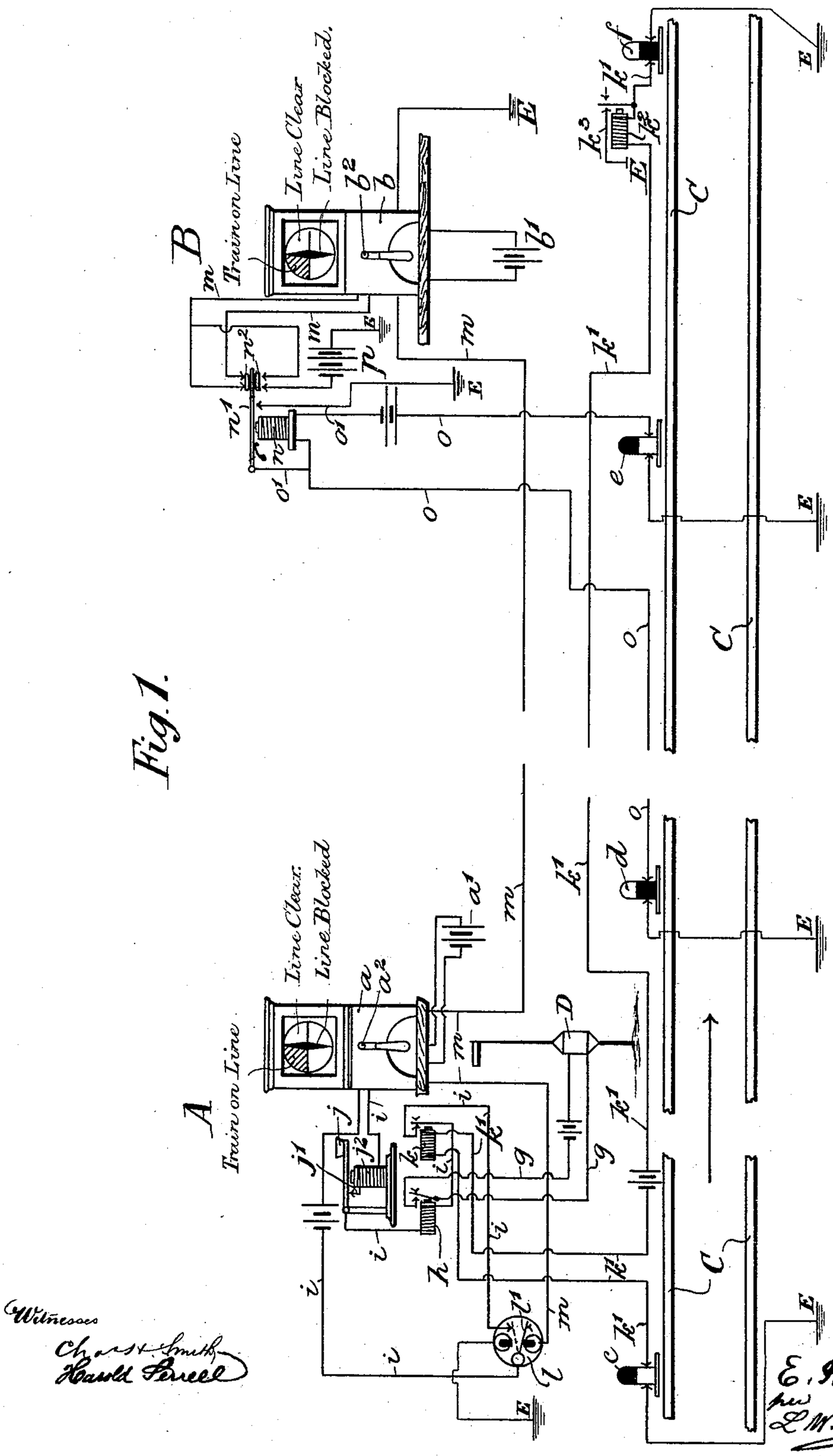
(No Model.) 3 Sheets—Sheet 1.

E. BLAKEY.

SIGNALING ON RAILWAYS AND MEANS THEREFOR.

No. 543,721. Patented July 30, 1895.



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(No Model.) 3 Sheets—Sheet 2.

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SIGNALING ON RAILWAYS AND MEANS THEREFOR.

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Fig. 3.

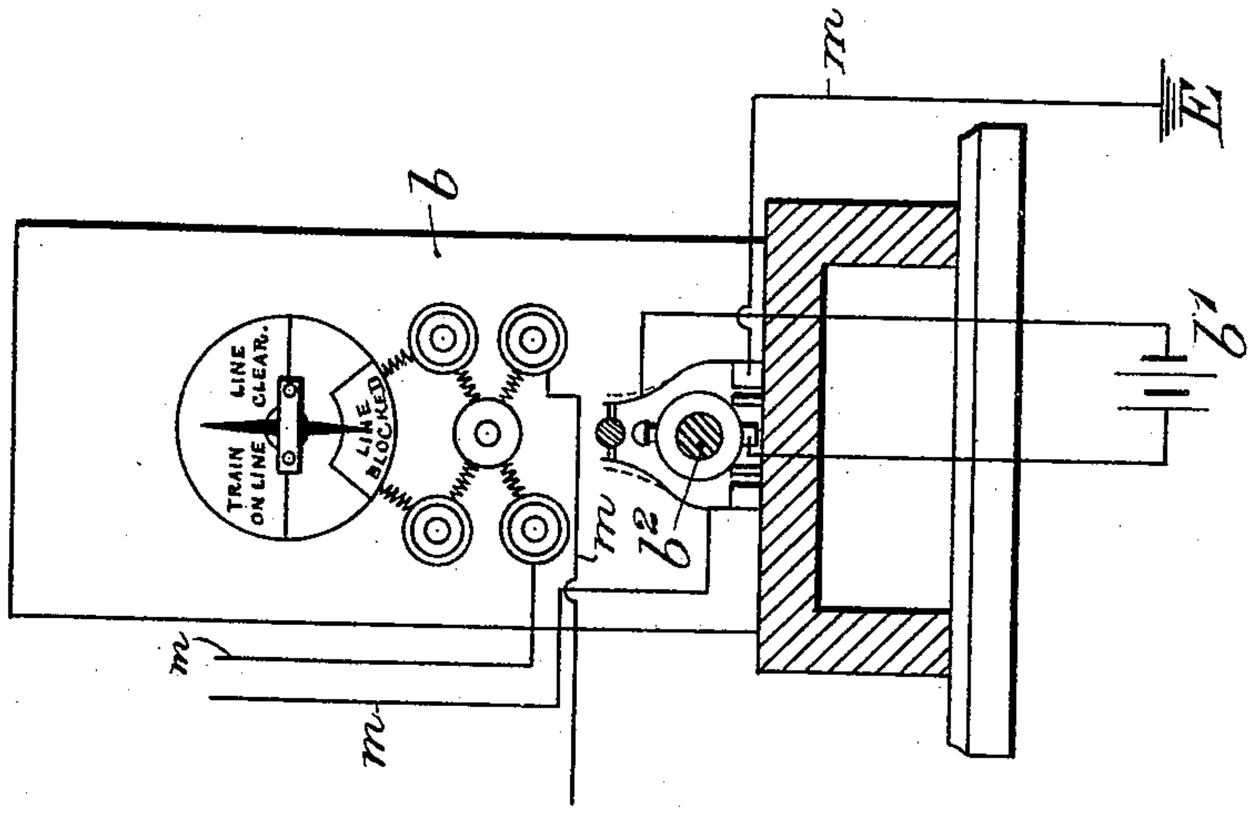


Fig. 4.

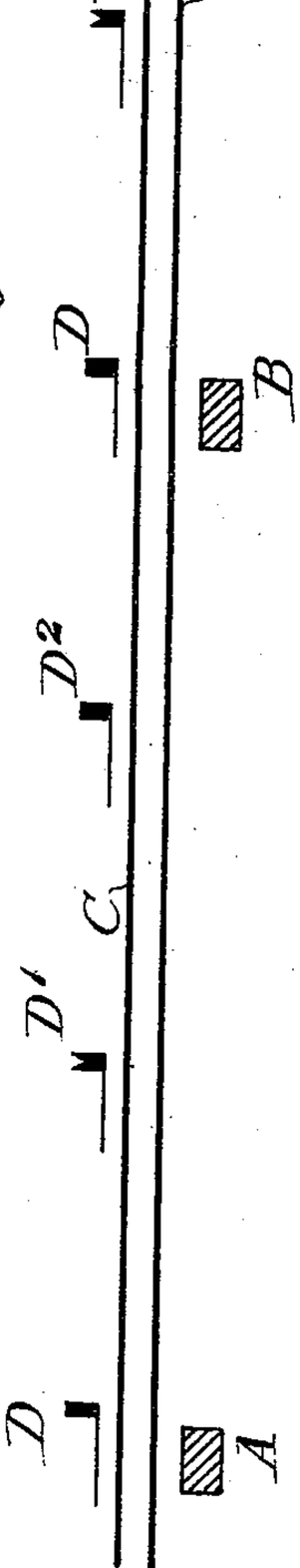
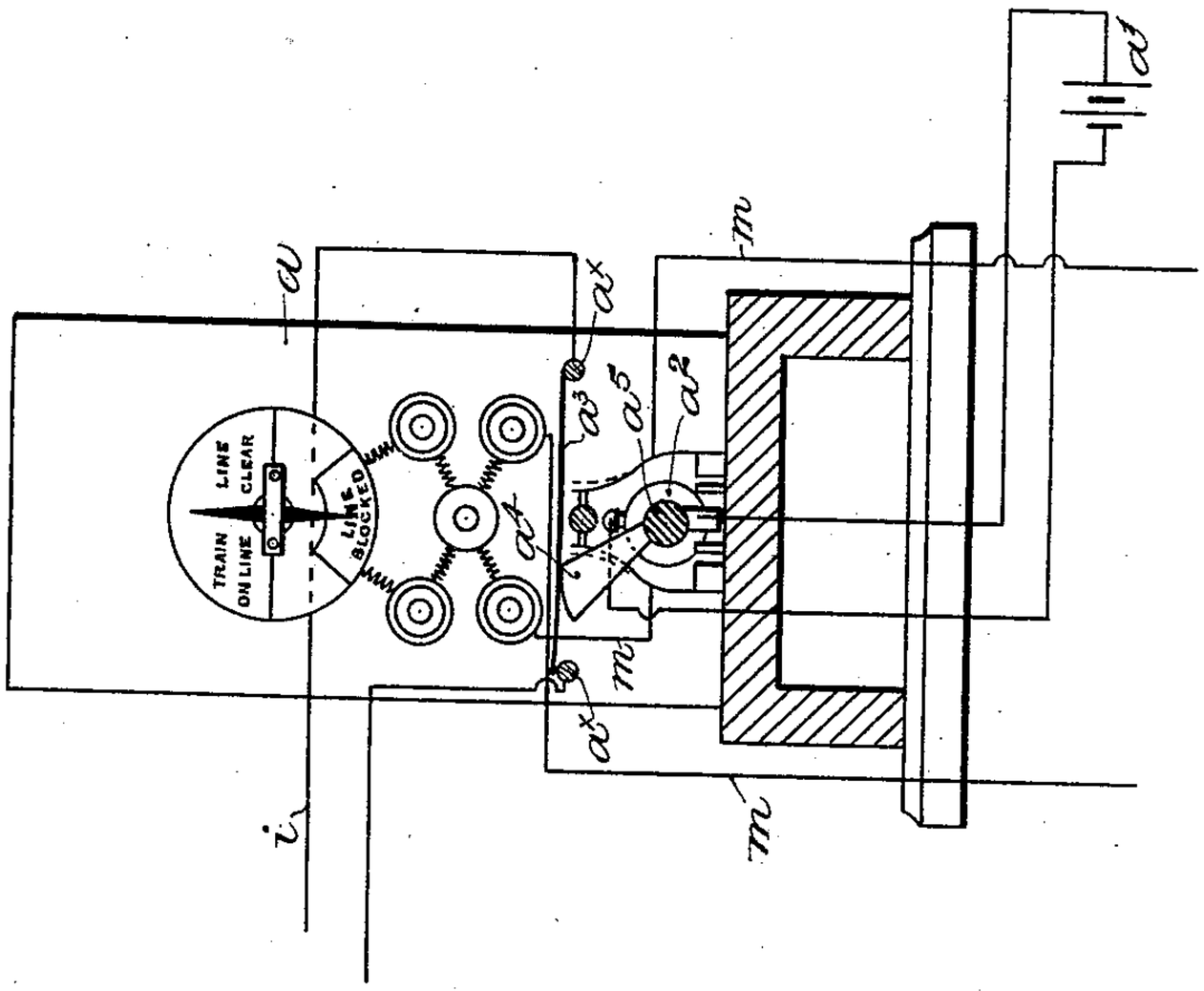


Fig. 2



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(No Model.) 3 Sheets—Sheet 3.

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SIGNALING ON RAILWAYS AND MEANS THEREFOR.

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Fig. 5

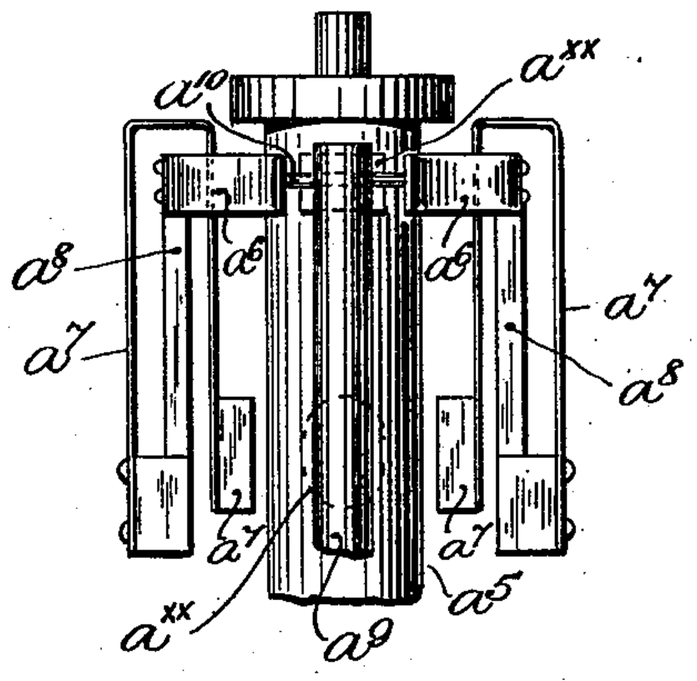
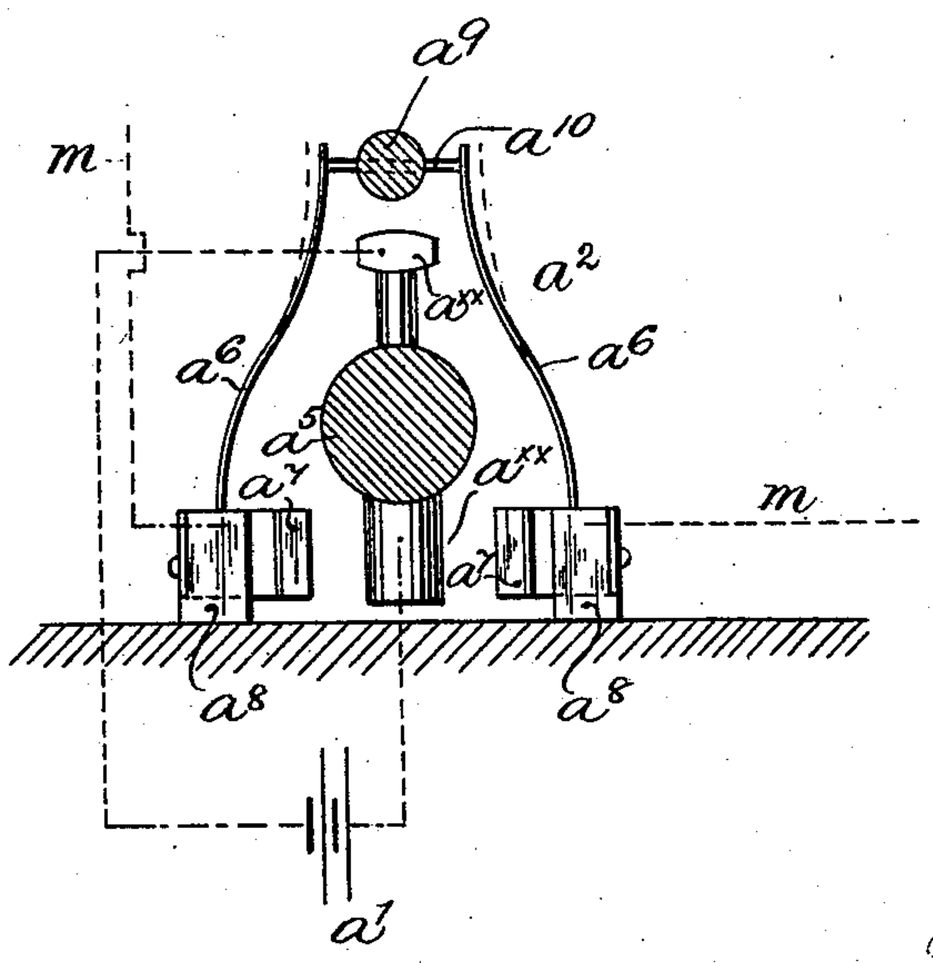


Fig. 6.



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UNITED STATES PATENT OFFICE.

EDWIN BLAKEY, OF BRADFORD, ASSIGNOR TO THE AUTOMATIC ELECTRIC RAILWAY SIGNAL COMPANY, LIMITED, OF LIVERPOOL, ENGLAND.

SIGNALING ON RAILWAYS AND MEANS THEREFOR.

SPECIFICATION forming part of Letters Patent No. 543,721, dated July 30, 1895.

Application filed June 11, 1894. Serial No. 514,205. (No model.)

To all whom it may concern:

Be it known that I, EDWIN BLAKEY, a subject of the Queen of Great Britain and Ireland, residing at Bradford, England, have invented certain new and useful Improvements in Signaling on Railways and Means Therefor, of which the following is a specification.

This invention relates to improvements in signaling on railways and means therefor, and is designed to be employed in conjunction with the ordinary single-needle block system at present in use on railways or with any permanent current block system.

In the improved system of block-signaling about to be described the block regulations remain unaltered. The said single-needle instrument is retained substantially unaltered and has no mechanical connections (as is usual in other forms of lock and block systems) with the levers of the interlocking apparatus.

In the ordinary single-needle block system, owing to the instruments being entirely under the control of the signalmen, serious accidents occur through carelessness in operating the instruments. It is, therefore, the object of the present invention to provide against such carelessness, and thereby to afford increased safety in railway traveling. For this purpose I employ, in addition to the ordinary electrical arrangement of the single-needle or other block system, electrical circuits provided with relays, and having a series of contact devices adapted to be actuated by the train, the arrangement being such that a train on entering a section will automatically place the signal controlling that section at "danger," and the signalman at the commencement of the section will be prevented from clearing the signal until the train has passed out of the section and he has received the "line clear" signal from the signalman in the next cabin. The arrangement, moreover, is such that should the signalman at the beginning of any particular section neglect to give the signal "train on line" to the next cabin the train will automatically give this signal by actuating a suitable contact device and closing a relay which cuts out the signal-batteries and brings in a more powerful battery, and will, in any case, lock the instruments in both cabins at "train on line." The train when passing out of the section again unlocks the needles by operating another contact device. The semaphores or signal-arms, which are under electrical control and are all arranged so that they move to "danger" by gravity cannot be cleared by the signalman so long as the train remains on the particular section which each signal respectively controls.

For the purposes of this description the signal is worked mechanically and a contact-key is arranged to control any suitable electric slot or signal-replacer, and this key may be so constructed as to control two or more signals—say, for instance, "home" and "distant"—provided an electric slot is fixed on each of the said signals.

My invention will be readily understood by reference to the accompanying drawings, in which—

Figure 1 shows diagrammatically my improved system of electric signaling for use on railways. Figs. 2 and 3 show interior views of the transmitting and receiving single-needle instruments I find it advantageous to employ, only so much of the instruments being shown as is required to illustrate the connections. Fig. 4 is a diagram illustrating the arrangement of the sections of the line. Fig. 5 is a plan, and Fig. 6 an elevation in larger size showing the signaling-instrument in detail.

A and B represent signal-cabins situated, respectively, at the commencement and at the end of a section.

C C represent the rails in the section, of which only a single set is shown, and D represents the starting or other signal by which the section is controlled.

It is to be understood from Fig. 4 that what is meant by the word "section" is the portion of line comprised between one starting-signal and the next starting-signal, there being thus two sections shown in Fig. 4.

D′ D^2 are respectively the "distant" and "home" signals of each section.

a is a single-needle block instrument situated in the cabin A and actuated in the ordinary manner by a battery *a′* and a current-reverser a^2, the internal arrangement of the

instrument *a* and its connections being more clearly shown in Fig. 2. To prevent the signalman at cabin A operating his signal to the "safety" attitude by giving "line clear" to himself, a spring a^3 is provided, which bridges the gap between two bars $a^\times$, one on each side of the instrument. This spring, through which the current for actuating the signal passes, is adapted to be raised by a cam or projection a^4 on the axle a^5 of the reverser a^2, so as to interrupt the circuit *i* to the signal when the reversing-handle is put to "line clear." The construction of the said reverser a^2 will be more clearly understood by reference to Figs. 5 and 6, in which $a^{\times\times}$ $a^{\times\times}$ are the movable poles of the reverser, which are secured upon the axle a^5 and are connected with the battery a', as indicated in dotted lines, by means of flexible wires, or in any other convenient manner.

a^6 and a^7 are contact-springs, with which the movable poles are arranged to make contact when the axle a^5 is turned one way or the other by its operating-handle. Both springs a^6 a^7 on the same side are in electrical connection, being secured to common brass bases a^8, and the circuit-wires *m* lead to these brass bases.

a^9 is a brass rod projecting from the front cover of the instrument and carrying a cross-pin a^{10}, against which the ends of the springs a^6 press when neither is moved back (into the dotted position) by the pole of the reverser, thus keeping the circuit complete when the battery a' is not switched into it.

b is a similar instrument to *a*, situated in the cabin B and actuated by a battery b' and a current-reverser b^2. The connections of this instrument are shown in Fig. 3. The two instruments serve for the section of line between the two cabins, and it is to be understood that each section of the line is similarly controlled.

c, *d*, *e*, and *f* are four contact devices adapted to be operated by the train in passing along the section. The contacts which I find it advantageous to employ are those described in the specification of British Letters Patent No. 13,778 of 1887. I also find it advantageous to actuate the said contacts by means of the depressible rail described in the specification of British Letters Patent No. 12,985 of 1891. The contact devices *c* and *e*, when depressed by the train, are arranged to interrupt the circuits in which they are situated, while, on the other hand, the contacts *d* and *f* are arranged, when so depressed, to complete their circuits.

The signal D for the set of rails shown is controlled or operated by a circuit *g*, the apparatus for effecting such control being preferably the electrical signal replacer or "slot" apparatus described in the specification of British Letters Patent No. 12,775 of 1893. The circuit *g* is termed the "local" circuit, and is controlled by a relay *h*. The magnet of this relay is included in a circuit *i* termed the "signal-circuit," which can be closed by the signalman by means of a key *j*, which, after being pressed against a contact *j'*, is kept closed by the action of a magnet j^2 included in the same circuit. The completion of the signal-circuit *i* depends, further, on the closing of two other relays *k* and *l*, the latter being polarized. The former relay *k* is situated in a circuit *k'*, termed the "main" circuit, controlled by the contact devices *c* and *f* and containing near the end of the section a relay k^2, whose tongue or armature, when attracted, completes a branch k^3, leading to earth, and keeps this magnet energized after the contact device *f* has resumed its normal position. On the opening of the line the armature of this relay k^2 is first closed by hand, but afterward, in the working of the line the trains themselves effect this closing automatically in leaving the section.

The polarized relay *l* is included in the circuit *m* of the single-needle instruments *a b*, and is arranged so that it only completes the signal-circuit *i* when the signal "line clear" has been sent through the single-needle circuit *m*. This circuit *m* also passes through contacts on a relay *n*, whose tongue or armature *n'* carries two insulated contact-plates n^2, and whose magnet is in a circuit *o*, controlled by the two contact devices *d* and *e*. The purpose of this relay is to cut out, at the proper time, the batteries a' and b' and to bring another, and preferably stronger, battery *p* into the single-needle circuit *m*, and vice versa.

The working is as follows: Prior to a train approaching the section, which it does in the direction of the arrow, the parts are in the positions shown in Fig. 1, the relays *k* and k^2 having been energized by a preceding train, as will be hereinafter described, and their tongues being held or attracted. The circuit *k'* is thus completed and attracts the tongue or armature of the relay *k*. On the signalman at B sending the "line clear" signal to A, current will flow from the reverser through the portion of the circuit *m* (see Fig. 3) leading to the upper contacts n^2 of the relay *n* back to the coils of the instrument at B; thence through the line-circuit *m* to the reverser a^2, and from this reverser through the coils of the instrument *a* to the coils of the polarized relay *l*, Fig. 1, and to earth, and back by the earth to the earth connection of the reverser *b* to the battery b'. In passing through the polarized relay *l* the tongue *l'* of the latter is drawn over into the position shown in dotted lines, so completing the circuit *i*, save for the break at the contact *j'*.

When the signalman at A wishes to lower the signal at D, he depresses the key *j*, so completing the contact *j'* and the circuit *i*, energizing the relay *h* and causing its tongue to close and complete the local circuit *g* and permitting the signal to be operated. The train is thus admitted to the section, and on passing the first contact device *c* it interrupts

the main circuit k' and causes the tongues or armatures of the relays k and k^2 in that circuit to open. The former of these interrupts the signal-circuit i, releases the key j, and thereby demagnetizes the relay h, interrupts the local circuit g and causes the signal to go by gravity to "danger." The signalman at A cannot then lower the signal until the train has passed the last contact f. When the train reaches the contact d it depresses it and momentarily completes the circuit o, energizes the magnet of the relay n, and draws down the tongue n', thereby completing the branch circuit o' to earth, which keeps the relay-magnet energized until the train passes the third contact e. So long as the tongue remains in the position shown, the battery p only is in the single-needle circuit m and keeps the needles locked at "train on line," so that in case the signalman at A should have forgotten to send this signal to B the train will thus do it automatically. The current from the battery p passes through earth to the polarized relay l, thence through the wire m to the instrument at a, next to the reverser a^2, thence to the reverser b^2, the coils of the instrument b, the lower plate n^2 of the tongue of the relay n, and finally back to the battery p. This battery is by preference stronger than the batteries at a' and b'. As soon as the train passes the third contact e, however, the circuit o is interrupted momentarily and the tongue n' of the relay n rises, the battery p is cut out of the single-needle circuit m, and the instruments at A and B are unlocked and assume the "line blocked" position, (provided the signalman has placed his handle to the normal position,) ready for the signalman at B to send such signals to A as may be necessary. The contact device d, by reversing the polarized relay l, will also cause the signal-circuit to be broken and the signal D to go to "danger" should the first contact device c from any reason have failed to act. As the train passes the last contact f it depresses it and thereby remakes the main circuit k' and re-energizes the relays k and k^2. As already stated the tongue of the latter completes a branch circuit k^3, by which its magnet is kept energized after the contact f has resumed its normal position. The closing of the other relay k puts the signal-circuit i in a state ready for completion by means of the key j after the sending of the signal "line clear" has closed the relay l.

I claim as my invention—

1. The combination in a system of railway signaling apparatus, of a main circuit, extending from a point in advance of the signal to the end of the section controlled by said signal; a single needle circuit containing single needle instruments, one at each end of the section; a local circuit containing the signal; a signal circuit containing a relay for closing said local circuit; a polarized relay in the single needle circuit; a relay in the main circuit, and a key in the signal circuit, said relays and key serving to control the closing of such signal circuit and consequently the operation of the signal, means for causing the train to lock the needles of the instruments at "train on line" as it passes along the section; and means for causing it to open the main circuit when approaching the signal, and to close such circuit on leaving the section, substantially as described.

2. The combination in a system of railway signaling apparatus, of a main circuit extending from a point in advance of the signal to the end of the section controlled by said signal; a single needle circuit containing single needle instruments, one at each end of the section; a local circuit containing the signal; a signal circuit containing a relay for closing said local circuit; a polarized relay in the single needle circuit, a relay in the main circuit and a key in the signal circuit, said relays and key serving to control the closing of such signal circuit and consequently the operation of the signal; a relay in a separate circuit for switching off the battery of the single needle circuit and substituting another battery to lock the needles at "train on line;" means for causing the train to first close and then open the circuit of this relay; and also means for causing it to break the main circuit on approaching the signal and to remake it on leaving the section, substantially as described.

3. The combination in a system of railway signaling apparatus in which contact devices are operated by a passing train through the medium of depressible rails, of single needle instruments a b, a main circuit k', a contact breaker c in said circuit (operated by the passing train), a signal circuit i controlled by a relay k situated at or near the commencement of the section and containing the key j for controlling the signal, a polarized relay l in the circuit m of the single needle instruments also controlling the signal circuit, a local circuit g, including the signal and controlled by a relay h, a battery p for locking the signal instruments at "train on line," a relay n for putting this battery in and out of the single needle circuit m, a battery with a circuit maker d, and a circuit breaker e, (operated by the passing train) for controlling such relay n, a branch circuit o' to earth to keep the relay closed, and a circuit maker f (operated by the train) at the end of the section to energize a second relay k^2 in the main circuit k' and cause it to close its earth connection k^3, substantially as specified.

4. In a system of railway signaling apparatus the combination with depressible rails or bars operated by a passing train, single needle instruments and signals of a primary circuit breaker operated by the depressible rails or bars, two electro-magnets in that circuit one at the home and the other at a distant station, a local circuit g containing a relay h, and acting to allow the signal to fall to "danger," a second circuit closer operated by the

passing train, a battery, relay magnet and a third train-operated circuit-breaker in such circuit, a branch circuit closed by the last named electro-magnet to earth to hold its armature, and a battery and single needle circuit to keep the needles to indicate "train on the line," the said circuit being broken when the train actuates the third circuit breaker and the relay magnet breaks the circuit to the needle, allowing the same to be actuated, and a fourth train-operated circuit closer to energize its adjacent relay k^2 and close the earth connection, substantially as specified.

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

EDWIN BLAKEY.

Witnesses:
CLAUDE MEEKER,
FRED HAMMOND.