m : conductor 2^m extending to a rail of the track in block 3, and conductor -2^m extending to a rail of the track in block 1, with which said rails said conductors are in electrical contact.

1^e , 1^f , and 3^e , 3^f , are respectively movable electric conductors, controlled by the armatures of the electro-magnets in the track circuits, which are indicated by numbers designating the blocks and an index, as above recited, indicating the element or conductor.

Conductors -3^j and $-3^{j'}$, are the same elements in the track side installation of block 3 that conductors -2^j and $-2^{j'}$, represent in the trackside installation of block 2.

In blocks 1 and 4, (Fig. 1), X and $-X$ respectively represent a motor, engine, or other movable body on the rails of the track. The coils of the electro-magnet 1^b , in block 1, are illustrated as not energized by the battery 1^a sufficiently to hold thereto the armature thereof, said coils being shunted or short circuited by car $-X$; hence the circuits controlled by said magnet are open; while blocks 2 and 3, not having a car or similar body thereon, and the coils of electromagnets 2^b and 3^b being sufficiently energized, the circuits controlled thereby are closed.

In block 2 the track circuit; starting from battery 2^a , comprises the upper rail, (as viewed in Fig. 1), of the track of block 2, conductor 2^d , the coils of the electro-magnet 2^b , conductor 2^e the lower rail of said block 2, and said battery 2^a . The track side installation of the circuits controlled thereby,

and illustrated as continuous in block 2, comprise, from battery 2¹, conductor 2^k, contact point 2^s, movable conductor 2^o, conductor 2ⁿ, station 2^o, conductor 2^l, station a¹ of the ramp in block 3, the lower rail of said block 3, conductor 2^m, station 2^a, conductor 2^p, movable conductor 2ⁱ, contact 2^h, conductor 2^l to said battery 2¹; also, tapped into the conductor 2^l, the controller Y, and, when said controller is closed, as under "clear" conditions, point y¹, conductor 2^u, and section a of said ramp in block 3. They also comprise from station 2^o, conductor —2^l and section b¹ of the ramp in block 1, controller —Y, which is tapped into conductor —2^l, the lower rail of block 1, and conductor —2^m, and thence as from the lower rail of block 3, back to battery 2¹, and when said controller is closed, as illustrated, (incident to "clear" condition), point —y¹, conductor —2^u, and section b of said ramp in block 1. The sections a, a¹, of the ramp in block 3, and b, b¹, of the ramp in block 1, are thus elements of a trackside installation which includes a battery 2¹ and a continuous conductor therefrom to said ramp, as in the last preceding paragraph traced. The remaining elements of said last named circuits are installed in the moving body, or bodies, (X or —X), and as either, or both, of said bodies move, or moves, into blocks 1 or 3, said circuits are completed and energized; and signals are given in said moving body to indicate the conditions of the trackside circuits controlled by the relay in block 2, as is hereinafter fully described.

In Fig. 4 a vertical sectional view of one of duplicate mechanisms which are mounted on the motor, engine, or other moving body which is adapted to travel on rails E, is given: and in said figure, F represents a shoe mounted on arms f, f, and having a plurality of members f¹, f¹, which are arranged to contact with the several ramps AB. Shoe F, in Fig. 4, is illustrated in its extreme upward position, as when raised by contact with the apex of a ramp, and the plunger (G), of said mechanism is also illustrated, in said figure, in its extreme upward position. Z, Z¹ represents the two part frame, shell or casing, of the mechanism illustrated in Fig. 4, said parts being electrically separated by the insulation indicated by reference character Z². Plunger G is longitudinally movable in casing Z, and comprises a hollow portion, or part, at the lower end thereof, in which is loosely mounted the longitudinally movable member g, which is yieldingly held in contact with the upper face of shoe F, by spring g¹. The upper end of said spring g¹ abuts against valve g², hence this spring yieldingly holds said valve closed on its port, as well as holding member g in contact with shoe F. In case of the breaking of one or both of the arms f, f,

while shoe F is not in contact with a ramp member g will be forced out of the plunger G, and spring g¹ and valve g² will move downward, opening the port which at all other times is closed by said valve. H, represents a piston which is rigidly mounted on plunger G, and h, h, are piston rings on piston H. Piston H, is adapted to close the lower end of cylindrical chamber I in casing Z. I¹, represents an additional chamber in casing Z, below said piston H, and I² represents a gland permitting the plunger G to move longitudinally without loss of any air under pressure, which is contained in said chamber I¹ (after piston H moves below port J¹). h¹, h¹, are apertures in plunger G, which communicate, respectively, with the cylindrical chamber I, and with the port h² of valve g². J, indicates an inlet port to the cylindrical chamber I, and j represents one end of a flexible (rubber), hose, which leads from the train pipe to said inlet port J. J¹, indicates an outlet port to the cylindrical chamber I, which outlet port is closed by piston H when said piston is in a position as illustrated in Figs. 4 and 7; is partially opened when said piston is in the position in which it is illustrated in Fig. 8, and is opened when said piston is in the position in which it is illustrated in Fig. 9, of the drawings. j¹, represents one end of a pipe, or conduit, attached to the outlet port J¹, the other end of said pipe extending to and adapted to discharge into signaling apparatus; which is particularly illustrated in Fig. 10 of the drawings, and hereinafter described. I³ represents a stuffing box adapted to close the upper end of cylindrical chamber I, without interfering with longitudinal movement of plunger G, and K represents a spring yieldingly holding the plunger G in the position thereof which is illustrated in Fig. 9 of the drawings. Said spring K, being compressed by the raising of the plunger G to the position in which it is illustrated in Fig. 4, by its resiliency forces said plunger downward from its said position in Fig. 4, tending to hold the plunger against the shoe F, and also to hold said shoe against the ramp rail which has raised the shoe. The upper end (G¹), of plunger G is represented as insulated from the lower end of said plunger, by insulation G². L represents a table provided with an aperture through which the upper end G¹, of plunger G, loosely extends, and l is a portion or part of table L on which the jaws M, M, (Figs. 4, 5, and 6), carrying armature N of electro-magnet O, rest. Jaws M, M, are pivoted, as at m, and the free end of said jaws, when the same are closed, are in the path of movement of the beveled edge of part G¹ of the plunger, and hence, as said plunger is raised by shoe F in ascending a ramp AB, said jaws are mechanically forced

apart out of said path of movement, regardless of whether or not the coils of electromagnet O are energized. The upper edge of end G¹, is indicated as chamfered or beveled at G³ in Fig. 4, and the lower edge of jaws M, with which said upper end of the plunger G comes in contact in its upward travel is also illustrated as beveled (see Figs. 7, 8, and 9). The upper end G¹ is provided with the annular grooves or recesses P, P¹. Said recesses are illustrated as undercut as at p. Q represents an electrical contact member attached to the upper end G¹ of plunger G, and electrically insulated therefrom by insulation Q¹. Q² represents a brush on contact Q, and q, q, represent guides attached to the top or table Z³, of part Z¹ of casing Z, but insulated therefrom by insulation q¹. The contact Q is in electrical contact with guides q, q. q², represents an electrical conductor which is attached to guides q, q. R, R¹, R² and R³, represent electrical contacts with which the brush Q² is successively in electrical contact, in the longitudinal movement of plunger A. r, r¹, r², r³, represent electrical conductors attached at one end to contacts R, R¹, R², R³, respectively. R⁴, (Fig. 10), represents a battery which is arranged to energize the several signals and control circuits contained in the engine, or cab, r⁴, represents a conductor from battery R⁴ to ground R^{4g}. Conductors r, r¹, r², and r³, are illustrated as respectively extending to grounds R⁵, R^{1g}, R^{2g}, R^{3g} with signals R⁵, R^{1s}, R^{2s}, and R^{3s}, interposed thereon; said grounds R⁵, R^{1g}, R^{2g}, R^{3g}, and R^{4g}, being the frame of the engine, or motor car, or cab.

The electro-magnets O (Figs. 4, 5, and 6), are contained in frame S, and said frame is contained in part Z¹, of casing Z. When the coils of electro-magnets O are energized armatures N are attracted thereby, and jaws M, M, are thereby closed on plunger G, and in the descent of said plunger and the energizing of said coils at the time one of the recesses P, P¹, is in suitable position, closes said jaws into said recesses, and holds said plunger suspended.

T represents an electric conductor attached to shoe F, and to the base of casing Z; and T¹ represents a similar conductor attached to casing Z and to the positive side of the coils of electro-magnets O. T² represents a conductor attached to the negative side of said coils of electro-magnets O, and to top Z³ of casing Z. t represents a conductor from top Z³ to ground t¹, said ground being the frame of the engine, motor, or cab.

In Fig. 10 is illustrated an elevation of a signal apparatus, air releasing mechanism, a controlling lever, and an electric governor, with a diagram of other members. The discharge pipe j¹, from the cylindrical cham-

ber I, in casing Z, (see Fig. 4), is tapped by the pipes u, u, and said pipes are closed by the valves u', u², when said valves are seated. The normal position of valve u' is illustrated, being open, so that when the piston H descends to open port J¹ to the cylindrical chamber I, air from the train pipe flowing through flexible pipe j, port J, cylindrical chamber I, port J¹, and pipe or conduit j¹, into pipe u, may escape through the port with which said valve u' co-acts, into pipe U, and to and through the whistle U', to sound the same, as is indicated by the arrows which are designated by character U''. The valve u² also is normally open and a similar flow of air may occur through pipe u, the port with which valve u² co-acts, and said signal U'.

To enable the engineer to proceed at a pre-determined speed when piston H is in the position illustrated in Fig. 9, and the air is flowing from the train pipe through the ports of valves u', u², as last above described, I provide an electric governor, (see Fig. 10), which is illustrated as comprising springs V¹, V¹, balls V², V², on said springs, commutator rings V³, attached to one end of said springs, and slidably movable on shaft V⁴, and brushes W, W¹. I also provide, from brush W of this governor, the conductor W², which extends to contacts W⁴, W⁴; and from brush W¹ conductor W³, which extends to the coils of electro-magnets which are indicated by the rectangle W⁵; and conductor W⁶ from said coils to ground W^{6g}. Also, there are provided armature W⁷, on lever W⁸, the rocking bar W⁹, link W¹⁰, and lever W¹¹. When said lever W¹¹ is in the position illustrated by full lines in Fig. 10, valves u', u², may both be open and said valve u' is necessarily open, with the stem thereof resting on lever W⁹; and valve u² is open when the electro-magnet W⁵ is not energized, (to draw its armature W⁷ and lever W⁸, upward). By moving said lever W¹¹, into the position which is indicated by the broken lines designated by the character W¹², the rocking bar W⁹, is moved on its pivot to raise the end of lever W⁸, (which rests thereon when the coils of electro-magnet W⁵ are not energized), so as to close valve u² on its port, thereby preventing the flow of air through said port. When said valve u² is closed, by movement of lever W¹¹, as last above set forth, in the event of the coils of electro-magnet W⁵ being energized, said magnet will attract armature W⁷, and maintain said lever W⁸ in its raised position; and so long as brushes W, W¹, are in contact with the slidably commutator rings V³, said coils will be energized and said valve u² will remain closed on its ports, after the lever W¹¹ is moved from the position indicated by said broken lines W¹²; and said lever may be

moved from said position into the position which is indicated by the broken lines designated W^{13} . By the last recited movement of lever W^{11} , the rocking bar W^0 is moved to raise the valve u' to close its port, the stem of said valve, (as hereinbefore recited) resting on said lever.

Both of said valves u' and u^2 being closed, by the means and the above recited movements of lever W^{11} , the flow of air from the cylindrical chamber I, through port J' , pipe j' , pipes u , and the ports of valves u' , u^2 , is stopped; and the brakes of the train are released in the ordinary manner of releasing brakes when the flow of air from a train pipe is stopped. The train may now proceed so long as said valves u' , u^2 , are seated to close their respective ports; and they will remain so seated so long as the engineer retains his grasp on lever W^{11} , holding it in the position indicated by broken lines W^{13} and the brushes W , W^1 are in contact with commutator rings V^3 . So long as the speed determined by the governor is not exceeded, the circuits comprising the contacts W^4 , conductor W^2 , brush W , rings V^3 , brush W^1 , conductor W^3 , the coils of electro-magnet W^5 , conductor W^6 , ground W^{6a} , ground R^{4a} , battery R^4 , conductor R^5 , switch R^6 , conductor q^2 , the combined guide and conductor q , contact Q , brush q^2 to said contact W^4 , are closed; but when the predetermined speed is exceeded the governor will operate to slide commutator rings V^3 on shaft V^4 , out of contact with brushes W , W^1 . The circuit will be broken by said last recited movement of commutator rings V^3 , and the electro-magnet W^5 , being thereby deenergized, armature W^7 and lever W^8 , will fall, permitting valve u^2 to become unseated, whereupon a flow of air will again occur from the train pipe, as hereinbefore recited, through pipes u , U , and signal U' ; the brakes being thus again applied the speed of the engine, or motor car, will be slowed down. When the governor moves commutator rings V^3 to electrically connect brushes W , W^1 , upon again repeating the movement of lever W^{11} into the position designated by W^{12} , and from there to W^{13} , valves u^1 , u^2 , may be again closed, the brakes released, and a forward movement of the engine resumed.

It will be observed that the recited manipulation of lever W^{11} , to permit said forward movement of the train, engine, or motor car, is necessitated only when the plunger G is in the position illustrated in Figs. 8 and 9, (that is, caution or danger). At said time, when proceeding at not more than a pre-determined rate of speed, valve u^2 is held seated by electro magnet W^5 , and valve u^1 is held seated by lever W^{11} being maintained in the position indicated by broken lines W^{13} . Hence, if the person in

charge releases or loses grip of said lever, when in said position W^{13} , said valve u^1 becomes unseated and brakes are automatically applied.

At each ramp location the upward movement of the plunger G raises brush Q^2 above contact W^4 , thereby opening the circuit in which coils of magnet W^5 are elements. Said magnet will thereupon release its armature, allowing valve u^2 to open. Should the indication at a ramp be caution, or danger, piston H uncovers outlet J^1 , and air may escape through valves u^1 , u^2 , to apply brakes, and said valves can only be closed by manipulating lever W^{11} , as recited.

The car mounted elements, shoe F , conductor T , the lower part of casing Z , (it being made of electric conducting material), conductor T' , the coils of electro magnet O , conductor T^2 , the upper end Z^2 of casing Z , conductor t , and ground t' , hereinbefore recited, complete the circuit of which the track side installations illustrated in Fig. 1 of the drawings, are elements; and when the operable sections of a ramp with which said shoe is in contact are energized, the electro-magnet O will be energized and jaws M , M , will be closed, to co-act, on the downward movement of plunger G , with recesses P , P' , as said plunger follows the downward movement of shoe F , as said shoe travels over the descending sections of a ramp. As but two sections of a ramp are electrically operable, (because of the mechanical operation obtained by the ascending sections) in whichever direction a body is moving on the tracks, said jaws M , M , are moved in, in timed relation with recess P on plunger G , to engage therewith, if section a , (when the engine, cab, or car is moving in one direction) or b , (when moving in the opposite direction), is energized; and with recess P' , (section a or b being deenergized) if section a' or b' , is energized. If both sections of the electrically operable (on the descending side) sections of the ramp are deenergized jaws M will not be moved by said electro-magnet, and hence will not engage with either of the recesses P , P' , and plunger G will move downward after passing the ramp, into the position which is illustrated in Fig. 9, that is, into "danger" position.

It will be seen, on reference to Fig. 4, that when the plunger G is raised to its upward limit of travel, by shoe F being on the apex of a ramp, brush Q^2 is in electrical contact with contact R ; and by reference to Figs. 4, 7, 8, 9, and 10, that when the jaws M engage with recess P , said plunger is suspended with said brush in electrical contact with contact R' , (as in Figs. 7 and 10), and when said jaws are engaged with recess P' , said brush is in electrical contact with con-

tact R^2 , and also with contact W^4 , (as in Fig. 8); and when said jaws are not moved into engagement with either of said recesses, said plunger descends until said brush is in contact with contacts R^3 and W^4 , as in Fig. 9.

To provide for a possible variation of the level of the ramp relative to the rail of the track, as by the jar of a heavy engine, or by frost, the plunger G is arranged to travel upward beyond the point necessary to disengage the jaws M, M , as the shoe moves over the apex of said ramp.

R^4 , Fig. 10, represents a battery which is arranged to energize the several signal circuits contained in the engine or cab. r^4 represents a conductor from battery R^4 to ground R^{4g} . Conductors r, r', r^2 , and r^3 , are illustrated as respectively extending to grounds $R^g, R^{1g}, R^{2g}, R^{3g}$, with signals R^s, R^{1s}, R^{2s} , and R^{3s} , interposed thereon.

When any of the circuits of which contact R is a member is closed, it is energized by battery R^4 , and a signal R^s is energized. This occurs as every ramp is passed, at the time the shoe F , is midway of the ramp, and plunger G is at its highest point of travel; and said circuit consists of the conductor R^s , from battery R^4 , switch R^6 , conductor q^2 , guides q , contact Q , brush Q^2 , contact R , conductor r , to ground R^g , ground R^{4g} , conductor r^4 , and the battery R^4 . The signal R^s , which is interposed or cut into conductor r , is thus energized at the passing of every ramp, and serves to call attention to the fact that entrance is being made on to a new block, and the signals R^{1s}, R^{2s} , and R^{3s} , should be observed.

The respective circuits of which signals R^{1s}, R^{2s} , and R^{3s} , are elements, includes the same elements from battery R^4 to brush Q^2 , as those in the last described circuit of which signal R^s is an element, and as plunger G descends they are successively closed, by the successive bringing of said brush into electrical contact with the contacts R^1, R^2 , and R^3 .

The circuit which includes signal R^{1s} , starting from brush Q^2 , is, contact R^1 , conductor r^1 , to contact R^1 of the duplicate device which is installed on the engine, (or cab), and from said contact, brush Q^2 , conductor r^1 to ground R^{1g} , ground R^{4g} , conductor r^4 , and battery R^4 . This is a continuously closed and energized circuit between ramps, when the section a (or b) is energized as a shoe contacts with the first descending section of said ramp, and is the "clear" signal circuit. The circuit including signal R^{2s} , from said brush Q^2 , includes contact R^2 , conductor r^2 , to ground R^{2g} , and thence as before, from ground R^{4g} , on conductor r^4 , to battery R^4 . This is a continuously closed and energized circuit when section a (or b), is deenergized by the con-

tinuity of the trackside conductor of the j series being broken, by movable conductors of the f series, as hereinbefore recited, and section a' (or b'), is energized, the continuity of the trackside conductors of the j series being maintained by the movable conductor of the e series, and is the caution signal circuit. The circuit in which signal R^{3s} is included, comprises, from said brush Q^2 , contact R^3 , conductor r^3 , to ground R^{3g} , and thence as before, from ground R^{4g} . This is a continuously closed and energized circuit when the descending side or end of the ramp is wholly deenergized, and is the danger signal circuit. It occurs when the continuity of the conductors of the j and j series of the trackside installation is broken, as by movable conductors of the e and f series breaking contact.

It will be observed that when the caution and danger circuits are closed, that is, when the brush Q^2 is in electrical contact with contacts R^2 , and R^3 , said brush is also in electrical contact with contact W^4 , and that the circuit comprising said contact W^4 , conductors W^2 , brush W , rings V^3 , brush W^1 , conductor W^3 , coils of electro-magnet W^5 , conductor W^6 , ground W^{6g} , ground R^{4g} , conductor r^4 , battery R^4 , conductor R^5 , switch R^6 , conductor q^2 , guide and conductor q , contact Q , and brush Q^2 , is operable.

It will also be observed that the "clear" signal circuit as above traced, includes the contact R^1 of the duplicate device which is illustrated in the engine or cab, and which for all other purposes is inoperative, there being no ramp on the opposite side of the track. This contact of said duplicate device is included as an element of the "clear" circuit so as to insure the maintenance and operativeness of the electrical installation of said duplicate device at all times, so that if the engine be turned, at any time, to be run in the opposite direction, the signals displayed by the operation thereof may be relied upon.

The switch R^6 is mounted on lever Z^4 of valve Z^3 , and when the device is to be made inoperative, the turning of said lever Z^4 to close the valve Z^3 , (thus cutting off the air supply from the train pipe to cylindrical chamber I), opens said switch, and opens all the electrical circuits in which the electric contacts of the R series are members.

The several grounds $R^g, R^{1g}, R^{2g}, R^{3g}$, are installed so that in case the positive sides of the coils of electro-magnets O are accidentally grounded said coils will not be energized by battery K^4 , the effective operation of the device requiring said coils to be energized by the batteries of the trackside installation which energizes the ramps.

Attention is called to the fact that although all the sections of a ramp may be energized when a shoe commences to slide or

travel thereover, the plunger G will not be affected by the raising of the shoe, provided said plunger is suspended to give a "clear" signal, until said shoe is near the apex of the ramp, and about to energize the "attention whistle" R^s, and that as said shoe "climbs" the ramp, it is on the mechanically operative side or part thereof and is thoroughly cleaned by said ramp, insuring electrical as well as mechanical contact between said shoe and said ramp, as the shoe descends the ramp on the electrically operative side thereof; said electrically operated side being, at all times, the descending sections of the ramp, in whichever direction an engine, or motor, or cab, is moving; said ascending side being the mechanically operative side, regardless of whether it is or is not energized.

Z⁵, Fig. 10, represents a link which is attached at one end to lever Z⁴ of valve Z³, and is attachable at its other end to the lever of the engineer's brake valve, so that when said engineer's brake is in "lap" position, as when an engine is used as a pusher or helper, valve Z³ is closed, and switch R⁹ is opened, and when said brake valve is again put into usable position, said valve Z³ and switch R⁹ are automatically put into operative condition. The lever Z⁴ in the construction illustrated in Figs. 11 and 12, is provided with a groove, Z⁷, having an inclined portion, Z⁶, which is engageable with link Z⁵, when the engineer's brake lever (Z⁸ in said Fig. 11), is moved from running to lap position. The remainder of said groove is substantially horizontal so that said lever Z⁴ is not moved on its fulcrum Z⁹, (Fig. 12), when said brake lever is moved from any position, except from running to lap, or back again. In Fig. 11, valve Z³ is illustrated as closed, and switch R⁹, as opened, the engineer's brake valve being at lap. The several parts illustrated in Fig. 11 being in the position there shown, in case the engineer's brake valve is moved to service or emergency, valve Z³ remains closed and switch R⁹ remains open.

In the modification illustrated in Fig. 13, the several parts illustrated are lettered the same as in Figs. 11 and 12, the only difference in this construction being, that the pivot Z⁹ of the lever Z⁴, in Figs. 11 and 12 is in a horizontal plane while in Fig. 13 it is in a vertical plane and the portion of the link Z⁵ which engages with a groove Z⁷ and incline Z⁶, in Figs. 11 and 12 is in a horizontal plane while the position of said link which engages with said groove and incline in Fig. 13 is in a vertical plane.

By the above described construction of the valve Z³, lever Z⁴, said valve Z³ is closed while engineer's brake valve is in lap, service, or emergency position and opened when said brake valve is in holding, running or

release position. Thus when engine is used as a pusher or helper or engineer is applying the brakes the automatic train control apparatus are inoperative.

A detail of the mechanism whereby a train must come to a full stop upon a danger signal being displayed, is illustrated in Fig. 14. By said construction the train may thereafter be moved forward at a determined speed until the next ramp is passed. This movement of the train is made possible by the engineer operating a push button, which can only be reached by him after he dismounts from the engine, and thereafter manipulating the lever W¹¹, as hereinbefore described. This detailed construction consists of a switch having a circuit breaker Z¹⁴, which is mounted on lever Z¹¹, and insulated therefrom by insulation Z¹². Lever Z¹¹, is pivotally mounted on pin Z¹³. Said circuit breaker or conductor Z¹⁴, is adapted to form a bridge between the terminals Z¹⁵ and Z¹⁶, which are mounted on the upper end Z⁸ of the mechanism illustrated in Fig. 4 and insulated therefrom by insulating material Z¹⁷. Conductor Z¹⁸ (branching from conductor W²), conductor Z¹⁹, (from contact R²), and terminals Z¹⁵, and Z¹⁶, are in electrical connection. Z²⁰, represents a push button, having stem Z²¹, said push button being yieldingly held inoperative by spring Z²² and returned to inoperative position after being depressed to force circuit breaker Z¹⁴ between terminals Z¹⁵ and Z¹⁶, (said return not affecting said circuit breaker to release it from said terminals. One end of the lever Z¹¹, extends into the path of movement of the beveled end G³ of plunger G. When the engine or motor car which is provided with this apparatus has come to a full stop the engineer, or other person at his direction, may depress push button Z²⁰ thereby forcing stem Z²¹ into abutment Z²³ of lever Z¹¹, turning said lever into the position in which it is illustrated in Fig. 14; and so long as said lever remains in said position, said push button returning to its normal position, as recited, the electrical circuit of which governor V is an element is closed so that lever W¹¹ (Fig. 10) may be manipulated as hereinbefore set forth, and the train proceed as described. Upon passing the next ramp the upper end G³ of the plunger G will move the lever Z¹¹ of the circuit controller to break electrical connection between terminals Z¹⁵ and Z¹⁶ and on receiving a new danger signal the train will again be brought to a full stop, and to proceed push button Z²⁰ must again be depressed.

When the above described mechanism is used, as in passenger service, the contact, W⁴, is of substantially the same length as contact R³, as is indicated in Fig. 14; the conductor Z¹⁹ is attached at one end to plate

R³ and at the other end to terminal Z¹⁶, and from terminal Z¹⁵, the conductor Z¹⁸ extends to and is tapped into conductor W². Installed as described, when brush Q² is in contact with contact R² and W⁴ the "caution" signal is given, and the engineer by manipulating lever W¹¹, may proceed as hereinbefore described; when however, said brush Q² passes below the contact W⁴ and electrically engages with contact R³, the circuit of which conductor W² is an element, is broken until the push button Z²⁰, is depressed to force lever Z¹¹ into the position in which it is illustrated in said Fig. 14, at which time terminals Z¹⁵ and Z¹⁶ are bridged by conductor Z¹⁴, and the conductor Z¹⁹ from contact R³, the terminal Z¹⁵, bridge Z¹⁴, terminal Z¹⁶ and conductor Z¹⁹, back to conductor W² are brought into a closed circuit, which comprises from battery R⁴, the conductor R⁵, switch R⁶, conductor q², the guide q abutment Q, brush Q² to contact R³ and the last above recited elements, and from said elements the remainder of the circuits hereinbefore described which includes the conductor W², to wit, (see Fig. 10), the brushes W, W¹, rings V³, conductor W³, the coils of the electromagnet W⁵, and conductor W⁶, and ground W⁵, and from the ground thence to ground R⁴ and conductor r⁴ to said battery R⁴. The engineer will therefore, after having forced bridge Z¹⁴ between terminals Z¹⁵ and Z¹⁶, be able to proceed in the manner hereinbefore described, by manipulating the lever W¹¹, as hereinbefore set forth.

I claim;

1. In an installed block railroad track sectional ramps installed adjacent to the track rails of the blocks adjacent to a determined block, the upper faces of said sections inclined, with the outer ends of the end sections of the ramp in a lower plane than the adjacent ends of the middle sections thereof, means to insulate the sections of said ramps from each other and from the ground, means to energize two of the sections of said ramps, said two sections being at the ends of said ramps which are nearest said determined block, means to make and break the electric circuits of which said energizable sections of said ramps are elements, means positioned in said determined block to control said make and break means, in combination with a mechanism adapted to be mounted on a body movable on said rails said mechanism comprising a shoe adapted to slide on said ramp and be raised as it is moved from one end to the middle thereof and electric installation on said moving body arranged to complete said circuits as said shoe descends said ramp, and electric conductors connected to said shoe and to said rails.

2. In a track signal system, a sectional

ramp one of the operable faces whereof ascends from one end of said ramp to a summit and one whereof descends from said summit to the other end of said ramp, the one of said sections which is provided with said descending face comprising an insulated electrical conductor, in combination with a movably mounted shoe the operable face whereof is provided with an insulated electrical conductor, and said shoe arranged to co-act with said ramp to be mechanically operated on contact with said ascending face and electrically energizable on contact with said descending face as said shoe is moved along said ramp.

3. A casing provided with a base and provided with a cylindrical recess through said base and into said casing, a plunger longitudinally movable in said casing, a piston on said plunger arranged to form the movable wall to a chamber obtained thereby in said cylindrical recess, an inlet to said chamber and an outlet from said cylindrical recess, said piston arranged to alternately make and interrupt communication between said chamber and said outlet on a determined movement of said plunger.

4. A casing provided with a base and provided with a cylindrical recess through said base and into said casing, a plunger longitudinally movable in said casing; and provided with recesses adjacent to the upper end thereof, an electromagnet, movable jaws adapted to be moved into engagement with said recesses when said magnet is energized, and to be mechanically moved from said engagement on a determined movement of said plunger.

5. A casing provided with a base and provided with a cylindrical recess through said base and into said casing, a plunger longitudinally movable in said casing, and provided with recesses adjacent to the upper end thereof, an electromagnet, movable jaws adapted to be moved into engagement with said recesses when said magnet is energized, and to be mechanically moved from said engagement on a determined movement of said plunger, a piston on said plunger arranged to form the movable wall to a chamber obtained thereby in said cylindrical recess, an inlet to said chamber and an outlet from said cylindrical recess, said piston arranged to alternately make and interrupt communication between said chamber and said outlet on said determined movement of said plunger.

6. A casing provided with a base and provided with a cylindrical recess through said base and into said casing, a plunger longitudinally movable in said casing and provided with a recess adjacent to the upper end thereof, an electromagnet, movable jaws adapted to be moved into engagement with said recess when said magnet is energized,

and to be mechanically moved from said engagement on a determined movement of said plunger, a piston on said plunger arranged to form the movable wall to a chamber obtained thereby in said cylindrical recess, an inlet to said chamber and an outlet from said cylindrical recess, said piston arranged to interrupt communication between said chamber and said outlet on said determined movement of said plunger, and to make a limited communication between said chamber and said outlet, when moved in the opposite direction into position to bring said jaws and recess into co-acting position, all combined as set forth.

7. A casing provided with a base and provided with a cylindrical recess through said base and into said casing, a plunger longitudinally movable in said casing, and provided with recesses adjacent to the upper end thereof, an electromagnet, movable jaws adapted to be moved into engagement with said recesses when said magnet is energized, and to be mechanically moved from said engagement on a determined movement of said plunger, stationary electric contact members, a brush mounted on said plunger and arranged to successively contact with said contact members on the longitudinal travel of said plunger, and signals, said contact members and brush arranged to form, when in contact, elements of electric circuits which include said signals, and means to energize said circuit, all combined as set forth.

8. A casing provided with a base and provided with a cylindrical recess through said base and into said casing, in combination with a plunger provided with recesses adjacent to the upper end thereof, and longitudinally movable in said casing, an electromagnet, movable jaws adapted to be moved into engagement with said recesses when said magnet is energized, and to be mechanically moved from said engagement on the approach of said plunger to the end of its upward travel, stationary electric contact members, a brush mounted on said plunger, and arranged to successively contact with said contact members on the longitudinal travel of said plunger, and signals, said contact members and brush arranged to form, when in contact, elements of electric circuits which include said signals, manually operated means to break said circuits and means to energize said circuits.

9. A conduit adapted to form an air passageway, from the train pipe of air controlled brake mechanism, a plunger, a movable piston arranged to obstruct said passageway, the position of said piston being controlled by the position of said plunger, a circuit breaker normally in open position and a plurality of means for manually obstructing said air passageway, the control-

ling elements of one of said obstructing means and said circuit breaker being elements of an electric circuit, and a track side member, said plunger arranged to co-act with said track side member to mechanically control an open position to said circuit breaker.

10. An air passageway, a plunger, a valve arranged to obstruct said passageway, an electric circuit provided with energizing means, said circuit comprising a mechanically operable circuit breaker arranged to be normally open and the coils of an electromagnet, an armature to said magnet arranged to maintain said valve subsequent to the manual operation thereof on its seat when said magnet is energized, track side means arranged to coact with said plunger to move said circuit breaker to its normal position, and manually operable means to move said circuit breaker to a closed position.

11. In a train carried signal apparatus, the combination of a plurality of electric circuits comprising means to generate an electric current, a brush actuated by a movably mounted plunger, a contact plate positioned in the path of movement of said brush, a conductor from said plate and a signal interposed on said conductor, and one of said circuits also comprising a normally open circuit breaker positioned in the path of movement of said plunger and being closed, arranged to be opened by the movement thereof in a determined direction, and manually operable means to return said circuit breaker to its closed position.

12. Train controlling mechanism provided with an electric circuit comprising a circuit breaker, and provided with an air valve, in combination with means to join said circuit breaker and said air valve with the engineer's brake lever of an air brake mechanism to open said circuit breaker and close said valve when said brake lever is moved in a determined direction to a predetermined position, to maintain said circuit breaker open and said valve closed when moved in one direction and to close said circuit breaker and open said valve when moved in the opposite direction from said predetermined position.

13. In a train control mechanism, a signal, an air passageway communicating at its inlet end with the train pipe of air brake mechanism and arranged to discharge through said signal at its outlet end, and mechanically operable means to obstruct said passageway, in combination with track-side means to operate said means to obstruct, means to close said passageways and means to join said closing means to the lever of the engineer's brake valve of said air brake mechanism, said means to join arranged to close said closing means when

said lever is moved in a determined direction to a predetermined position, to maintain it closed when said lever is moved in one direction from said pre-determined position and to open it when moved in the opposite direction therefrom.

14. In a train carried signal apparatus duplicate mechanisms respectively provided with a longitudinally movable plunger, an electrical brush controlled by said plunger and a contact plate positioned in the path of movement of said brush, in combination with electric conductors from a contact plate in one to the brush in the other of said mechanisms, and a conductor from the contact plate in the last named mechanism to and through a signal and to ground.

15. Duplicate mechanisms respectively comprising a longitudinally movable plunger, electrical brushes mounted on said plunger, contact points positioned in the path of travel of said brushes, means to conduct electrical energy from a contact in one of said mechanisms to the brush of the other of said mechanisms and means to conduct electrical energy from the contact of said last named mechanism to ground, with signals interposed in said last named conducting means, and means to energize the circuit of which said recited parts are elements.

16. Duplicate mechanisms respectively comprising a longitudinally movable plunger, electrical brushes movably controlled by the movement of said plunger, contact points positioned in the path of travel of said brushes, means to conduct electrical energy from a contact in one of said mechanisms to the brush of the other of said mechanisms and means to conduct electrical energy from the contact point of said last named mechanism and from the remaining contact points of said mechanisms, to ground, with signals interposed in said last named conducting means, and means to energize the circuits of which said recited parts are elements.

17. In a train control mechanism, a signal, an air passageway communicating at its inlet end with the train pipe of air brake mechanism and arranged to discharge through said signal at its outlet end, and mechanically operable means to obstruct said passageway, means to close said passageway and means to join said closing means to the lever of the engineer's brake valve of said air brake mechanism, said means to join arranged to close said closing means when said lever is moved in a determined direction to a pre-determined position, to maintain it closed when said lever is moved in one direction from said pre-determined position and to open it when moved in the opposite direction therefrom, additional means adapted to close said passageway, and manually operable means arranged on the move-

ment thereof to a determined position to close said additional means, said manually operable means arranged to automatically release said additional closing means on the failure to retain said manually operable means in said determined position in combination with trackside means to operate said means to obstruct.

18. In a train control mechanism, an electrical circuit and means to energize said circuit, a signal, an air passageway communicating at its inlet end with the train pipe of air brake mechanism and arranged to discharge through said signal at its outlet end, and mechanically operable means, comprising an electric conductor to obstruct said passageway, and to close said electric circuit, means to close said passageway and means to join said closing means to the lever of the engineer's brake valve of said air brake mechanism, said means to join arranged to close said closing means when said lever is moved in a determined direction to a predetermined position, to maintain it closed when said lever is moved in one direction from said pre-determined position and to open it when moved in the opposite direction therefrom, additional means adapted to close said passageway, and manually operable means arranged, on the movement thereof to a determined position, to close said additional means, said manually operable means arranged to automatically release said additional closing means on the failure to retain said manually operable means in said determined position in combination with trackside means to operate said combined means to obstruct said passageway and close said circuits.

19. In a train control mechanism, a signal, an air passageway communicating at its inlet end with the train pipe of air mechanism and arranged to discharge through said signal at its outlet end, and mechanically operable means to obstruct said passageway, means to close said passageway and means to join said closing means to the lever of the engineer's brake valve of said air brake mechanism, said means to join arranged to close said closing means when said lever is moved in a determined direction to a pre-determined position, to maintain it closed when said lever is moved in one direction from said pre-determined position and to open it when moved in the opposite direction therefrom, a plurality of additional means to close said passageway, an electromagnet, means to energize said magnet, manually operable means to close said plurality of additional means, and means controlled by said energized magnet to maintain one of said plurality of additional means closed, said manually operable means arranged to automatically release the one of said plurality of additional closing means

which is not controlled by said magnet on the failure to retain said manually operable means in said determined position, in combination with trackside means to operate said means to obstruct.

20. In a train control mechanism, a signal, an air passageway communicating at its inlet end with the train pipe of air mechanism and arranged to discharge through said signal at its outlet end, and mechanically operable means to obstruct said passageway, means to close said passageway and means to join said closing means to the lever of the engineer's brake valve of said air brake mechanism, said means to join arranged to close said closing means when said lever is moved in a determined direction to a pre-determined position, to maintain it closed when said lever is moved in one direction from said pre-determined position and to open it when moved in the opposite direction therefrom, a plurality of additional means to close said passageway, an electric circuit, an electromagnet in said circuit, means to energize said circuit, a governor adapted to break said circuit, manually operable means to close said plurality of additional means, and means controlled by said energized magnet to maintain one of said plurality of additional means closed, said manually operable means arranged to automatically release the one of said plurality of additional closing means which is not controlled by said magnet on the failure to retain said manually operable means in said determined position, in combination with trackside means to operate said means to obstruct.

21. In a train control mechanism, a signal, an air passageway communicating at its inlet end with the train pipe of air mechanism and arranged to discharge through said signal at its outlet end, and mechanically operable means to obstruct said passageway, means to close said passageway and means to join said closing means to the lever of the engineer's brake valve of said air brake mechanism, said means to join arranged to close said closing means when said lever is moved in a determined direction to a pre-determined position, to maintain it closed when said lever is moved in one direction from said pre-determined position and to open it when moved in the opposite direction therefrom, a plurality of additional means to close said passageway, an electric circuit, an electromagnet in said circuit, means to energize said circuit, manually operable means to close said plurality of additional means, and means controlled by said energized magnet to maintain one of said plurality of additional means closed, said manually operable means arranged to automatically release the one of said plurality of additional closing means which

is not controlled by said magnet on the failure to retain said manually operable means in said determined position, in combination with trackside means to operate said means to obstruct and also to break said electric circuit.

22. In a trackside apparatus, standards attached to track rails of insulated blocks, a ramp rail comprising a plurality of ascending and descending members insulated from each other mounted in and insulated from said standards, electric conductors from determined blocks to determined members of said ramp, circuit breakers forming elements of said conductors, electromagnets forming elements in additional circuits, whereof the track rails of said determined blocks are elements, arranged to control said circuit breakers, in combination with a cab carried apparatus arranged to co-act mechanically with said ascending and descending members, and electrically with selected sections of said descending members.

23. A shoe adapted to slide on a ramp, consisting of ascending and descending members, said shoe comprising the combination of a base and a plurality of transversely extending bars arranged to come in contact with said ramp, said bars being of electric conducting material and adapted to be members of an electric circuit, in combination with a plunger arranged to be actuated by said shoe, and electrically controlled means to subsequently selectively retain said plunger in an actuated position.

24. In a railway signal system, a track way divided into blocks, a road side member in each of said blocks, said road side member having ascending and descending sections, in combination with a car carried electrically and mechanically responsive member, and an additional car carried member arranged to co-act mechanically with said ascending and electrically with said descending sections.

25. In a railway signal system, a track way, a ramp provided with ascending and descending insulated sections, in spaced relation to the trackway, in combination with a cab carried apparatus arranged to co-act mechanically with the ascending and electrically with the descending sections of said ramp.

26. In a railway signal system, a track way, a road side member in spaced relation to the track way, said road side member having ascending and descending insulated sections, in combination with a car carried apparatus having as elements thereof a shoe, a plunger and electroresponsive means adapted to co-act with said descending section, to suspend said plunger, and said shoe and plunger arranged to co-act with said ascending section to mechanically release said electroresponsive means.

27. In a railway signal system, a track
way divided into blocks, a road side member
in each of said blocks comprising ascending
and descending sections, said descending sec-
5 tions being electrically controlled by the
condition of a plurality of blocks adjacent
thereto, in combination with a car carried
apparatus having a suspended shoe, a
plunger and an electroresponsive member,
said shoe adapted to co-act mechanically 10
with said ascending section, and electrically
with said descending section.

ANDREW J. BROOKINS.

In the presence of—

CHARLES TURNER BROWN,
J. SCUDDER.