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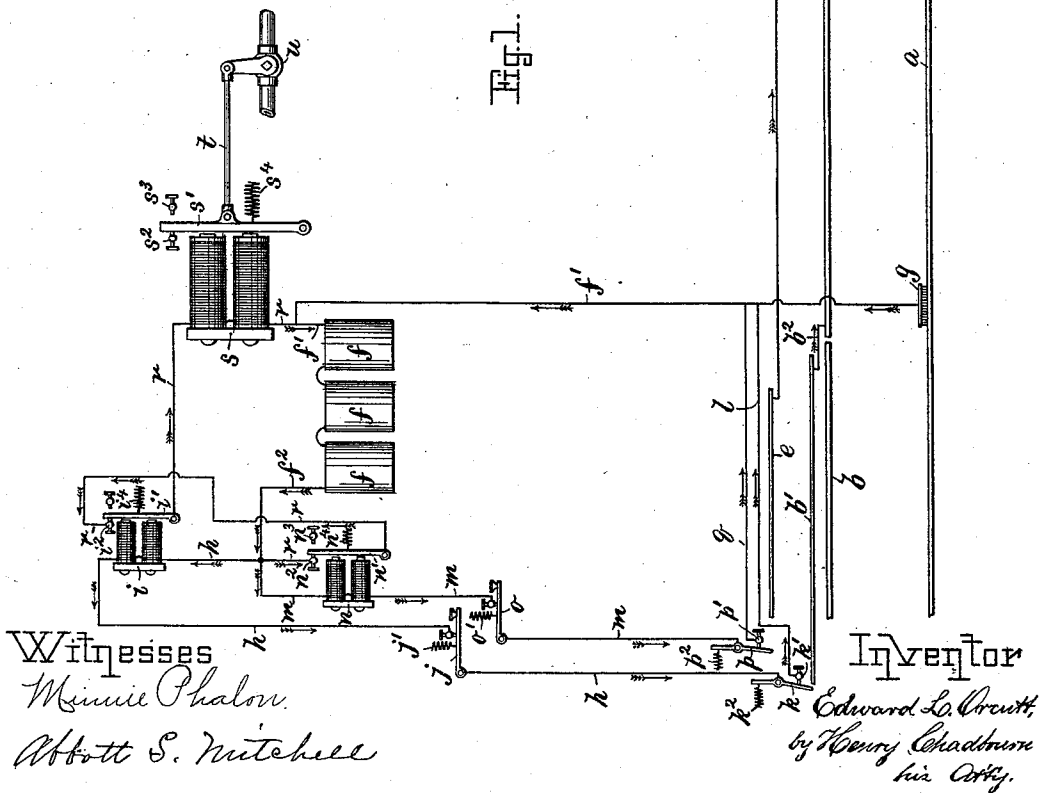
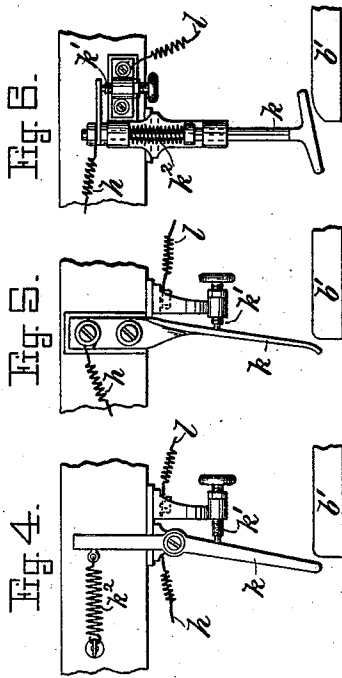
2 Sheets—Sheet 1.

E. L. ORCUTT.

ELECTRIC SAFETY APPLIANCE FOR RAILROADS.

No. 531,214.

Patented Dec. 18, 1894.



Witnesses
Minnie Phalon.
Abbott S. Hutchins

Inventor
Edward L. Cressett,
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his Atty.

(No Model.)

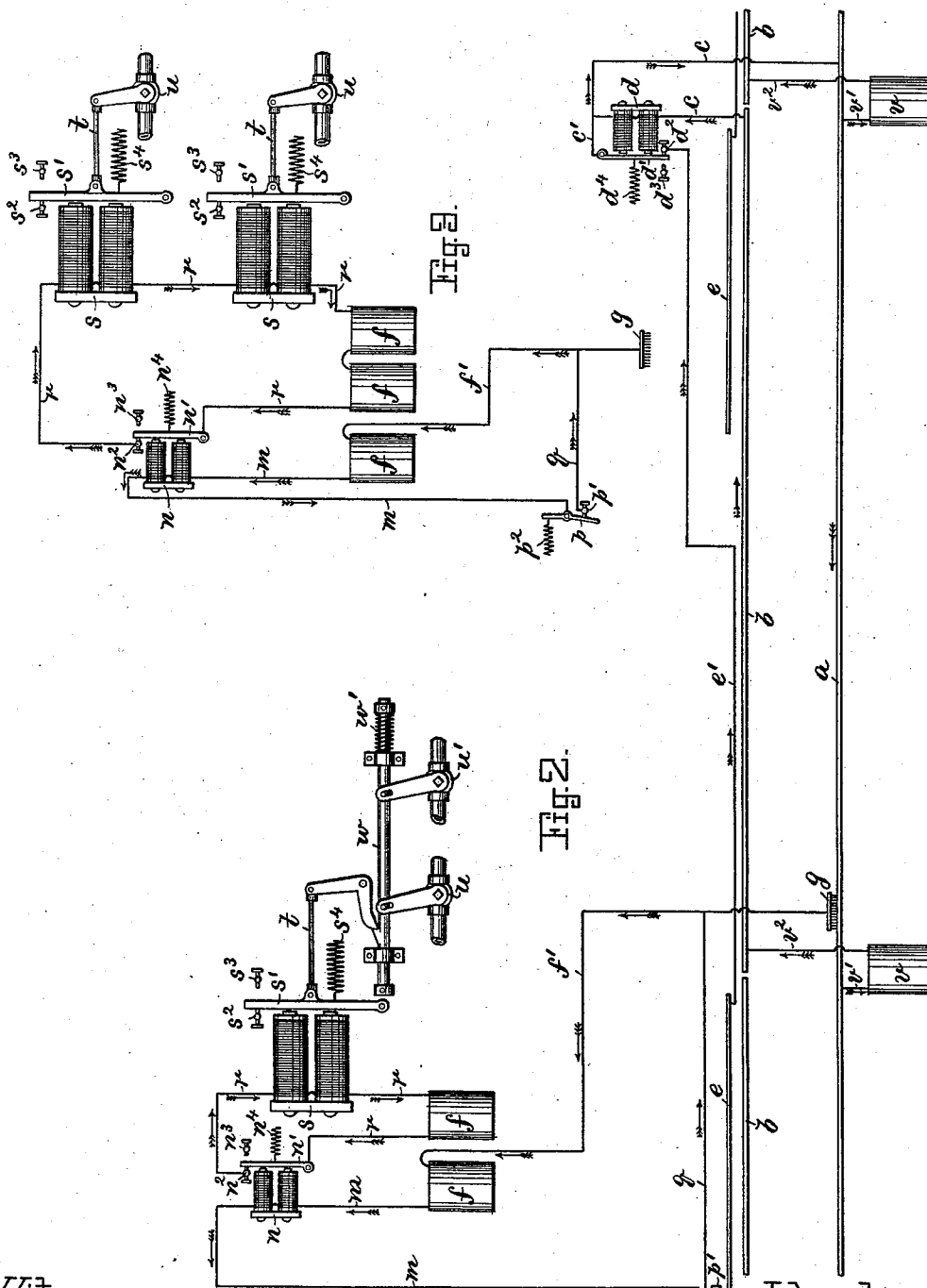
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UNITED STATES PATENT OFFICE.

EDWARD L. ORCUTT, OF SOMERVILLE, MASSACHUSETTS.

ELECTRIC SAFETY APPLIANCE FOR RAILROADS.

SPECIFICATION forming part of Letters Patent No. 531,214, dated December 18, 1894.

Application filed November 2, 1893. Serial No. 489,809. (No model.)

To all whom it may concern:

Be it known that I, EDWARD L. ORCUTT, a citizen of the United States, residing at Somerville, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Electric Safety Appliances for Railroads; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in electric safety appliances for railroads, and is especially designed for the purpose to automatically stop a train of cars if either of the rails of a section of the track ahead is broken, if a switch or drawbridge in said section is misplaced, if a car or similar object is on the rails of said section or if the mechanism constituting said appliance is not in perfect working order.

In carrying out this invention one of the rails of the track is preferably constructed so as to be in electrical contact throughout its entire length, or in other words is a continuous rail and forms a conductor for electricity from one end of the track to the other end, while the other rails are divided up into sections or blocks of any convenient length. Each of said sections of rails is in electrical connection with a contact surface or plate located in some convenient position to be brought into contact with a brush or brushes on the train prior to the entrance of the train upon the section of the rail to which said plate is connected. Each block or section of the rail is in electrical connection with the opposite rail by means of a conductor which includes an electro-magnet. This construction of the track causes it to be composed of a series of incomplete electric circuits each circuit being composed of a contact surface or plate, an insulated section of one of the rails, the opposite continuous rail, connections between the contact plate and insulated section of the rail and between the insulated section of the rail and the opposite rail, the latter connection containing an electro-magnet which is energized by a current of electricity passing through said circuit when completed which current may be generated by any convenient source of electricity carried

on the train or located at some convenient place near the track.

A second series of incomplete circuits are employed upon the track, which are composed of a second series of contact surfaces or plates, the continuous rail of the track and connection between the contact plate and the continuous rail which connection includes the armature of the electro-magnet in the other incomplete track circuit and is broken or closed by the movements of said armature caused by said electro-magnet, or it may include a mechanical device for breaking or closing said circuit as will be described hereinafter. This second incomplete track circuit is normally broken by the armature of the electro magnet in the first incomplete circuit, and is closed only when said electro-magnet is energized by a current of electricity through said first circuit.

Upon the train of cars, and preferably upon the locomotive, is carried a source of electricity, two complete closed circuits, each of said circuits including an electro-magnet, and a looping or switching brush, which brush comes into contact with its respective series of contact plates on the track, and loops or switches in the incomplete circuit on the track, which includes such contact plate. A third complete closed circuit is also carried upon the train, which circuit includes an electro-magnet and both armatures of the electro-magnets of the other two circuits on the train and this last circuit is either broken or closed by the movements of either or both of said armatures—that is to say, when the two complete circuits on the train which include the electro-magnets and the switch brushes, are properly charged and are complete, the electro-magnets will be energized and their armatures will be drawn toward them and in such position as to close or complete the third circuit and thus the electro-magnet in said third circuit will be energized and its armature drawn toward the magnet.

The armature of the electro-magnet in the third circuit on the locomotive is properly connected to a valve or valves governing the supply of motive fluid to the locomotive, or the movements of the air brakes, either or both, as desired, so that when the circuits are complete and properly charged the motive

fluid valve will remain open and the air-brake valve in such a position as to withdraw the brake from the train; but should either of the three circuits on the train be broken from any cause, either from failure of the supply of electricity or from defects in any of the apparatus, then the third circuit will be opened or broken and the movements of the armature of its electro-magnet will cause the stopping of the train, either by cutting off the supply of motive fluid, setting the air brakes, or both cutting off the supply of motive fluid and setting the air brakes. As the train moves over the rails, the brushes on the train come into contact with their respective contact plates of the two incomplete circuits on the track by which the currents of electricity in the circuits which include the brushes are switched through the incomplete circuits on the track. Now if these complete circuits are without breaks, the two circuits on the locomotive to which they are connected will remain closed, and the train will be allowed to proceed over said section of the track; but if through any cause either or both of the incomplete circuits are broken or open, then the two circuits on the locomotive to which they are connected will be broken and the train will be stopped by the shutting off of motive fluid or setting of the brakes, as above set forth.

On the accompanying drawings, representing the invention in different forms, Figure 1 represents the appliance diagrammatically in its preferred form and operating a single valve. Fig. 2 represents the appliance also diagrammatically, in a different form, arranged to release two valves. Fig. 3 represents a diagram of the train apparatus, arranged to operate two valves. Fig. 4 represents a switching brush pivoted to the train and operated by a suitable spring. Fig. 5 represents a different form of brush. Fig. 6 represents still another form of a switching brush.

Similar letters refer to similar parts on the different parts of the drawings.

Referring to Fig. 1 of the drawings, the track of the railroad is composed of the continuous rail *a* and the opposite sectional rail formed of a series of insulated sections *b b b*. Each of said sections *b* is in electrical connection with a contact surface or plate *b'* by means of the conductor *b²* substantially as shown. These contact plates are preferably located close to the rail of the section preceding the one with which they are in electrical connection. The opposite end of each section to where its contact plate *b'* is connected is in electrical connection with the opposite continuous rail *a* by means of the conductor *c*, and in said conductor is located the electro-magnet *d*. Thus each contact plate *b'*, conductor *b²*, connected section *b* of rail, conductor *c*, electro-magnet *d* and continuous rail *a*, forms an incomplete circuit, which is termed the "track-circuit." A contact sur-

face or plate *e* preferably shorter than the contact plate *b'* is arranged near each contact plate *b'* and is in electrical connection with the front stop *d²* for the armature *d'* of the electro-magnet *d*, by means of the conductor *e'*.

The armature *d* which is normally held against the back stop *d³* by means of the spring *d⁴* or equivalent device, is in electrical connection with the conductor *c*, or, if so desired, direct with the rail *a*, by means of the conductor *c'*. Thus each contact plate *e*, conductor *e'*, armature *d'*, conductors *c'* and *c* and continuous rail *a*, forms an incomplete circuit, which is termed the "parallel or actuating circuit."

Each train of cars which is to move over the track, and whose movements are to be governed by this improved safety appliance, is provided with a proper source of electricity, which may consist of a galvanic battery *f f f* as represented on the drawings, or with a suitable dynamo, storage battery or other well known means for supplying electricity. One pole of this source of electricity is in electrical connection with the continuous rail *a* by means of the conductor *f'* and the wheels of the train which travel on said rail, or by a suitable brush *g*, substantially as shown. The opposite pole of the source of electricity is in electrical connection by means of the conductor *f²*, with three circuits for the conveyance of the current of electricity, all of which circuits are complete or closed circuits and are as follows:

The first circuit connected with the source of electricity, which is termed the "track-circuit charging-circuit," consists of the conductor *h*, the electro-magnet *i*, and circuit-breaker *j* included in said conductor, the switching or looping brush *k* to which said conductor is in electrical connection, the stop *k'* for said brush, and against which it is normally held in contact by the spring *k²* or equivalent device, the conductor *l* forming an electrical connection between the stop *k'* and conductor *f'* and said conductor *f'* to the source of electricity. Thus it will be seen that said first circuit is normally a closed circuit, as the circuit breaker *j* is normally held closed by the spring *j'*.

The second circuit connected with the source of electricity which is termed the "parallel or actuating-circuit charging-circuit," consists of the conductor *m*, the electro-magnet *n* and circuit breaker *o* included in said conductor, the switching or looping brush *p* with which said conductor is in electrical connection, the stop *p'* for said brush and against which it is normally held in contact by the spring *p²* or equivalent device, the conductor *q* forming an electrical connection between the stop *p'* and conductor *f'* and said conductor *f'* to the source of electricity. Thus it will be seen that said second circuit is normally a closed circuit as the circuit breaker *o* is normally held closed by the spring *o'*.

The third circuit connected with the source

of electricity, which is termed the "train controlling circuit," consists of the conductor *r*, the front stop *n*² for the armature *n*' of the electro-magnet *n*, the armature *n*', the front stop *i*² for the armature *i*' of the electro-magnet *i*, the armature *i*' and the electro-magnet *s* included in said conductor, and the conductor *f*' with which said conductor *r* is in electrical connection to the source of electricity.

The electro-magnet *s* is provided with the armature *s*' held against the front stop *s*² when the "train controlling circuit" is charged and said electro-magnet energized, but withdrawn from said front-stop against the rear stop *s*³ by the spring *s*⁴ when the "train controlling circuit" is broken.

The armature *s*' is connected by a suitable connection *t* with a valve *u*, which valve may govern either the flow of motive fluid to the locomotive or the setting of the brakes, the latter being the preferable arrangement, or said connection may govern the operation of two or more valves as shown in Fig. 2, which will be fully described hereinafter. The valve *u* is such that the train is free to proceed when the connected armature *s*' is against its front-stop, but will cause the stopping of the train should the armature leave said stop.

The armature *i*' of the electro-magnet *i* is held against the front stop *i*² when the "track-circuit charging-circuit" is charged and said electro-magnet is energized, but is withdrawn from said front-stop against the rear-stop *i*³ by the spring *i*⁴ when the "track-circuit charging-circuit" is broken; also the armature *n*' of the electro-magnet *n* is held against the front-stop *n*² when the "parallel or actuating-circuit charging-circuit" is charged and said electro magnet is energized, but is withdrawn from said front-stop against the rear stop *n*³ by the spring *n*⁴ when the "parallel or actuating-circuit charging-circuit" is broken.

The brush *k* in the "track-circuit charging-circuit" is arranged upon the train of cars in such a position as to engage the series of contact plates *b'* *b'* in the "track-circuit," and by so engaging the plate said brush is disconnected from the stop *k*' thereby looping the "track-circuit" into the "track-circuit charging-circuit" in the place of the conductor *l*.

The brush *p* in the "parallel or actuating circuit charging-circuit," is arranged upon the train of cars in such a position as to engage the series of contact plates *e* *e* in the "parallel or actuating-circuit" and by so engaging the plate said brush is disconnected from the stop *p*', thereby looping the "parallel or actuating-circuit" into the "parallel or actuating-circuit charging-circuit," in the place of the conductor *q*.

With the supposition that all of the apparatus is in perfect working order and the section of track upon which the train is to enter is complete and unobstructed, the operation of the

safety appliance is as follows: The three circuits on the train being closed will allow the train to proceed, which will cause the brush *k*' to come in contact with the plate *b'* which is connected with the section of the track upon which the train is to enter. This will loop the track-circuit of said section into the "track-circuit charging-circuit," on the train, as above described, and as this combined circuit will be a closed circuit, the armature *i*' will remain in such position as not to break the "train-controlling-circuit," but will energize the electro-magnet *d*' so as to attract its armature *d*' thereby making the "parallel or actuating-circuit" unbroken by said armature. The brush *p* will then engage the contact plate *e* which is included in the "parallel or actuating-circuit." This will cause the looping of the "parallel or actuating-circuit" of said section, into the "parallel or actuating-circuit charging-circuit" on the train, as above described, and as this second combined circuit will be a closed circuit the armature *n*' will also remain in such position as not to break the "train-controlling-circuit" and the train will be allowed to proceed over said section of the track in safety; but should there be a break in either the "track-circuit" or the "parallel or actuating-circuit," caused by a broken rail, a misplaced switch, a break in any of the conductors of said circuits, or the shunting of the "track-circuit" on account of a car or similar object obstructing the free passage over said section of track, thereby preventing the energizing of the electro-magnet *d*, and causing the breaking of the "parallel or actuating-circuit" by the armature *d*', one or both of the circuits on the railroad will be broken, and consequently one or both of the armatures *i*' and *n*' will be moved by their respective spring, so as to open the "train-controlling-circuit" and thus stop the train before it enters the section of track connected with the plates on which the brushes are in contact as said plates are sufficiently long to stop the train when at full speed, before the brushes leave them.

In the modification shown in Fig. 2, the appliance is shown diagrammatically when the "track-circuit charging-circuit" carried on the train, shown in Fig. 1 is dispensed with, and in which case the "track-circuit" of each section or block of the track is a closed circuit, being charged by a separate and suitable source of electricity *v* arranged in some convenient position, preferably near its connected section, which source of electricity may be varied, as in that used on the train as above described, and which has one of its poles in electrical connection with the continuous rail, *a* by means of the conductor *v*' and the other pole in electrical connection with the section *b* of the opposite rail, by means of the conductor *v*². By this construction the electro-magnet *d* included in the "track-circuit" is energized at all times excepting when

the "track-circuit" is broken or the rails included in said circuit are obstructed and when said electro-magnet is energized its armature d' included in the "parallel or actuating-circuit" of said section of the track will be attracted and held in contact with the front-stop d^2 thereby preventing a break in the "parallel or actuating-circuit" so as to allow the train to proceed over said section of track as set forth in the description of Fig. 1; but should any part of the "track-circuit" be broken or the rails in said circuit obstructed and its circuit thereby shunted as above set forth then the armature d' will be released by the failure to energize the electro magnet, and the train be stopped before it reaches the broken or obstructed section of track by the opening of the "train-controlling circuit" on the train, as above described. In this modified form of the appliance as shown the operation of the armature s' of the electro-magnet s in the "train controlling circuit" when released by the breaking of said circuit acts to release the valve u or valves u and u' one or both which govern the train which valve or valves are then moved by mechanical means as for instance a rod w moved automatically when released by means of a spring w' as shown or the action of said armature may operate upon one or more valves in a manner similar to that shown in Fig. 1. When the valves u and u' move mechanically as shown in Fig. 2 are used it necessitates their being returned by hand or mechanical means before the train will be allowed to proceed, whereas when said valves are connected direct to the armature s' in a manner similar to the construction shown in Fig. 1, said valves will be automatically brought into position to allow the train to proceed by the repairing of the break in the circuit or the removal of the obstruction from the rail.

The modification of the train apparatus shown in Fig. 3, consists in including two electro-magnets s in the "train controlling-circuit," each of which is energized by the current in said circuit and operates a valve u connected to the armature of the respective magnets by the connection t' or by other and well known mechanical means.

In Figs. 4, 5 and 6 are shown three of the different constructions of the switching or looping brushes adapted to be used on the train to form a contact with the contact plates or the track and thereby to loop in the "track" or "actuating-circuit." In Fig. 4 the brush k is pivoted to some suitable support, and is held against the stop k' by means of the spring k^2 , which spring yields and allows the contact between the brush and stop to be broken when the brush comes in contact with the plates on the track. In Fig. 5 the brush k is shown forming in itself a spring which yields when contacting with the plates and breaks the contact between the brush and stop k' . In Fig. 6 the brush k is shown as sliding in suitable bearings against the influence of the

spring k^2 when coming into contact with the plates on the track, and thereby breaking the contact of the brush with the stop k' . It is obvious that different constructions of the brushes within the scope of mechanical skill may be used in this appliance, without departing from the invention.

Separate sources of electricity f may be used to charge each of the circuits in this device as shown in Figs. 2 and 3 or one source of electricity may be used to supply two or more of said circuits, as shown in Fig. 1.

It will be readily understood that the various and modified constructions of the different parts of the invention shown on the drawings may be interchangeable—that is to say, the connecting mechanism between the armature f' and valves u and u' shown in Fig. 2 may be exchanged with that shown in Fig. 1, if so desired, and the same is the case with other parts of the appliance.

The circuit breakers j and o shown in Fig. 1 are employed when it is desired to test the workings of the mechanism carried on the train by the breaking of either of the circuits containing them, and it will be obvious to any mechanic that a similar circuit-breaker may be placed in the "track" or "actuating-circuit," and be attached to a switch, target or other device used on a railroad to stop a train so that the circuit containing it will be broken or stop the train when said device so indicates.

It will be obvious to any person skilled in the art to which this invention appertains that the "train-controlling-circuit" might be entirely dispensed with and the valve or valves u u' be connected directly with the armature or armatures of the electro-magnet or magnets included in the "parallel or actuating-circuit charging-circuit" and operate to produce the result set forth, but it is thought preferable to use a "train-controlling-circuit" as shown on the drawings.

It will also be obvious that when two valves are used two separate and distinct "train-controlling-circuits" might also be employed, one for each valve, if so desired.

Having thus fully described the nature, construction, and operation of this invention, what I wish to secure by Letters Patent and claim is—

1. In an electric safety appliance for railroads, the combination with a track-circuit formed in part of the rails of the track and a parallel or actuating-circuit so arranged that the charging or breaking of one of said circuits will close or break the other and a contact plate in each circuit, of a source of electricity, a closed track-circuit charging-circuit, a closed parallel or actuating-circuit charging-circuit, and a closed train-controlling-circuit on the train switching or looping brushes in the track-circuit charging-circuit and in the parallel or actuating-circuit charging-circuit, to engage respectively the contact plates in the track-circuit and parallel or actuating-

circuit, to loop the latter circuits into the former when said brushes engage said plates, and mechanism substantially as described, operated by the breaking of either of said circuits to stop the train, for the purpose set forth.

2. In an electric safety appliance for railroads, a track mechanism consisting of a track-circuit formed in part of the rails of the track, an electro-magnet contained in said circuit, a parallel or actuating-circuit, the armature of said electro-magnet contained in the latter circuit breaking or closing the circuit by its movements and a contact plate in the parallel or actuating-circuit, combined with mechanism carried on the train consisting of a suitable source of electricity for the circuits contained therein, a closed circuit for the contact plate in the track mechanism, a switching or looping brush and electro-magnet in said closed circuit, a closed train-controlling-circuit, an electro magnet and the armature of the electro-magnet in the other closed circuit on the train contained in the train-controlling-circuit and mechanism substantially as described, operated by the movements of the armature of the electro-magnet in the train-controlling-circuit to automatically govern or control the movements of the train for the purpose set forth.

3. In an electric safety appliance for railroads, a track-mechanism consisting of an open track-circuit, an electro-magnet contained in said circuit, an open parallel or actuating-circuit, the armature of the electro-magnet contained in the latter circuit breaking or closing the circuit by its movements, both of said circuits being formed in part of the rails of the track and a contact plate in each of said circuits, combined with a train mechanism consisting of a suitable source of electricity for the circuits contained therein, a closed track-circuit charging-circuit, a closed parallel or actuating-circuit-charging-circuit, a switching or looping brush to engage their respective contact plates in the track mechanism and an electro-magnet contained in each of said closed circuits, a closed train-controlling-circuit, an electro-magnet and the armatures of the electro-magnets in both charging-circuits contained in the track-controlling-circuit, and mechanism substantially as described operated by the movements of the armature of the electro-magnet in the train controlling-circuit to govern or control the movements of the train, for the purpose set forth.

4. In an electric safety appliance for railroads the combination of a track mechanism consisting of electric circuits, said circuits being composed in part of the rails of the track, and contact plates, a train mechanism consisting of a plurality of closed circuits, switching or looping brushes to loop the track circuits into the train circuits and mechanism operated by the breaking of either or all of the

circuits to automatically stop the train, for the purpose set forth.

5. In an electric safety appliance for railroads, the combination of a track mechanism consisting of a track circuit composed in part of the two parallel lines of the rails of the track and including an electro magnet, a parallel or actuating circuit controlled by the action of said electro magnet, and a contact plate in the parallel circuit, a closed circuit on the train having switching brush to engage said plate, an electro magnet in said closed circuit and mechanism controlled by said electro magnet to automatically stop the train when said closed circuit is broken, for the purpose set forth.

6. In an electric safety appliance for railroads, the combination of a track mechanism having a contact plate substantially as described, two closed circuits on the train, a switching or looping brush in one train circuit to engage the contact plate in the track mechanism, an electro magnet in the closed circuit which has the switching or looping brush, the armature of said electro magnet forming a part of the other closed circuit on the train, an electro-magnet in the second train circuit and mechanism connected to and operated by the armature of the electro-magnet in said second circuit to cause the stopping of the train by the breaking of either of the circuits on the train for the purpose set forth.

7. In an electric safety appliance for railroads, the combination with the incomplete track circuit composed in part of the rails having an electro magnet included therein, a second circuit parallel with the track circuit controlled by the magnet in the track circuit and contact plates in said circuits, of closed circuits upon the train said circuits having looping brushes included therein to engage the contact plates in the track mechanism to loop the track mechanism into the train circuits, the closed circuits on the train being controlled by the track mechanism substantially as described.

8. In an electric safety appliance for railroads, the combination of closed circuits carried on the train operating when broken to stop the train and looping brushes included in said circuits substantially as described, an incomplete circuit composed in part of two parallel lines of the rails of the track and including an electro magnet, a contact plate in said incomplete circuit, a second contact plate, connecting mechanism between the electro magnet and the second contact plate, the looping brushes on the train adapted to engage the contact plates in the track mechanism whereby the train circuits are controlled by the electro-magnet in the track circuit for the purpose set forth.

9. In an electric safety appliance for railroads, the combination with a closed circuit carried on the train operating when broken to

stop the train and a looping brush included in the train circuit, of a track mechanism consisting of a track circuit composed in part of the two parallel lines of the rails of the track and including an electro magnet, a parallel or actuating circuit including the armature of the electro magnet in the track circuit and a contact plate the looping brush engaging the contact plate to loop the track mechanism into the train circuit whereby the train circuit is controlled by the electro magnet in the track circuit, for the purpose set forth.

10. In an electric safety appliance for railroads, the combination with a plurality of closed circuits carried on the train operating to stop the train by the breaking of any or all of said circuits and a looping brush included in one of these train circuits, of a track mechanism consisting of a track circuit composed in part of the two parallel lines of the rails of the track and including an electro magnet, a parallel or actuating circuit including the armature of the electro magnet in the track circuit and a contact plate, the looping brush engaging the contact plate to loop the track mechanism into the train circuits whereby the circuits on the train are controlled by the electro magnet in the track circuit for the purpose set forth.

11. In an electric safety appliance for railroads the combination with a track circuit formed in part of the rails of the track and a parallel or actuating-circuit so arranged that the charging or breaking of one of said circuits will close or break the other and a contact plate in each circuit of a source of electricity, a closed track-circuit charging-circuit, a closed parallel or actuating-circuit, charging-circuit, and a plurality of closed train-controlling-circuits on the train, switching or looping brushes in the track-circuit charging-circuit, and in the parallel or actuating-circuit charging-circuit to engage respectively the contact plates in the track-circuit and parallel or actuating-circuit to loop the latter circuits into the former when said brushes engage said plates, and mechanism substantially as described operated by the breaking of either of said circuits to stop the train, for the purpose set forth.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

EDWARD L. ORCUTT.

In presence of—
HENRY CHADBURN,
MINNIE PHALON.