(No Model.) 2 Sheets—Sheet 1.

J. P. LIVERMORE.

RAILWAY SIGNAL APPARATUS.

No. 273,558. Patented Mar. 6, 1883.

Fig: 1.

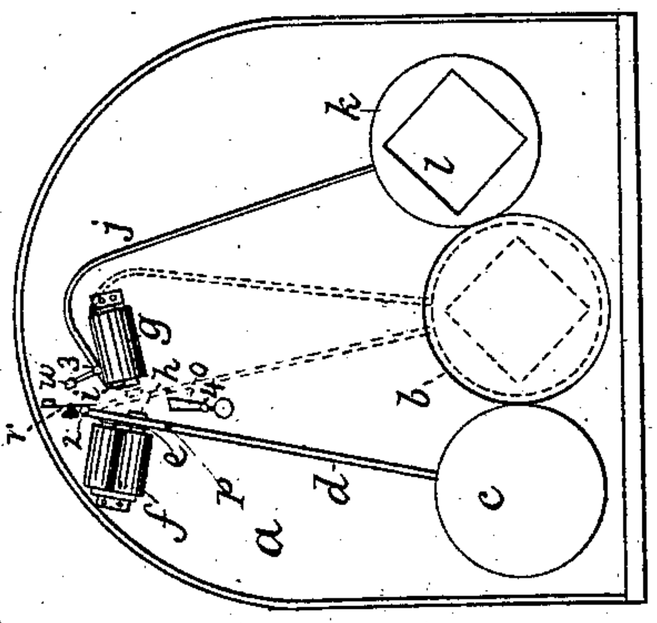


Fig: 2.

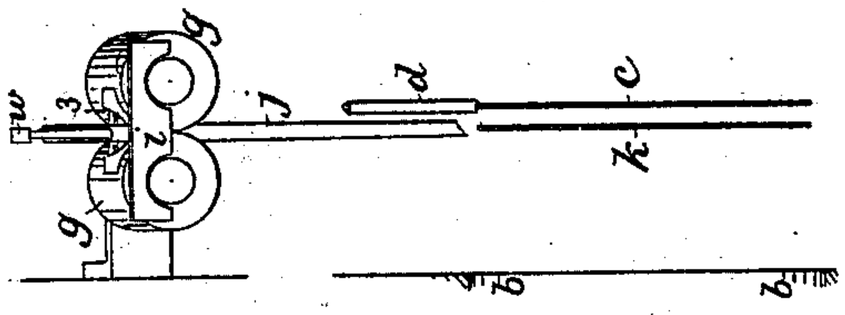


Fig: 3.

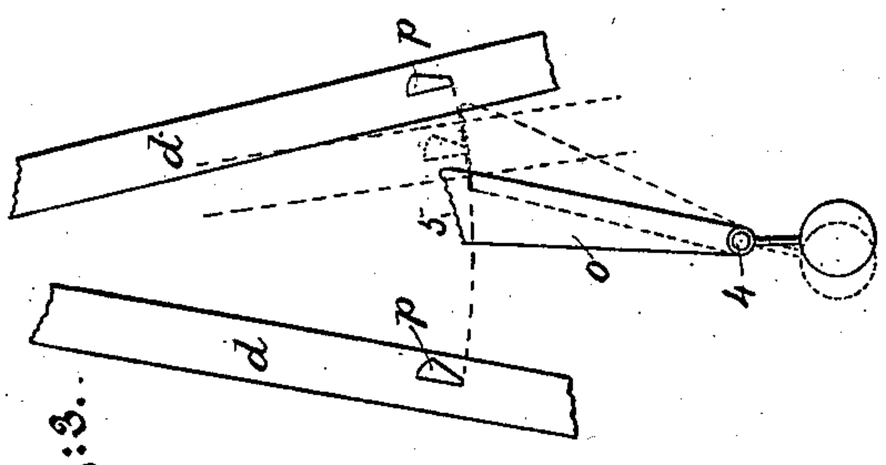


Fig: 4.

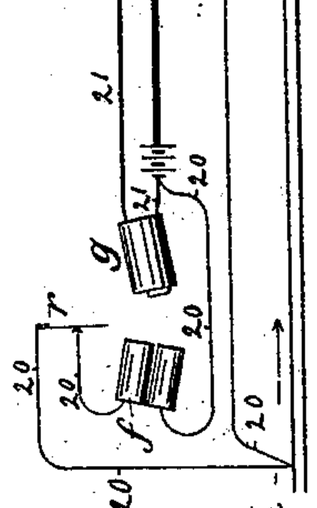


Fig: 5.

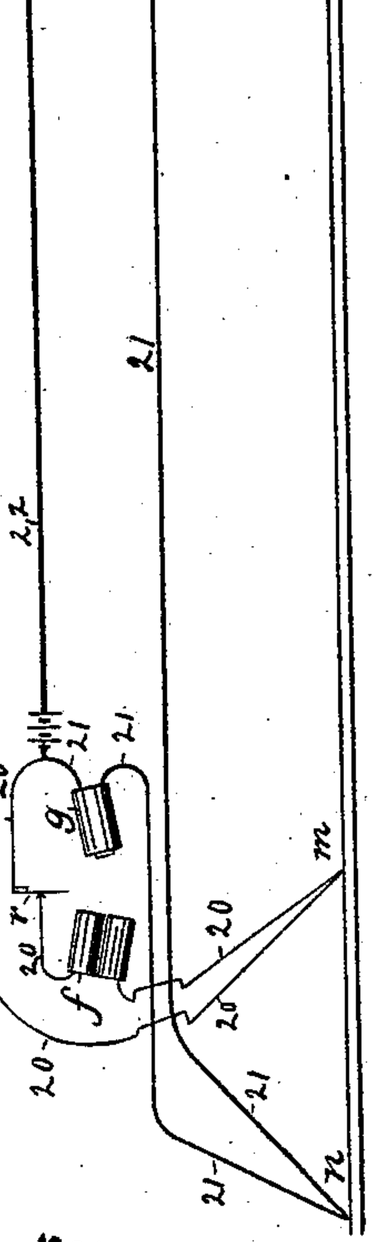
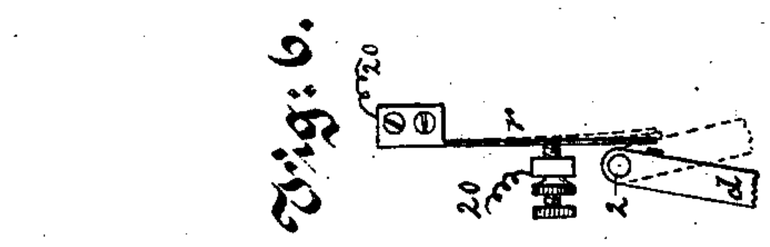


Fig: 6.



Witnesses,
R. F. Hoyer
John F. C. Brinkert

Inventor,
Jos. P. Livermore
by Crosby & Gregory
Attys.

(No Model.) 2 Sheets—Sheet 2.

J. P. LIVERMORE.

RAILWAY SIGNAL APPARATUS.

No. 273,558. Patented Mar. 6, 1883.

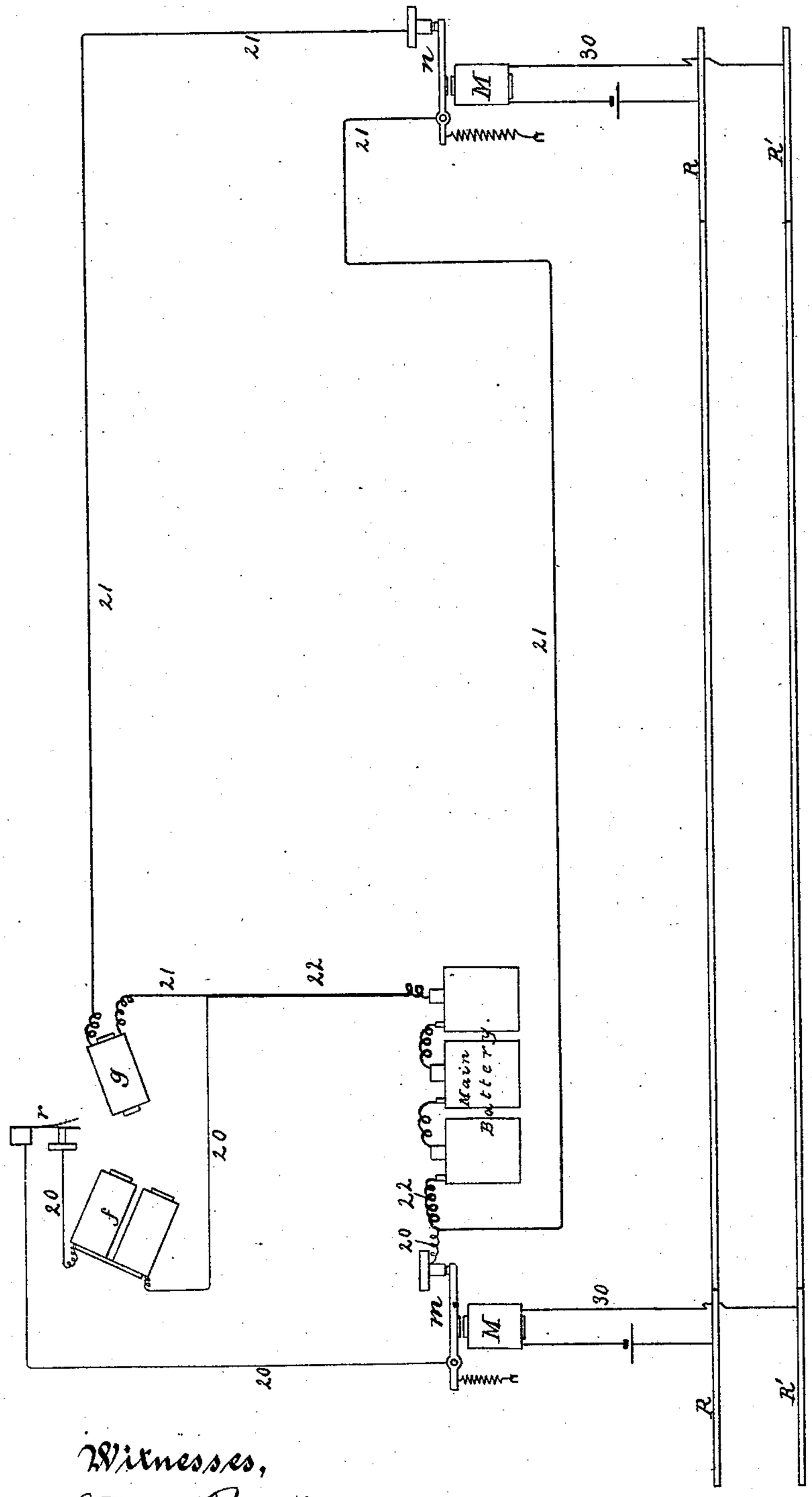


Figure 2.

Witnesses,
Fred A. Powell
John F. C. Partridge

Inventor,
Jos. P. Livermore

UNITED STATES PATENT OFFICE.

JOSEPH P. LIVERMORE, OF BOSTON, MASSACHUSETTS.

RAILWAY SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 273,558, dated March 6, 1883.

Application filed March 3, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH P. LIVERMORE, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Railway Signal Apparatus, of which the following description, in connection with the accompanying drawings, is a specification.

My invention relates to railway signal apparatus of that class in which a signal is set in one position—for example, its "danger" position—by the action of an electro-magnet in a circuit controlled by an instrument operated by the train entering the section, and is restored to its other or "safety" position by the action of a magnet in a circuit controlled by an instrument operated by the train leaving the section. In such apparatus, where the circuit-controlling instruments are operated by the wheels of the train, the signal will be affected when the first wheels arrive at the said instrument, and the said instrument will be retained in the condition to produce such an effect upon the signal during the entire time that the train is passing over the said instrument. It will be seen, therefore, that a long slow-moving train may, in passing off from the section, set the signal to "safety," and thus permit a following short or rapidly-moving train to enter the section before the whole of the first-mentioned train has passed off, so that the last portion of the said slow-moving train, in passing off the section, would cause the signal to be reset or retained at its safety-point after the fast-moving train entered the section, and the said fast-moving train would accordingly not be properly guarded, since a false safety-signal is worse than no signal at all.

One of the objects of my invention is to prevent a false safety-signal from being given under the chain of circumstances before enumerated, or under other circumstances which would produce a similar effect—such, for instance, as a train coming to rest accidentally or otherwise upon and affecting the instrument at the end of the section. For this purpose I provide a secondary signal operated only by the circuit controlled by the train leaving the section, so that the moment that the first portion of the said train restores the main signal to its "safety" position it also causes the secondary signal to be set in the "danger" position, and retains it there as long as the instrument is affected by the train leaving the section, the said secondary signal being removed to and normally retained in a concealed or "safety" position when the instrument at the end of the section is not affected by the train.

The main signal apparatus is so constructed that both the magnets controlling it are in circuits provided with normally-closed breaking instruments or keys, which are operated to break the circuit by the train. The main signal is shown as mounted on a pivoted rod, upon which it swings or vibrates from one to the other position as a pendulum, and the magnets are located upon opposite sides of the said rod, which is provided with armatures to be attracted by the said magnets. By this arrangement, although both magnets may exert equal attractive power, the signal will remain held by that one of them under the influence of which it was last placed until the circuit of such magnet is broken, when the signal will swing by the action, gravity, and the attractive power of the other magnet into the control of the said other magnet, and will be retained thereby until its circuit is broken, when the signal will return to its original position. That one of the magnets which holds the signal concealed, and thus indicating "safety," and which will, for the sake of distinction, be called the "safety-magnet," has in its circuit a normally-closed circuit-breaking instrument or key adapted to be operated by the wheels of the train entering the section, the said key being of any usual construction and forming no part of the present invention. The other or danger magnet is in a circuit having a normally-closed breaking instrument or key properly located to be operated by the train leaving the section, and the said danger-magnet is provided with an armature controlling the movements of a secondary signal in such manner that the said signal is displayed when the said circuit is broken. It will be seen that by thus having both the circuits normally closed the signals also indicate any failure in the apparatus, for should the battery or a wire of the safety-magnet become broken the main signal will indicate "danger," and if a wire of the circuit of the

danger-magnet should be broken or its battery fail the secondary signal would indicate that fact. If both wires should be broken, both signals will be displayed. If under any circumstances the safety-magnet should release the signal when the other magnet was inoperative, the said signal might swing back and forth until, finally, if the safety-magnet should again become charged, it might be attracted and held by it, thus indicating "safety" when it should indicate "danger." To guard against such an event, I have provided a locking device so arranged that when the signal moves from the "safety" to the "danger" position and is not immediately held by the danger-magnet it will be held by the said locking device; but when the signal has been held by the danger-magnet and is then released the said locking device will not prevent its movement to the "safety" position. It will be seen that such a locking device operates to prevent a false safety-signal from being given under the circumstances before mentioned, and that by its employment the secondary signal might be omitted; but both are preferably employed, as greater security is thereby afforded.

It is obvious that any number of magnets may be included in each of the circuits, all in one circuit being operated simultaneously, and I have shown both the said circuits as operated by the same battery. I have also provided a circuit-breaker in the circuit of one of the said magnets, herein shown as the safety one, which is operated by the signal itself when brought into control of the other or danger magnet, so that the entire battery-power is then expended upon the magnet which is holding the signal. At switches, draw-bridges, or other breaks in the track I provide magnets in each of the circuits, which may be arranged to control a similar signal to the main one, but which will preferably each control a separate signal. When thus arranged the one in the danger-circuit will indicate when the track-instrument thereof is operated by a train passing over or brought to rest upon it, or when the wire or circuit is accidentally broken. The one in the safety-circuit will indicate when the main signal is at "danger," owing to the circuit-closer operated by the main signal. The attendant at the switch or draw-bridge will thus be warned of an approaching train having passed the main signal, and will be governed accordingly.

It will be seen that a circuit-breaker located any where in the safety-circuit can be employed to set the main signal to "danger," or a circuit-breaker any where in the danger-circuit may cause the secondary signal to be displayed, and such a circuit-breaker may be connected with the movable switch or draw-bridge operating mechanism, in order to cause the main signal to be set to "danger" when the line of the rails is broken. I prefer, however, to have the circuit-breaker which indicates breaks in the track or anything except the regular occupation of the block by a train passing through the section in the portion of the circuit common to both magnets, so that when it is operated both the main and secondary signal will be displayed. The main and secondary signals are shown as both displayed through the same opening, one behind the other, the one which appears in front being provided with an opening, through which the other can be seen. The circuit-breaker by which the signal is set to "safety" is preferably located a sufficient distance beyond the signal for the next section to enable a train to be stopped after it has passed the said signal for the next section and before it reaches the said circuit-breaker, so that a train is properly guarded by each signal before the protection of the preceding signal is removed. The circuit of the danger-magnet might, however, be controlled by the movement of the next signal when the train enters the following section, instead of by the wheels of the train.

Figure 1 is a rear elevation of the signal apparatus proper, the side of the inclosing-case being removed to show the apparatus within. Fig. 2 is a detail, showing the danger-magnet and armature by which the secondary signal is operated, and also showing the relative position of the two signals when both are displayed. Fig. 3 is a detail illustrating the locking device by which the signal is held in the absence of the proper magnet-power; Fig. 4, a diagram showing the circuits as applied to a double track where the trains normally move over a given line of rails in one direction only; Fig. 5, a diagram showing the invention as applied to a single track over which trains normally pass in both directions; Fig. 6, a detail showing the circuit-closer for one magnet operated by the signal when controlled by the other magnet; and Fig. 7, a diagram illustrating the circuits and one form of track-instrument which may be used, the said parts being arranged for one section of one track of a double-track road, the said section containing no intermediate switches, draw-bridges, or other interruptions.

The signal apparatus proper is contained in a case, *a*, provided with an opening, *b*, through which the signals are to be displayed. The main signal *c* (shown as the usual red disk or target) is mounted on a rod, *d*, pivoted at 2, in such manner that the said signal will vibrate from the position shown in full lines, Fig. 1, to the position shown in dotted lines and back, under the action of gravity, after the manner of a pendulum. The said rod *d* is provided with an armature, *e*, which is acted upon by a magnet, *f*, to draw the signal toward and retain it in position shown in full lines, Fig. 1, this condition indicating "safety," and the magnet *f* being called the "safety-magnet." The magnet *g* is arranged to act upon an armature, *h*, which may be the same as the one acted upon by the magnet *f*, the tendency of the said magnet *g* being to move the signal *c* toward and retain it in the position shown in dotted lines, Fig. 1,

when it can be seen through the opening *b*, and indicates "danger." The signal is primarily retracted from either magnet by the action of gravity, which, however, only partially effects the movement of the signal, and the two magnets *f* and *g*, thus arranged, each operate as an auxiliary retractor for the other, by which the movement of the signal is completed, and the armature is wholly removed from the control of the magnet from which it was thus retracted. The magnet *g* is provided with a second armature, *i*, mounted on an arm, *j*, pivoted at 3, and provided with a signal-disk, *k*, which is preferably of a different color from the one *c*, and so shaped that when both are in line with the opening *b*, the disk *k* being between the said opening and disk *c*, the latter will show behind the disk *k* through the opening *l* therein; or, if desired, the signal *k* may be square or of less area than the one *c*. When the armature *i* is not held by the magnet *g* the arm *j* and disk *k* move by the action of gravity into the position shown in dotted lines, and when the magnet *g* is demagnetized the signal *c* will usually be under control of the magnet *f*, so that the signal *k* will be displayed and the signal *c* concealed.

The circuits of the magnets *f* and *g* are shown in Figs. 4 and 5, that portion of the circuit belonging only to the magnet *f* being indicated by the figure 20 and shown in the finest lines, that belonging only to the magnet *g* being indicated by the figure 21 and shown in heavier lines, and the portion of the circuit which is common to both magnets being indicated by the figure 22 and shown in still heavier lines. The circuit 20 of the magnet or magnets *f* contains the circuit-breaking track-instrument, as at *m*, located at the entrance of the section, the said circuit-breaker being normally closed, but opened by the train in passing into the section. The circuit 21 of the magnet *g* is provided with a circuit-breaking track-instrument, as at *n*, located at the end of the section and normally closed, but adapted to be opened by the train in passing off the section.

Circuit-breaking instruments have been heretofore used and fully illustrated and described in Letters Patent and other publications. Any such instrument may be employed in carrying out the present invention, and, as shown in Fig. 7, the circuit-breakers *m n* consist of the armatures of electro-magnets M, the said armatures being normally retained in position to close the respective circuits 20 21 by their retractors when the said magnets M are not magnetized. The magnets M are in normally-open local circuits 30, connected with opposite short sections of rails R R′, insulated from the rest of the track, the said local circuits 30 being closed by the wheels and axles while the entire train is passing over the said rails R R′, and thus causing corresponding magnet M to attract its armature and open the circuit 20 or 21 controlled by it. Such a device is well known as a track-instrument for opening or closing a circuit, as required, while the train is passing, and of itself forms no part of the present invention.

Referring to Fig. 4, when a train moving in the direction of the arrow passes the circuit-breaker *m*, the signals *c k*, controlled by the magnets *f g*, being in the position shown in full lines, Fig. 1, it breaks the circuit of the magnet *f*, which thus releases the armature *e* and permits the signal *c* to swing into the position shown in dotted lines, Fig. 1, when the armature *h* is attracted and held by the magnet *g*. The signal *c* is thus retained displayed through the opening *b* while the train is traversing the section of track between the circuit-breakers *m n*, and any succeeding train will be warned not to enter the section. When the train which has passed the breaker *m* arrives at the breaker *n*, it breaks the circuit of the magnet *g*, which thus releases the armature and permits the signal *c* to return to the position shown in full lines, Fig. 1, or the "safety" position, and at the same time it releases the armature *i* and permits the signal *k* to move to the position shown in dotted lines, Fig. 1, where it will remain displayed through the opening *b* as long as the circuit-breaker is retained open by the train passing over it, so that, although the signal *c* is at "safety," the engineer of a following train will know that the first train has not fully passed off from the section. If either of the signals *c* or *k* is displayed as the train approaches the signal-post, the said train is not permitted to pass the circuit-breaker *m* until both the said signals are removed.

In signals of this class which are controlled by instruments located at the entrance and end of the section, the main signal, as *c*, is usually set to "safety" the moment the train arrives at the instrument *n* at the end of the section, and there is nothing to prevent a succeeding train from passing wholly over the instrument *m* before the first train has fully passed the instrument *n*, so that the latter, still acting on the said instrument *n*, will cause a false safety-signal to be given behind the second train which thus entered the section. This would not occur with the apparatus thus far described in case proper attention were given to the indication of the signal *k;* but in case the said signal should be disregarded and the train should have passed the circuit-breaker *m* while the magnet *g* was demagnetized, either through the action of a train upon a circuit-breaker or from any failure in the circuit of the magnet *g*, the main signal *c* can still be set to "danger," and retained so while the circuit-breaker *n* remains open and after it is closed until it is opened a second time. This is accomplished by means of the locking device *o*, (best shown in Fig. 3,) which is arranged to engage a projection, *p*, on the arm *d* of the signal *c* and hold the latter in its "danger" position, even though the armature *h* is not held by the attraction of the magnet *g*.

The locking device *o* is pivoted at 4 and properly weighted or acted upon to normally hang or remain in the position shown in full lines, Fig. 3, where its upper edge, 5, lies in the path of the projection *p* on the signal-arm *d* as the signal *c* passes from the "safety" to the "danger" position.

It is well known that a pendulum, in swinging under the action of gravity, does not rise so far above its lowest position as the point from which it started, owing to resistance it meets in its course. For this reason, when the signal *c* swings from its "safety" to its "danger" position under the action of gravity alone, unassisted by the attraction of the magnet *g*, it will not move quite to the position shown in dotted lines, Fig. 1, or in full lines, Fig. 3, but will stop somewhat short of such position, as shown in dotted lines, Fig. 3. In this movement the projection *p*, engaging the upper edge, 5, of the locking device *o*, will move it to the position shown in dotted lines, Fig. 3, in which the said locking device, in acting upon the projection *p*, will effectually resist the movement of the signal-arm *d* from the "danger" toward the "safety" position, but will not prevent its movement toward the "danger" position, which will take place as soon as the magnet *g* becomes again charged. When the said signal-arm *d* is moved wholly over to the "danger" position, as shown in full lines, Fig. 3, the projection *p* passes beyond and disengages the upper edge, 5, of the locking device *o*, permitting the latter to return to its normal position, (shown in full lines,) so that the projection *p*, in the return of the arm *d* from the "danger" to the "safety" position, will not engage the top of the said locking device, but will engage the side thereof, so that the said device will turn freely on its pivot 4, affording but little resistance to the movement of the arm *d*.

It will be seen that, as far as the operation of the main signal *c* is concerned, that one of the magnets, *f* or *g*, which is not acting upon the said signal might have its circuit broken, and in case separate batteries and circuits were employed for the two magnets the battery-power might be saved by employing a circuit-breaker for either magnet, which should be opened while the signal was held by the other magnet. Such a circuit-breaker is shown at *r* in the circuit 20 of the magnet *f*, it being opened by the action of the signal-arm *d*, (see Figs. 1 and 6.) when the latter is in the "danger" position, either held by the magnet *g* or by the locking device *o*. The said circuit-breaker thus serves to indicate the condition of the main signal at other desired points in the circuit. For instance, as shown in Fig. 4, the circuit 20 of the magnet *f* contains an electro-magnet, *f'*, which, in acting upon a signal, *c'*, shows when the said circuit is opened or closed, and consequently indicates whether the main signal is at "safety" or "danger." A magnet, *g'*, is also shown in the circuit 21 acting on a signal, *k'*, which indicates the condition of the circuit of the magnet *g*. These indicating-magnets *f' g'*, or the ones *f'* only, will be employed at switches, draw-bridges, or other places where there are breaks in the track, and will indicate when the main signal has been set to "danger" by a train passing the track-instrument *m*, so that the operator will be warned not to break the track while trains are approaching. When desired to break the track by opening the switch or draw-bridge or otherwise, the signal *c* at the head of the section can be set by opening the circuit 20 of the magnet *f*, or the signal *k* can be set without disturbing the signal *c* by opening the circuit 21 of the magnet *g*, or preferably both signals, *c* and *k*, will be set by opening that portion 22 of the circuit which is common to both magnets, as shown by the switch *s*, Fig. 4. The said switch may be connected with the movable operating mechanism for moving the rails or draw-bridge bolts, so as to be automatically operated before the track can be broken; and I prefer to use, in addition to a switch thus automatically operated, another hand-operated switch, so that the signals can be retained at "danger" during the various operations of shifting cars without changing the position of the said signal at each change of condition of the rails. When both circuits are thus broken the signal *k* will be retained displayed by the action of gravity, and the signal *c* by the locking device *o*, and it will be seen that if both circuits are closed simultaneously, once for all, the signal *c* will be caught by the nearer magnet *g*, and thus retained in the "danger" position. In order to prevent the signal *c* from thus being placed or left in the "danger" position when the switch *s* is returned to its normal position, closing the circuit 22 of both magnets, an additional switch, *s'*, mechanically connected with the one *s*, is employed, the said switch *s'* controlling the circuit 21 of the magnet *g* alone, as follows: The switch *s'* is provided with two anvil-pieces, 10 12, as shown, it moving across the space between them when the circuit-wire 22 is broken by the switch *s* to set the signals to "danger," and the switch *s* is provided with a single long anvil-piece, 14, from which it is moved to open the circuit of both magnets. By this arrangement, when the switches *s s'* are moved to the dotted-line position, Fig. 4, to set the signals *c k* to "danger," the switch *s'* will first break the circuit of the magnet *g*, which will have no effect upon the main signal *c*, as it is then controlled by the magnet *f*, and when the switch *s* has passed entirely off from its anvil-piece the circuits of both magnets *f g* will be broken simultaneously, and the main signal *c* will be caught in its "danger" position by the locking device *o*, as before described. In the return movement of the switches *s s'* both circuits will first be closed when they touch the corresponding anvil-pieces, 12 14, so that the magnet *g* will attract the armature *h*, and thus disengage the signal-arm *d* from the locking device *o*, the circuit

of the magnet *f* being then connected at the switch *s*, although it is still open at *r*. In the further movement of the switches *s s'* the switch *s'*, passing between its two anvil-pieces, 12 10, will break the circuit of the magnet *g*, thus permitting the signal *c* to pass over to its "safety" position, as desired, where it will be held by the magnet *f*, and in the further movement of the switches *s s'* both circuits will be restored to their normally-closed condition. By having the circuits of both magnets *f g* normally closed any failure of either circuit will be indicated, that of the magnet *f* by the main signal *c* taking the "danger" position, and that of the magnet *g* by the signal *k* taking the "danger" position.

It is obvious that the magnets *f g* and their circuits might be employed with a signal, *c*, which is moved positively in one direction by the action of the proper magnet, unassisted by gravity, and I prefer to have the magnets of sufficient strength to move the signal from an intermediate position up to their poles. By arranging the signal as a pendulum, as shown, only a very small magnetic force is required to operate it—less than half that required for the ordinary signal, in which it has to be moved positively from one extreme position to the other, for even if the signal should come to rest in its intermediate position the magnet which first acted upon it unopposed by the other would only have to move it for half the distance from one to the other extreme position.

It is not necessary that the signal *k* should move with great promptness, and it may therefore be nearly counterbalanced, as by the weight *w*, so that but slight power is required to move it—much less than when prompt action is desired upon the breaking of the circuit of the magnet by which the signal is retained concealed.

For double-track roads it is not necessary to extend the circuit 20 of the magnet *f* beyond the signal-post containing the said magnet, and in this case the magnet *g* and signal *k* alone would be depended upon for indicating breaks in the track, it being controlled by a suitable switch, as shown at s^2, Fig. 4.

For a single-track road where trains enter a section from both ends, and it is desirable to set a signal both ahead of and behind the train, the arrangement shown in Fig. 5 may be employed. In this case instruments *m* are placed so as to be operated last by the train entering the section and the instruments *n* to be operated last by a train leaving the section in either direction. A distance greater than the length of the longest train should be left between the instruments *m* and *n* at either end of the section; or, if desired, a second locking device, *o*, may be employed to engage the signal when moving from the "danger" to the "safety" position.

It is obvious that the secondary signal *k* might be omitted, and the locking device *o* would prevent a false safety-signal from being given by a train passing off the section while and after a succeeding train was entering the section, and in case the signal *k* is omitted a circuit-breaker similar to the one *r* might be used in the circuit of the magnet *g*, it being opened by the signal-arm *d* in its "safety" position.

It is also obvious that by proper observation of the signals *c* and *k* the locking device *o* might be omitted; but it is preferable to use the entire apparatus shown in Fig. 1, as greater security is thereby insured under all circumstances.

The circuit-breaker for the magnet *g* of one signal might be operated by the signal of the next block in advance, or the magnet *f* of each signal might be included in the same circuit with the magnet *g* of the first or second signal in the rear, so that a single circuit-breaker will operate to set the signal at the entrance of a block entered by a train to "danger," and also set a preceding signal, the protection of which is no longer needed, to the "safety" position.

I claim—

1. In a railway signal apparatus, the combination of the following elements: the main signal, an electro-magnet and circuit-controlling instrument operated by trains entering the block-section guarded by the said signal, an electro-magnet and circuit-controlling instrument operated by the train leaving the said section, and a secondary signal, the said main signal being controlled in its movements by each of the said magnets in turn, and the secondary signal being controlled only by the last-mentioned magnet, substantially as and for the purpose set forth.

2. The combination, with the main signal, of an electro-magnet and its circuit and normally-closed circuit-breaker operated by the train entering the section, and an electro-magnet, its circuit and normally-closed circuit-breaker, and means to open it when the train leaves the section, the movements of the said signal being controlled by each of the said magnets in turn when the normal condition of the said circuit-breakers is changed upon the passage of a train, substantially as described.

3. The main signal, electro-magnet, and normally-closed circuit-breaker, opened by a passing train, combined with a second electro-magnet which controls the said main signal after the said circuit-breaker is operated, a circuit-controlling instrument in the circuit of the said second magnet, the condition of which is reversed while a train is passing it, and a secondary signal controlled wholly by the said second magnet, and thus indicating the condition of its circuit-controlling instrument, substantially as and for the purpose described.

4. The signal combined with two electro-magnets in normally-closed circuits, respectively provided with circuit-breaking instru-

ments at the entrance and end of the block-section, the said signal being movable from control of one into control of the other of the said magnets upon the opening of the instrument in circuit of the magnet at that moment controlling the signal, substantially as set forth.

5. The signal and two electro-magnets combined with means to primarily partially retract the signal from one of the said magnets toward the other, and a locking device by which the said signal is retained thus partially retracted until engaged and wholly retracted by the said magnet toward which it was moved, substantially as and for the purpose described.

6. The signal and two electro-magnets controlling its movement from one to the other position, the circuit of each of the said magnets being normally closed when the signal is moving into and retained in control thereof, combined with a self-closing circuit-breaker in circuit with one of the said magnets adapted to be held open by the signal while under control of the other magnet, substantially as and for the purpose described.

7. The main signal and electro-magnet, by the attraction of which it is held in the "safety" position, combined with a circuit-breaker in circuit with the said magnet, adapted to be held open by the said signal while in its "danger" position, and an indicating-signal and controlling electro-magnet therefor in the circuit of the said circuit-breaker operated by the main signal, whereby the condition of the main signal is indicated, substantially as described.

8. The signal and its two controlling electro-magnets and circuit-breaking instruments in their respective circuits, the said instruments being closed, except when positively held otherwise, combined with independent indicating electro-magnets and signals in each of the said circuits, substantially as and for the purpose described.

9. The signal and its two controlling electro-magnets and normally-closed circuit-breakers in their respective circuits, combined with an electric switch in circuit with both the said magnets, substantially as described.

10. The signal, its two controlling electro-magnets and locking device, operating as described, combined with an electric switching apparatus in circuit with both the said magnets, and adapted in its movement to its normal position to first close both circuits, then open one of the said circuits, and finally again close it, leaving both circuits complete at the said switch, substantially as and for the purpose set forth.

11. The signal-arm provided with a projection and a signal hung thereon to swing as a pendulum under the action of gravity, combined with the pivoted locking device having its upper portion in the path of the said projection, whereby when the said signal makes less than a complete oscillation the said projection is engaged and prevented from return movement by the said locking device, but when it makes a complete oscillation it passes out of engagement with the said locking device and is permitted to make its return movement.

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

JOS. P. LIVERMORE.

Witnesses:
G. W. GREGORY,
W. H. SIGSTON.