(No Model.)

C. D. TISDALE.

ELECTRIC RAILWAY SIGNAL.

No. 252,545. Patented Jan. 17, 1882.

Fig. 1.

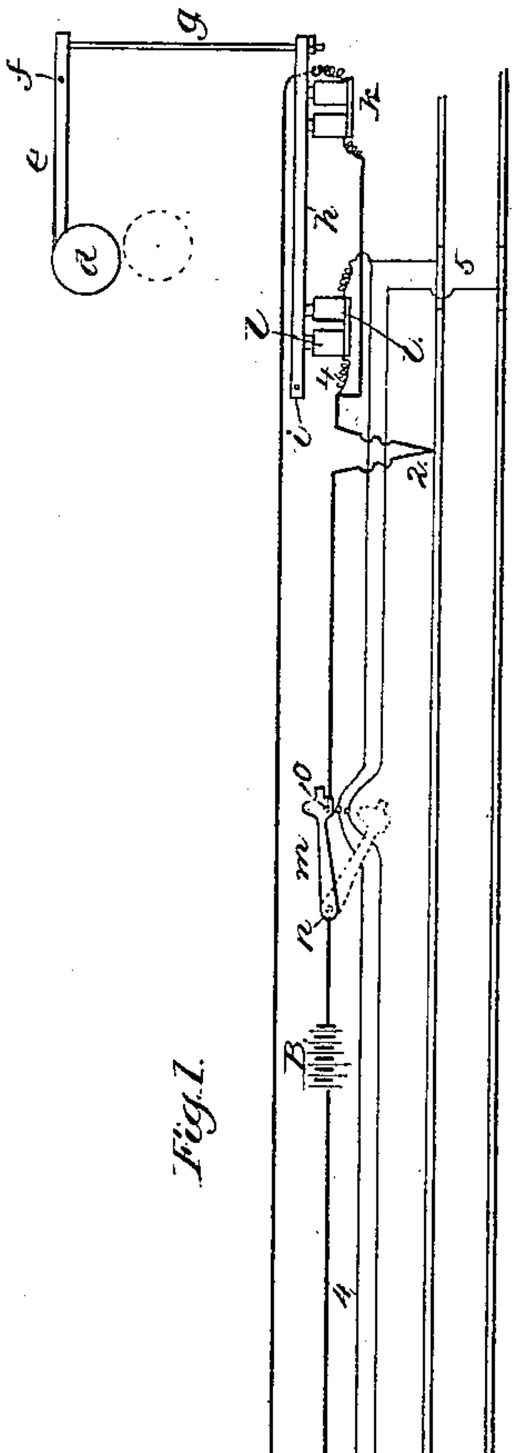


Fig. 2.

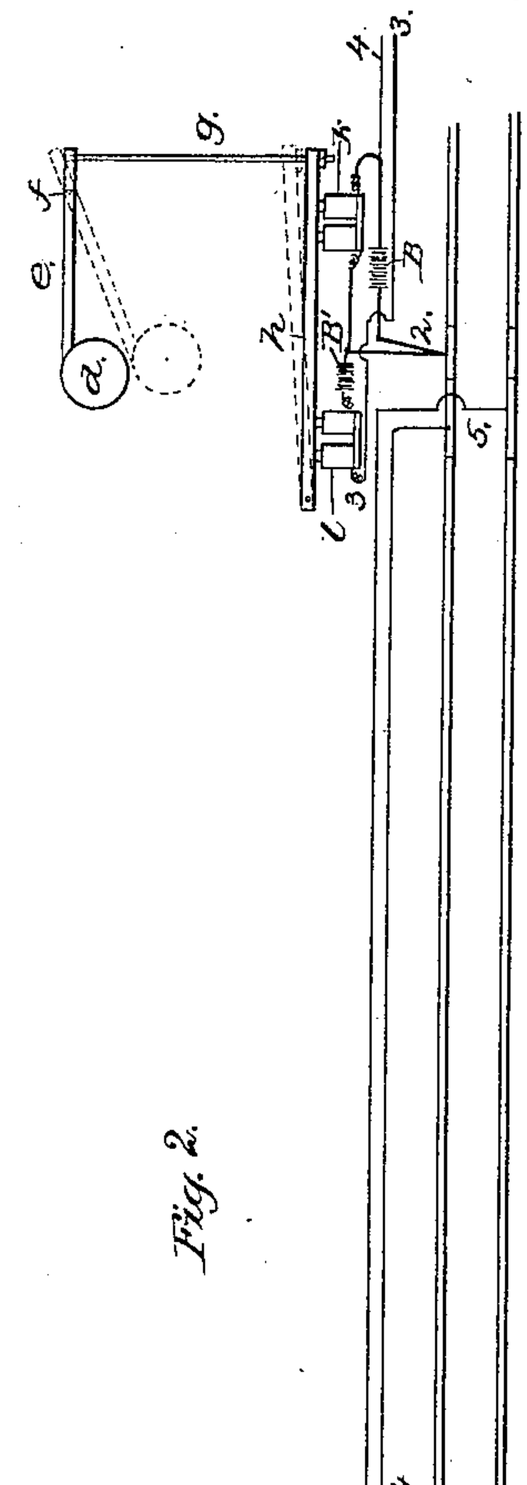


Fig. 4

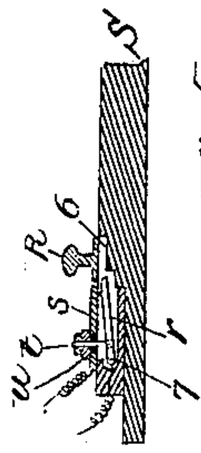


Fig. 5.

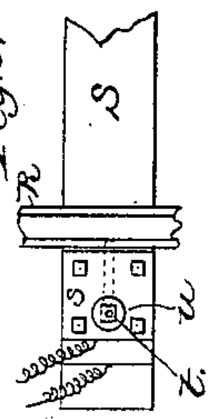


Fig. 3.

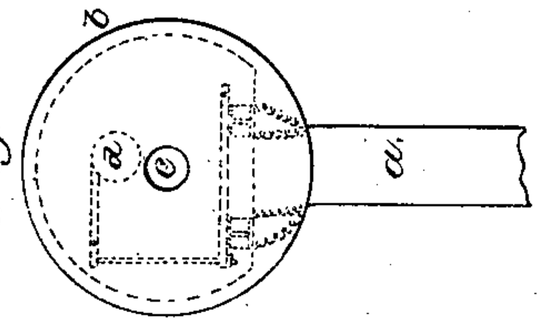
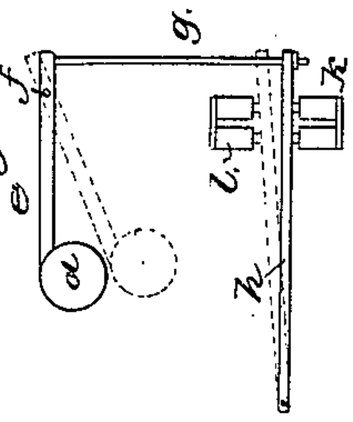


Fig. 6.



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UNITED STATES PATENT OFFICE.

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ELECTRIC RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 252,545, dated January 17, 1882.

Application filed August 29, 1881. (No model.)

To all whom it may concern:

Be it known that I, CHARLES D. TISDALE, of Boston, Suffolk county, State of Massachusetts, have invented a new and useful Improvement in Electric Railway-Signals, of which the following description, in connection with the accompanying drawings, is a specification.

My invention relates to railway-signals, and is intended as an improvement upon the apparatus shown in Letters Patent No. 209,148, dated October 22, 1878, to which reference may be had. In the said patent I have shown one or more signals controlled by electro-magnets in a circuit that is normally closed, but momentarily broken as a train passes a given point to demagnetize the magnets, release the armatures, and permit the position of the signals to change. When thus released the armature was retracted so far from the poles of the magnet as to be substantially unaffected thereby, so that upon the subsequent closing of the circuit it was not again moved up to the poles, and the signal remained in the position assumed upon breaking the circuit until the armature was positively restored to the poles of its magnet by means of mechanism actuated mechanically by the passing train. By this arrangement it is possible to cause the armature to move away from the poles of the magnet by a circuit-breaker operated at any point to which the circuit could be extended; but it is not practicable to extend the mechanical connections any considerable distance, so that the armature could be moved up to the poles of the magnet only when the train passed the point at which the said magnet and signal was located. In the said apparatus the signal was in the position indicating "danger" when the armature was attracted and indicating "safety" when the armature was removed from the poles of its magnet, the train, when passing a signal-post, mechanically setting the signal at "danger" by moving the armature up to the poles of its magnet, where it was retained by the attraction thereof while the train was passing over the block-section, at the end of which it broke the circuit and permitted the signal to return to the "safety" position, where it remained till operated by another train, the circuit-breaker being closed immediately after the train had passed, so that the signal would be held at "danger" when set by the next train, as before.

It is desirable that the signal should indicate "danger" when the armature is retracted and "safety" when it is held by the magnet, as any failure or breakage in any part of the apparatus will thus be indicated at once; and to accomplish this and enable the proper movements of the signal to be controlled from any desired point is the object of my present invention, which consists mainly in employing any auxiliary magnet and circuit properly arranged to draw the armature into the range of its main controlling-magnet, instead of employing mechanical means to do this.

The auxiliary circuit containing the auxiliary magnets is normally open, it being closed momentarily at any desired point to set the signal to "safety," where it is retained by the main magnet after the auxiliary circuit is restored to its normal or open condition. The said auxiliary circuit is herein shown as an open branch of the main circuit, provided with circuit-closers placed at the points from which it is desired to operate the signals, so that when closed a portion of the current of the main battery will pass through the auxiliary magnet and cause it to draw the armature up to the poles of the said magnet, and thus restore the signal to its "safety" position, where it is held by the main magnet until the main circuit is broken, as in my former invention.

The magnets are herein shown as acting upon a lever at different distances from its fulcrum, the main magnet being remote from the fulcrum where the movement is large and the auxiliary being near the fulcrum where the movement is small, so that the armature does not pass beyond the range of its effective attractive influence. By this arrangement a current of given strength divided between the two magnets will have a greater effect upon the lever when retracted than if the current is confined to the main magnet, and the various

parts may be so adjusted that the former condition will cause the movement of the lever, while the latter will not.

Figure 1 is a diagram illustrating the circuit and apparatus as employed upon a single-track road where it is desired to set signals at both ends of the section at "danger" when the train enters either end of the section, and to retain them so until the train passes off the section. Fig. 2 illustrates the arrangement employed on a double-track road where the trains move on a given track in one direction only, and it is desired to set a signal at the end of the section to "danger" when the train passes it, entering the section, and to retain it until the train passes off the section, when the said signal will be set to "safety," and the signal of the next section set to "danger;" Fig. 3, an elevation of the signal-post containing the operating mechanism; Figs. 4 and 5, a section and plan view of a convenient form of circuit-breaker for momentarily opening the circuit as the train passes a given point, and retaining it closed at other times; and Fig. 6, a modification to be referred to.

The apparatus is mounted upon a signal-post, *a*, (see Fig. 3,) provided with a head or case, *b*, of suitable form to inclose the operating parts, and provided with an opening, *c*, behind which the signal *d* is placed when desired to indicate "danger," and from which it is removed when desired to indicate "safety."

The signal *d* consists of a disk, of any desired color, usually red, mounted at the end of a lever, *e*, pivoted at *f*, and connected by link *g* with the vibrating end of the armature-lever *h*, pivoted at its other end, *i*.

The construction of the signal forms no part of my present invention, and is substantially the same as shown in Patents Nos. 218,693 and 229,285, to which reference may be had.

The said armature-lever *h* may be made of iron, or provided with armatures properly arranged to be controlled by the main and auxiliary electro-magnets *k l*, the former being placed remote from the pivot *i* of the said lever where its movement is greatest, and the latter being placed near its pivotal point where its movement is very slight. By this arrangement the lever *h* is retracted by the weight of the signal *d*, when the main magnet *k* in a normally-closed circuit is momentarily demagnetized, to the position shown in dotted lines, Fig. 2, where it is so remote from the poles of the said magnet *k* that the latter is not able to draw it up thereto when subsequently again magnetized, although the magnet *k* is amply strong to retain the lever when moved up thereto in the position shown in full lines.

The auxiliary magnet *l*, which may be made more powerful than the main magnet, and which does all the work of operating the signal, owing to the smaller movement of the lever from its poles, is able to affect the said lever, and when its circuit, normally open, is momentarily closed, it draws the lever up to the full-line position, where it is held by the main magnet, the circuit of which is at this time closed.

The main circuit (shown clearly in heavy lines, it including the main battery B, which may be located at any desired point therein) contains circuit-breakers 2, which are normally closed, but adapted to be broken by the train in passing. The said circuit includes the coils of the main signal-magnets *k* of as many signals as it is desired to operate simultaneously in the circuit, all the said magnets being demagnetized by the operation of any of the circuit-breakers 2, and permitting the signals to drop to the position shown in dotted lines, Fig. 2, to indicate "danger," and carry the lever *h* beyond the effective influence of the said magnet.

The auxiliary circuit is shown as consisting of the wire 3, branching from the main circuit on one side of the battery B, and the wire 4, branching from it at the other side. This auxiliary circuit, including the coils of the auxiliary magnets *l*, has terminals or electrodes properly located to be connected by a circuit-closer at any desired point, the said terminals being shown as carried in the double-track arrangement to the remote end of the section, and connected with opposite rails of the track, as at 5, so that the wheels and axles of the train as passing will close the said branch circuit, and cause a portion of the current of the battery B to pass through the auxiliary magnet and magnetize it, and cause it to draw the lever *h* up to the poles of the main magnet *k*, to set the signal to "safety" again. In the single-track arrangement it is necessary to close the branch circuit at either end of the section, and each wire 3 and 4 extended throughout the section has at each end thereof branches or electrodes connected with the opposite rails of the track, as at 5, to be operated as previously described.

If desired, the auxiliary magnets *l* may be operated by an independent circuit; or, if the divided current of the battery B in acting upon both the magnets *k l* is not of sufficient power to draw up the armature-lever *h* and set the signal to "safety," an auxiliary battery, B′, located in the auxiliary branch circuit, may be employed, its current being fully confined to the auxiliary magnet.

Circuit-breakers may be located at any point in the main circuit to set the signals to "danger," or they may be set by cutting the wire circuit in case of emergency.

In order to set the signals to "safety" it is necessary, in addition to again closing the main circuit, to also operate the auxiliary magnet, as by forming a connection between the branch wires 3 4 to close its circuit. An arrangement for accomplishing this is shown in Figs. 1 and 2, it being intended to indicate a break in the track, such as formed by a switch or draw-bridge. It consists of an electric switch or key, *m*, pivoted at *n* in connection with one por-

tion of the main circuit and resting on an anvil or button, *o*, to complete the main circuit when in the position shown in full lines. When in the position shown in dotted lines the main circuit is broken, the switch *m* being properly connected with the apparatus employed to move the rails or draw-bridge bolt to assume this dotted-line position when the track is broken. The wires 3 4 have anvils or buttons placed in such position relative to the button in the main circuit that while the switch *m* is being returned from its dotted to its full-line position it is in contact with all the buttons simultaneously, so that it connects the wires 3 4 to bring the auxiliary magnet in circuit, causing the armature-lever to be drawn up, as before described, and before it has disconnected the said wires it has completed the main circuit to return the said armature up to the poles of its magnet.

Circuit-controllers arranged like the one *m* may be placed in suitable boxes upon the telegraph-poles by which the circuit-wires are carried, so that the signals *d* may be operated by hand from those points, as is sometimes desired by the track workmen.

A form of circuit-breaker that I have employed with good results is shown in Figs. 4 and 5, it being mounted upon the sleeper S, properly chambered to receive it, the said sleeper being cut away beneath the rail R, as shown at 6, to permit a downward movement of the said rail relative to the sleeper as the train passes over it. The circuit-breaking lever *r* has one end pivoted at 7 and its other end extended beneath the flange of the rail R. The said lever *r*, which is of metal and connected with one of the wires of the circuit to be broken, is normally held by a link or bolt, *t*, in contact with its anvil-piece *s*, which is connected with the other wire of the circuit, and consists of a metal plate fixed relative to the sleeper S, the said link *t* being insulated from the anvil *s*, as shown in Fig. 4, and provided with a spring, *u*, shown as of rubber, to forcibly press the two terminals *r s* of the circuit together. When a train passes it depresses the rail R, which engages the end of the lever *r* and disconnects it from the anvil 3, breaking the circuit.

In the double-track arrangement, when it is desired to set the signal only when the train enters the section to guard its rear while in the said section, the main circuit of the magnet *k* need not extend beyond the signal-post, as shown at the right hand of Fig. 2; or it may extend as far as a given break in the track, the condition of which is to be indicated by the signal, as shown at the left hand of Fig. 2.

The terms "main" and "auxiliary" are merely used for the sake of distinction, the former being the one that is in effective operation the greater portion of the time; but the secondary magnet may be much the larger and stronger and operated by a greater battery.

The invention is not limited to the particular form of apparatus shown, as it may be greatly modified without changing the essential principle of the operation.

In Fig. 6 a modification is shown in which the auxiliary circuit is normally closed, the same as the main circuit, the auxiliary magnet *l* being placed opposite to the magnet *k* and acting in opposition thereto. In this arrangement either magnet is able to draw the lever *h* across the space between it and the opposite magnet, when unopposed by the said opposite magnet, and when both magnets are magnetized the lever will remain in contact with the one which is nearest, the other, on account of its greater distance, being unable to withdraw it. Thus, the signal being in its normal or "safety" position, and the lever *h* nearest the main magnet *k*, and both magnets being magnetized, if the main circuit is momentarily broken, the auxiliary magnet will be unopposed and will attract the lever *h*, causing the signal to indicate "danger," and it will retain it in this "danger" position after the main circuit has again been closed until the auxiliary circuit is broken, as by the train arriving at the opposite end of the section, when the reverse operation will take place, the armature being attracted by the unopposed main magnet, and then held thereby after the secondary circuit is closed and its magnet opposed to the main one.

In the single-track arrangement the circuit-controllers 5, which govern the action of the auxiliary magnets, have to be placed outside of the controllers 2, governing the main circuit, so that when a train enters the section from either end it operates the main circuit-controllers last, and leaves the signal on the corresponding position until the train passes off the section, when it operates the auxiliary controller last, leaving the signal in the corresponding condition, as is desired.

I claim—

1. The signal and main electro-magnet and its armature to control it, and a normally-closed main circuit, the armature of the said magnet being arranged, as described, to be retained in either position up to the poles of the said magnet, or retracted therefrom while the said magnet is magnetized, in combination with a circuit-breaker in the said main circuit, whereby the main magnet may be demagnetized and its armature retracted, and an auxiliary magnet and circuit therefor, to govern the return movement of the armature from its retracted position up to the poles of the main magnet, substantially as described.

2. The signal and its controlling main electro-magnet and armature, arranged, as described, to remain in either position assumed while acted upon by the said magnet alone, and a normally-closed main circuit for said magnet, and an auxiliary electro-magnet in a normally-open branch of the said main circuit, adapted, when magnetized, to attract the said armature up to the poles of the main magnet, combined with a momentarily-operated circuit

breaker and closer in the said main and branch circuits, respectively, adapted to be operated by a train while passing them, and located at proper points, the former to break the main circuit and permit the retraction of the armature, and the latter to close the auxiliary or branch circuit and cause the movement of the armature to the poles of its main magnet, substantially as and for the purpose described.

3. The signal and main magnet and its armature and retractor to control it, as described, the said magnet being in a normally-closed circuit, provided with a breaker adapted to remain closed except while positively opened by a train in passing, combined with an auxiliary magnet and circuit therefor, provided with a circuit-controller adapted for momentary action, the said auxiliary magnet being adapted to govern the movement of the armature from its retracted position up to the poles of the main magnet, substantially as set forth.

4. The signal and main magnet, its armature, and normally-closed circuit to control it, as described, combined with the auxiliary magnet in a normally-open branch of the main circuit and an auxiliary battery in the said branch, the effect of which is thus confined wholly to the said auxiliary magnet, and the circuit-controllers in the said main and branch circuits, substantially as described.

5. The signal and its controlling main and auxiliary magnets and circuits therefor, combined with an electric switch to open the said main circuit, it being adapted in its return movement, by which it closes the said circuit, to also operate the auxiliary circuit and magnet, substantially as and for the purpose described.

6. The herein-described circuit-breaker, consisting of a lever and anvil therefor, and spring by which the said lever is normally held in contact with its anvil, the said circuit-closer being mounted upon a sleeper or foundation chambered to permit an independent downward movement of the rail, and the end of the lever extended under the rail and operated thereby, substantially as described.

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

CHAS. D. TISDALE.

Witnesses:
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