No. 761,490. PATENTED MAY 31, 1904.

F. T. HOLLINS.

SAFETY DEVICE FOR ELECTRIC INTERLOCKING OR BLOCK SIGNALING APPARATUS.

APPLICATION FILED FEB. 18, 1901.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 6.

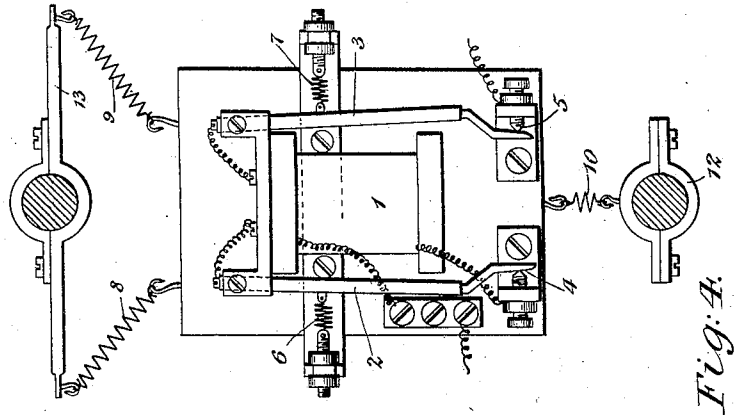

Fig. 4.

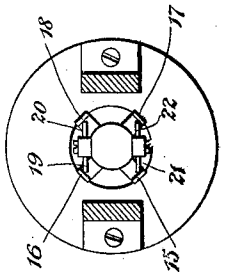

Fig. 5.

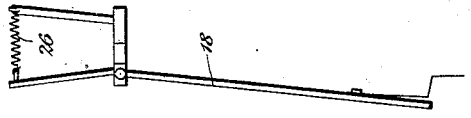

Fig. 3.

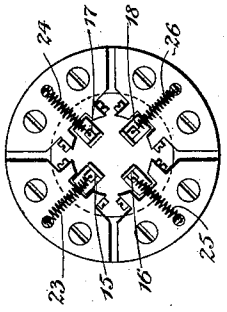

Fig. 2.

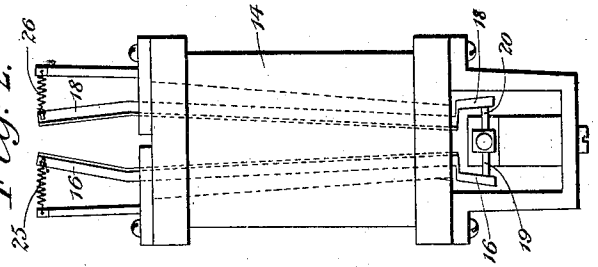

Fig. 1.

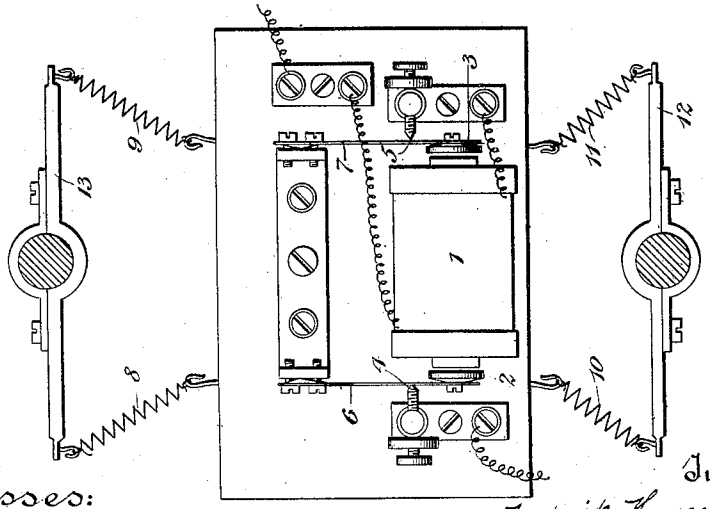

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Fig. 9.

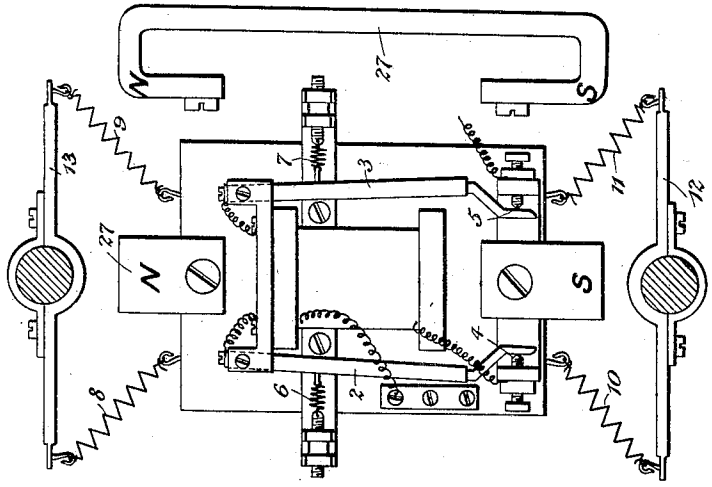


Fig. 8.

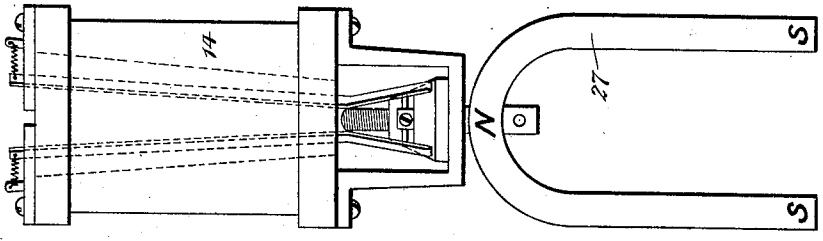
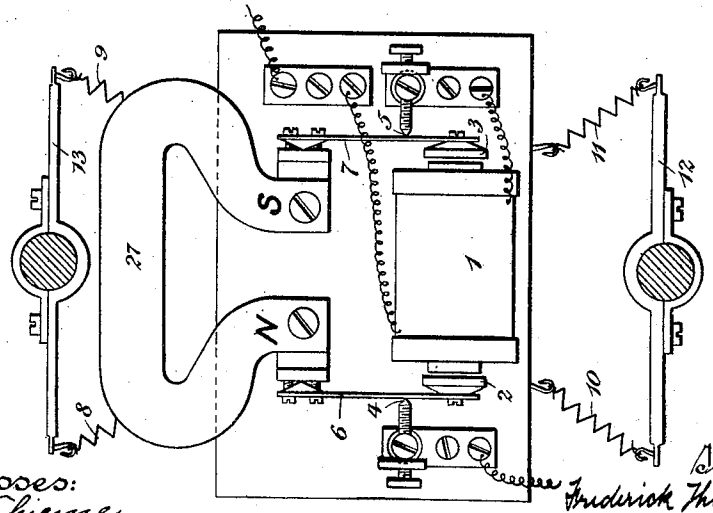


Fig. 7.



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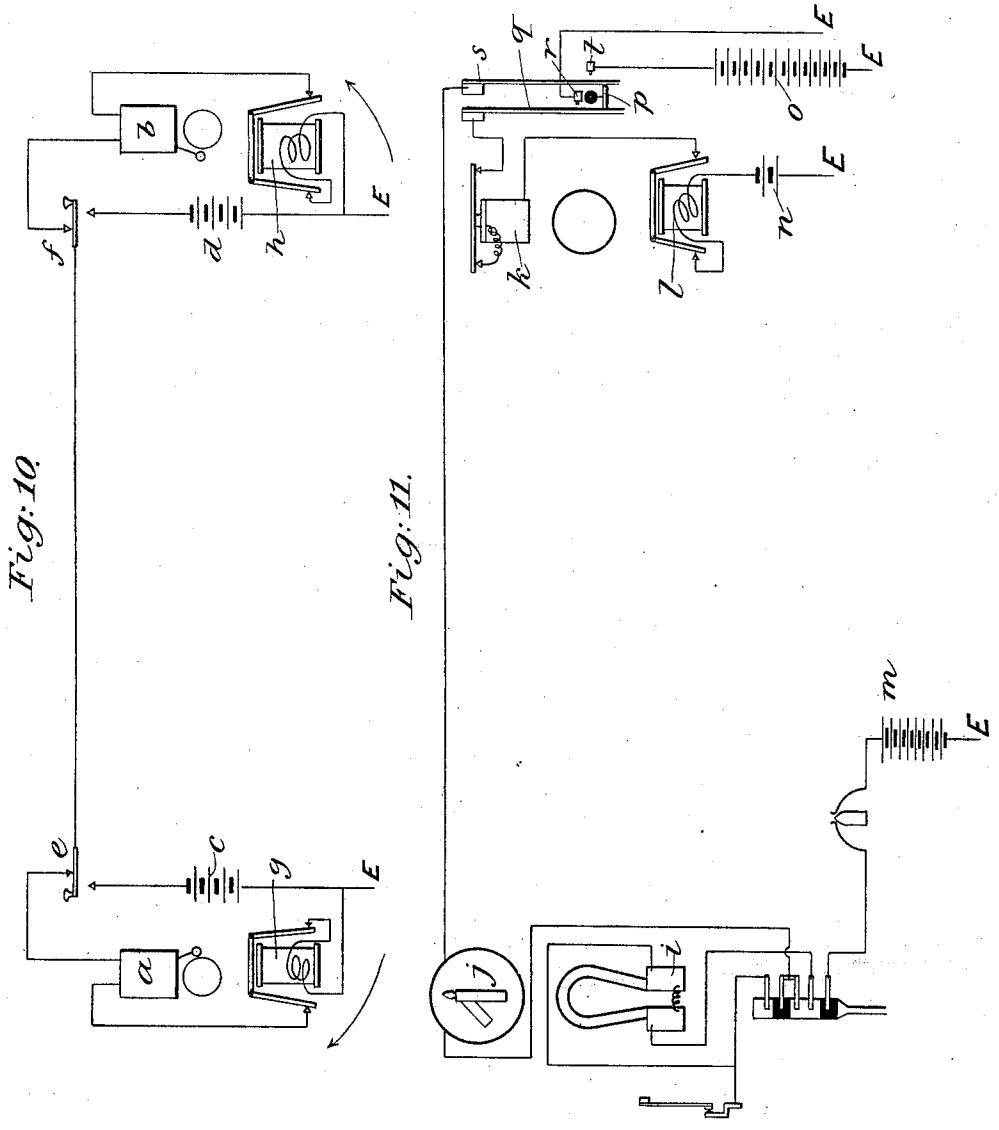
APPLICATION FILED FEB. 18, 1901.

NO MODEL. 3 SHEETS—SHEET 3.



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No. 761,490. Patented May 31, 1904.

UNITED STATES PATENT OFFICE.

FREDERICK THOMAS HOLLINS, OF LEYTONSTONE, ENGLAND.

SAFETY DEVICE FOR ELECTRIC INTERLOCKING OR BLOCK-SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 761,490, dated May 31, 1904.

Application filed February 18, 1901. Serial No. 47,753. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK THOMAS HOLLINS, a subject of the Queen of Great Britain, and a resident of Leytonstone, in the county of Essex, England, have invented new and useful Improvements in Safety Devices for Electric Interlocking or Block-Signaling Apparatus, of which the following is a specification.

My invention consists in providing a safety device adapted for use in connection with single-wire circuits whereby the single-wire circuits are safeguarded from foreign currents of a higher power than normally used on the said circuits.

My invention more particularly relates to a device for protecting block signaling and electric signaling apparatus used for signaling, controlling, and protecting the traffic on railways from interference by stray electric currents derived from the earth, owing to the fact that the block and interlocking circuits are connected to the earth, so that the earth may be used as a return-conductor for such circuits.

The use of electricity for lighting and power purposes has tended to make the use of the earth as a return-conductor for block and interlocking circuits undesirable and even dangerous, for the reason that the stray currents from the electric lighting and power circuits are always liable to effect the block and interlocking circuits and cause erroneous indications to be transmitted to the signaling circuits. This danger is particularly emphasized in those electric lighting and power systems where one of the conductors is connected in one or more points to earth, an accidental connection with earth made by any other conductor in such system causing a very large quantity of electricity to pass through the earth and be absorbed in part by any other electric circuits using earth as a return-conductor. In this manner false indications are liable to be transmitted, indicating to the signalman that the line is clear for a train to proceed when, in fact, a train is already in the section.

The object of this invention is to provide a protective device or arrangement insuring that such stray currents shall not operate the block-signaling and interlocking instrument and that they shall only be operated by the electric current intended for the purpose.

This safety device takes the form of an electro magnet or magnets with one, two, or more armatures, as may be preferred, and such electro magnet or magnets shall have their coils inserted in some suitable part of the circuit to be protected, and the armature or armatures also being inserted in the same circuit, so as to more or less make and break down the circuit passing through the same by means of fixed or adjustable back contacts when an electric current sufficiently strong to adequately energize the electromagnets passes, and the armature or armatures may be held back from the cores of the coils by means of any suitable tension-springs (spiral or otherwise) in contact with the back contact-points, through which the current for energizing the coil or coils shall have to pass, and the tension may be so adjusted as to regulate what amount or quantity of current may be allowed to pass, so that if for special reasons it may be desirable for a certain quantity of current to pass this may be permitted, but the tension shall be such that it shall prevent a sufficient quantity passing to operate the instrument which the safety device is intended to protect, as will be more clearly explained when describing its application to the Sykes system of electric interlocking.

In the accompanying drawings, Figure 1 is a top plan view of one form of arresting device. Fig. 2 represents in side elevation an arresting device of the solenoid type. Fig. 3 is a top plan view of the same. Fig. 4 is an inverted transverse sectional view. Fig. 5 is a detailed view of one of the armatures and its adjacent parts. Fig. 6 is a top plan view of a modified form of arresting device. Fig. 7 is a top plan view of the form of arresting device shown in Fig. 1 with the addition of a permanent magnet. Fig. 8 is a side view of an arresting device of the solenoid type combined with a permanent magnet. Fig. 9 is a top plan view of an arresting device of the type shown in Fig. 6 with the addition of a permanent magnet. Fig. 10 is a diagram-

matic view showing the arresting device fitted to an ordinary bell-circuit, and Fig. 11 is a diagrammatic view showing the arresting device as applied to an interlocking signal-circuit of the Sykes type.

In the telegraph and block-signaling circuits to which this device has been applied an appreciable time is taken to cause any movement of the indicators or locks, owing to the magnetic inertia of the magnet-coils and the mechanical inertia of the parts, to be moved.

The introduction of the make-and-break stray-current arrester splits up the stray current into a series of short momentary currents or impulses, thereby reducing the magnetic effect in the coils of the indicators or locks to a minimum or fixed amount, dependent upon the tension of the springs, which current is insufficient to operate the indicators or locks.

In Fig. 1 I have shown an electromagnet 1, which when operating upon armatures 2 and 3 opens the contacts 4 and 5. The springs 6 and 7 are so adjusted that the tension of the armatures will be such that the normal operating-current will be insufficient to cause the electromagnet 1 to attract the armatures. When a foreign current from the ground of a higher power than is usually used on the said circuit attempts to pass through the circuit, the electromagnet will be energized sufficiently to cause the armatures to vibrate rapidly, thus acting as a make and break which will prevent the releasing of the interlocking or block-signaling apparatus. As will be explained below, when the releasing-current is required to be sent the stray-current arrester is excluded from the circuit. This safety device, it will be seen, is suspended by springs 8, 9, 10, and 11 from the end of clips 12 and 13, so that the armatures may not be operated by mechanical vibration.

Figs. 2, 3, 4, and 5 show another method of arriving at the same result. 14 is a solenoid of the ordinary type, in which are suspended the light iron armatures 15, 16, 17, and 18, which are kept in contact with contact-points 19, 20, 21, and 22 by the springs 23, 24, 25, and 26, which, as before, are adjusted that only a given amount of current can pass without vibrating the armatures 15, 16, 17, and 18. When this given amount of current is exceeded, the light iron armatures, which are magnetized in the same direction by the current passing in the solenoid, repel one another sufficiently to open the circuit at contact-points 19, 20, 21, and 22, and so prevent more than the given amount of current from passing. Thus the normal or semaphore current is allowed to pass, and when the releasing-current is required to be sent the stray-current arrester is excluded from the circuit.

Fig. 6 is another form in which the same figures represent equivalent parts, as in Fig. 1; but 6 and 7 in Fig. 6 show spiral springs instead of flat springs, 6 and 7 carrying the armatures 2 and 3 in Fig. 1. In addition the safety device as a whole is only held in position at the bottom by one spiral spring 10 instead of two, as in Fig. 1. The operation is similar to that described in Fig. 1.

Fig. 7 is similar in all respects to Fig. 1, but has a permanent magnet 27, which serves to polarize the device, thus allowing a strong current to pass in one direction only. When any current beyond a given strength attempts to pass in the opposite direction, the current is split up into a series of short momentary currents, their duration depending on the tension of the springs 6 and 7.

Fig. 8 is similar to Figs. 2, 3, 4, and 5 with slight modifications, (the figures referring to equivalent parts,) but has a permanent magnet 27, which serves to allow it to respond similarly to that described in Fig. 7.

Fig. 9 is similar in all respects to Fig. 6, the figures representing equivalent parts to those shown in Fig. 1, but is furnished with a permanent magnet 27 for the same purpose as described in Fig. 7. It may not be necessary to use more than one armature-contact breaker or to use the exact form described; but it is found desirable to have more than one for extra security, and the typical examples given are found to be amply reliable in practice.

Fig. 10 shows the device fitted to an ordinary signaling-bell circuit. *a* and *b* are electric bells. *c* and *d* are batteries. *e* and *f* are the ringing-keys. *g* and *h* are the stray-current arresters, preferably of a form similar to Figs. 7 and 9. These only allow current to pass through them in the direction shown by the arrow, reducing any current coming in the other direction to an inappreciable amount determined by the tension of the springs, as before described. Thus the slight amount of current which passes is insufficient to work either of the bells when the circuit is in its normal state. It will be seen that in the normal state of the circuit both arresters are in circuit, one arresting or, more correctly speaking, reducing the current coming in one direction to a minimum and the other arresting or, more properly speaking, reducing to a minimum the current coming in the other direction, so that it is impossible for any stray earth-current to ring either of the bells. On pressing either of the keys to ring a bell the arresting device opposing the action of the current desired to be sent is taken out of circuit by the action of the key, and so the bell at the opposite end of the circuit can be rung. In this figure the armatures are of course polarized, and so hold up tightly against the contact with the working current.

Fig. 11 shows the device as applied to a Sykes interlocking circuit. *i* is the interlocking coil. *j* is the electric semaphore-arm. *k* is the train on coil. *l* is the stray-current arrester of a form similar to Figs. 1, 2, or 6. *m*, *n*, and *o* are batteries. The normal con-

dition is as shown, the springs of the arresting device being adjusted so that only current sufficient to operate the semaphore-arm *j* is allowed to pass, the battery *n* being only of sufficient strength to do this and is so connected up as to transmit a current of opposite polarity to that required to unlock the locking-coil *l*.

When it is necessary to send the releasing-current through the locking-coils, the action of operating-plunger *p* causes the arresting device to be taken out of circuit, and the releasing-current can be sent in the usual manner from battery *o*, the branch circuit, with the train on coils, being for the moment shunted direct to earth through contact-lever *q* coming into contact with stud *r* slightly before lever *s* breaks contact with contact-lever *q* and makes contact with stud *t*.

When this device is used in connection with the Sykes interlocking or block-signaling apparatus, both the lock and block-arm are polarized. Thus a current in one direction will lower the arm or merely hold the lock up tighter; but a current in the opposite direction will keep the arm up or discharge the lock, (Hughes magnet,) as the case may be.

The arm is operated by one cell, while the lock requires ten cells in, for instance, a six-mile section. The one cell (about one volt) is not sufficient to cause the current-arrester to work, and so the block-arm is operated through it.

If any stray current entering the circuit from the earth connections starts the arrester vibrating, owing to the make-and-break action, the resultant magnetic effect on the coils of the lock will not be sufficient to discharge the lock.

What I claim is—

1. The combination with an electric locking or similar circuit using the ground as a return-conductor, of a stray-current arrester for preventing the passage of more than a given amount of current, which current-arrester is irresponsive to a weak battery-current but is responsive to foreign currents of a higher power than that normally used on the circuit and which current-arrester is cut out of the circuit when a current of greater strength is required to be sent, substantially as set forth.

2. The combination with an electric circuit using the ground as a conductor, of a stray-current arrester located in said circuit comprising an electromagnet with spring-actuated armatures thereby held under tension sufficient to permit only a current of weak power to pass for preventing more than a given amount of a foreign current of higher power from passing through the circuit, such current-arrester being cut out of the circuit when a current of greater strength is required to be sent, substantially as set forth.

3. The combination with an electric circuit using the ground as a return-conductor, of a stray-current arrester located in said circuit comprising a permanent magnet and electromagnets with spring-actuated armatures thereby held under tension sufficient to permit a strong current to pass in one direction and an inappreciable or given amount dependent upon the tension of the springs in the opposite direction, the said stray-current arrester being arranged to make and break the circuit when a foreign current of higher power than that normally used in the said circuit enters the circuit by means of the earth connection in the direction which causes the spring-actuated armatures to vibrate, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 29th day of January, 1901.

FREDERICK THOMAS HOLLINS.

Witnesses:
ROBERT MILLIE,
FREDERICK KNAPPETT.