No. 883,964. PATENTED APR. 7, 1908.

H. N. LATEY.

SIGNALING SYSTEM FOR ELECTRIC RAILWAYS.

APPLICATION FILED JAN. 19, 1904.

2 SHEETS—SHEET 1.

Fig.1

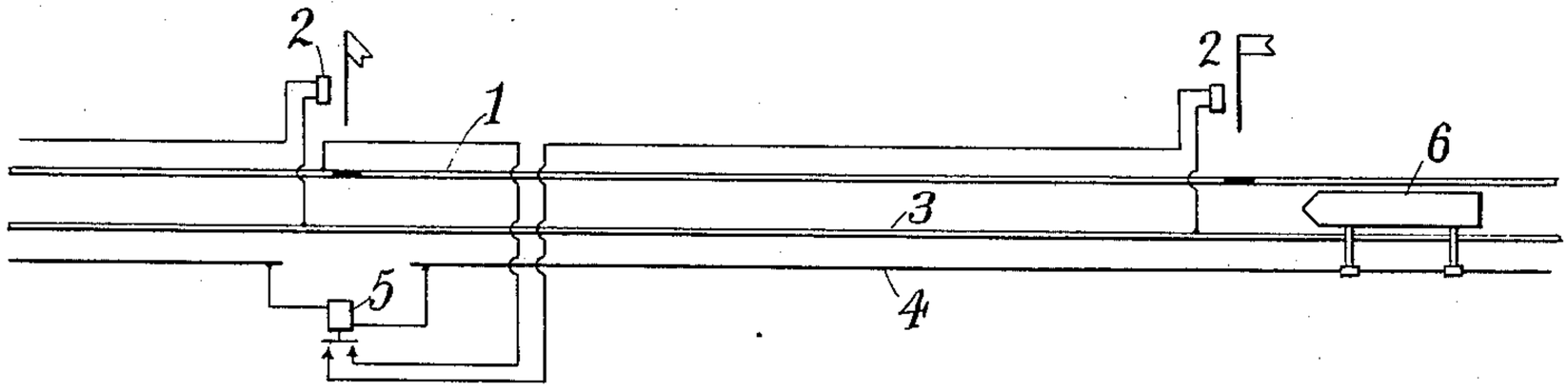


Fig.2

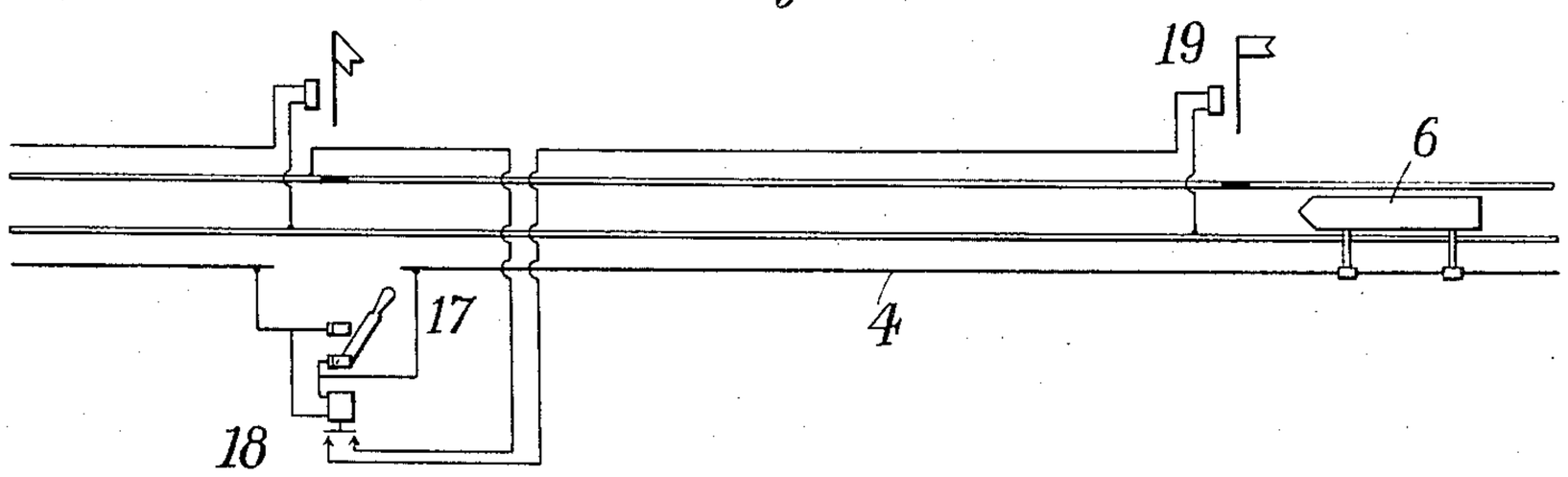


Fig.3

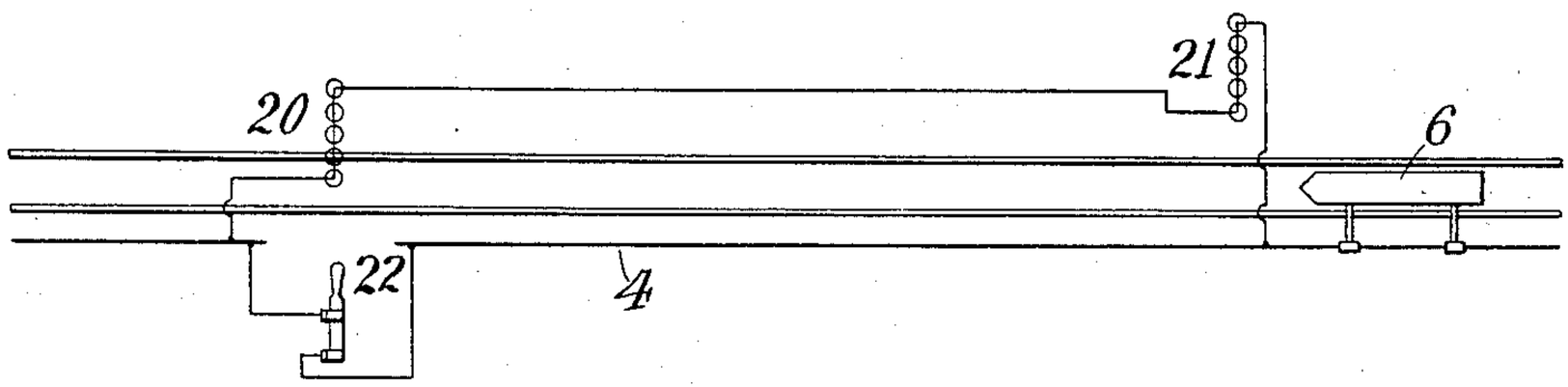
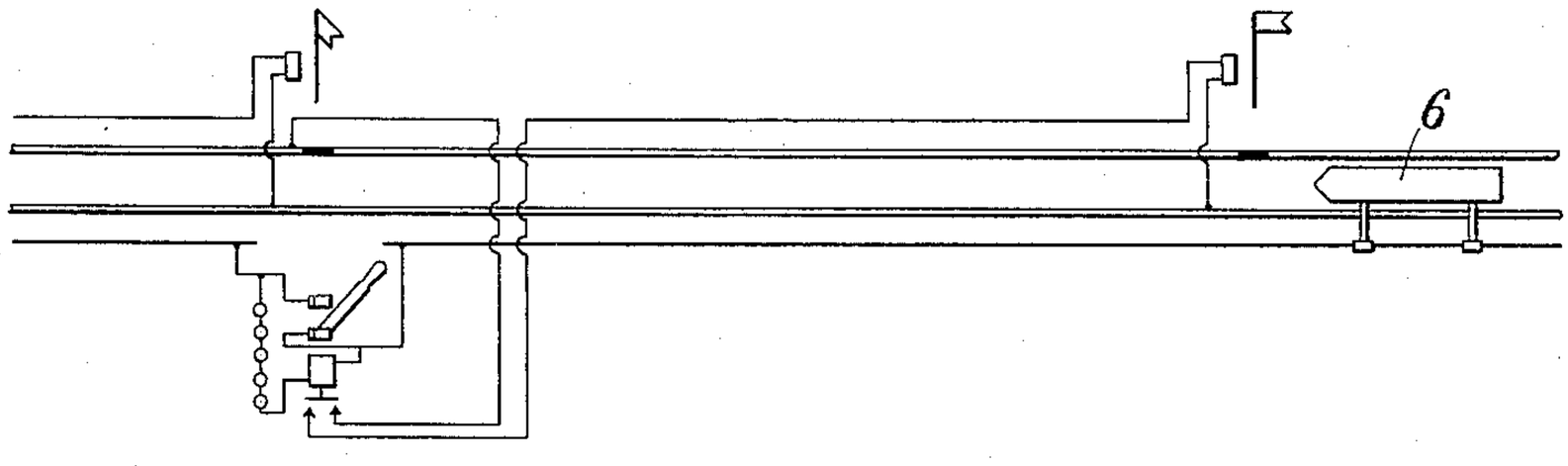


Fig.4



Witnesses:
Raphael Netter
S. S. Dunham.

Harry N. Latey, Inventor;
by Kerr, Page & Cooper, Atty's.

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2 SHEETS—SHEET 2.

Fig. 5.

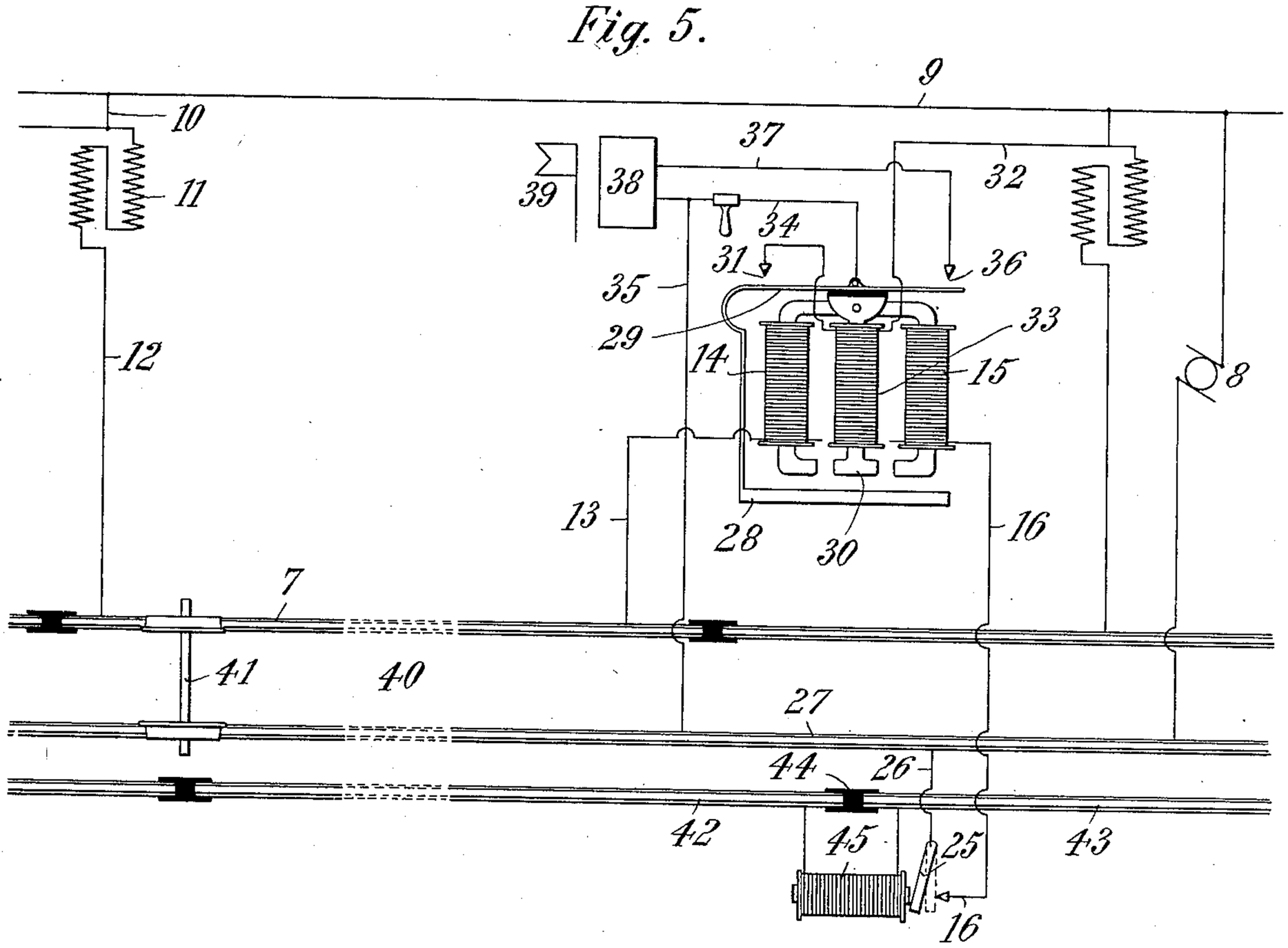


Fig. 6.

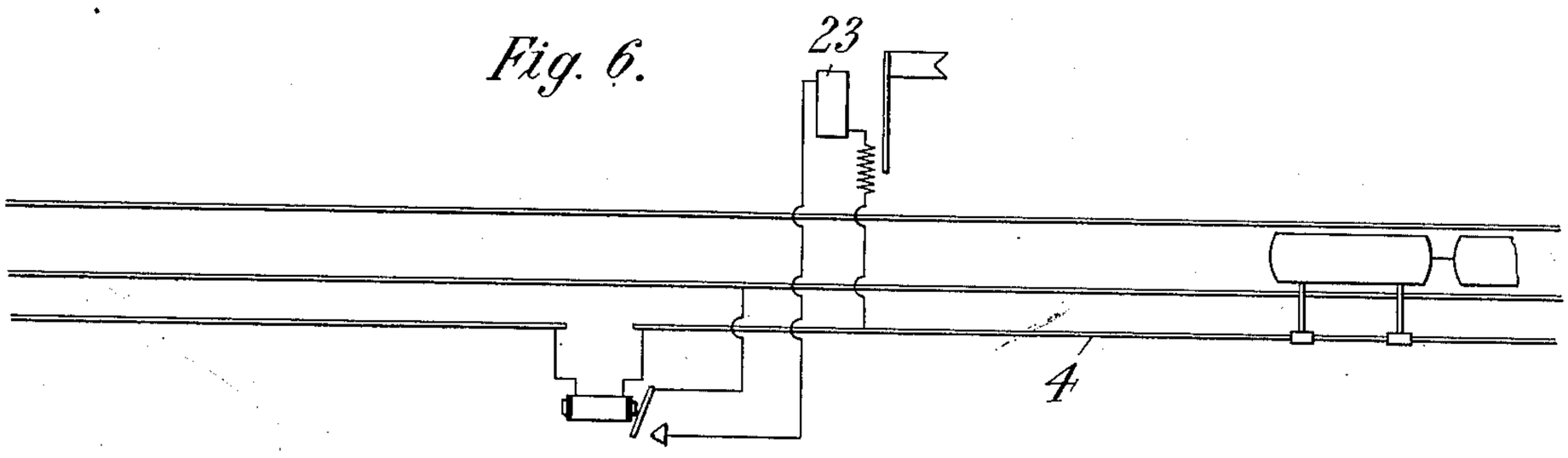
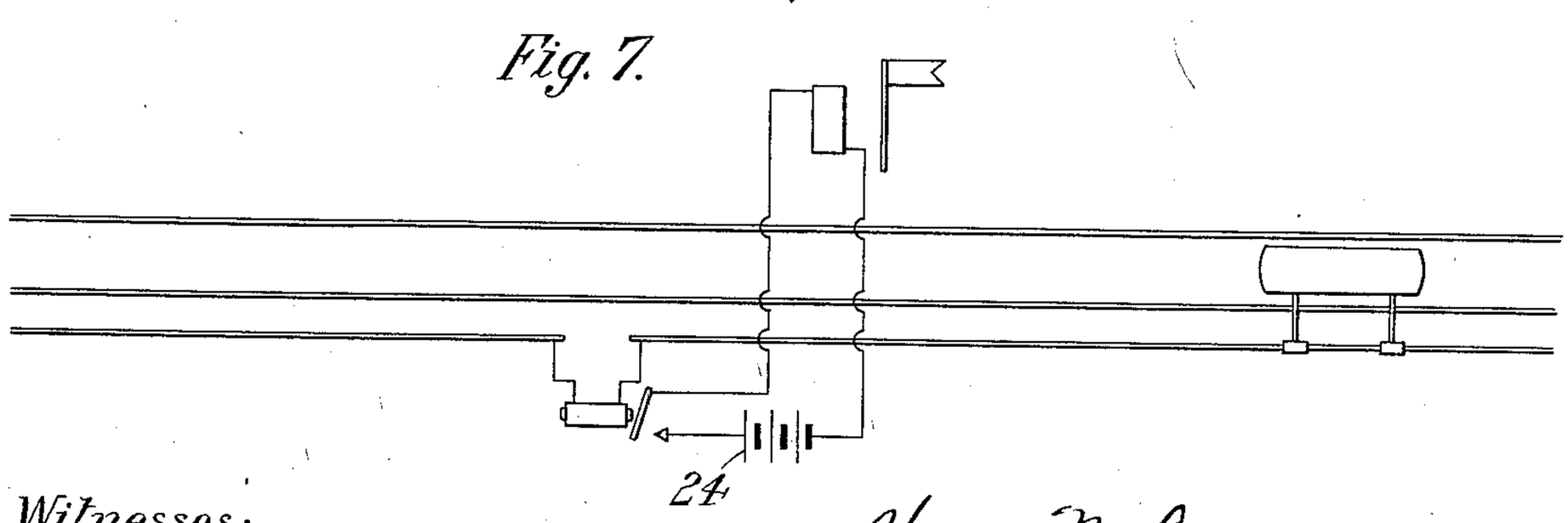


Fig. 7.



Witnesses:
Thos. J. Byrnes
D. S. Dunham

Harry N. Latey Inventor,
by Kerr, Page & Cooper, Att'ys.

UNITED STATES PATENT OFFICE.

HARRY N. LATEY, OF NEW YORK, N. Y.

SIGNALING SYSTEM FOR ELECTRIC RAILWAYS.

No. 883,964. Specification of Letters Patent. Patented April 7, 1908.

Application filed January 19, 1904. Serial No. 189,685.

To all whom it may concern:

Be it known that I, HARRY N. LATEY, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Signaling Systems for Electric Railways, of which the following is a specification, reference being had to the drawings accompanying and forming part of the same.

In electric traction systems in which the power is supplied to the car or train from a conductor arranged along the track or roadway, it has been proposed to divide the conductor into sections normally disconnected from each other, or adapted to be temporarily disconnected by suitable circuit breakers. By this arrangement the power may be cut off from any section or sections at will, at the same time leaving the others alive. Workmen engaged in the dead section of the roadway may therefore work in perfect safety though other sections of the conductor are energized and are supplying power to trains. Such a plan is particularly advantageous in the operation of elevated railways in cities, as it frequently happens that conditions arise there in which it is imperative that persons may move about on the elevated structure, as firemen in the discharge of their duties, without being hampered by the necessity of avoiding contact with the heavily charged conductor. It may happen, however, that when a section is cut out a car or train running on the adjacent live section may enter the other, and if the contact device carried by the car or train is long enough to bridge the gap between the sections the two will be connected and the dead section energized. The results might be fatal or dangerous to persons about the dead section, who, because of its previous condition, were not using care to avoid contact with it. Similarly, if a section should accidentally be short circuited. In such case, if a train or car with forward and rear contact shoes should attempt to enter the grounded section, bringing the forward shoe upon the said section while the rear shoe remained on the adjacent live section, the flow of current from the latter section through the car wiring to the dead section, might blow out the car fuse or fuses or damage the wiring of the car, or both. To prevent such accidents it has been proposed to make the gap between the sections slightly longer than the contacting surface of the contact device, or than the distance between the forward and rear contact devices, the inertia of the car being sufficient to carry it over the gap. But if more than one contact device be used on the car or train and they are electrically connected in any way, the gap in the line conductor must be at least as long as the distance between the forward and rear contacts. This is objectionable under any circumstances, and particularly where long, heavy trains are run, requiring large amounts of power.

Ordinarily the adjacent ends of the sections are of the same potential and could therefore be brought close together without the passing of trains from one to the other causing trouble, and each car would receive power through at least one contact device or shoe as the break was passed. Danger would then arise only when there had been a considerable drop in potential in one of the sections, as by reason of its being grounded or heavily loaded, or if it should be cut out for any purpose. In either case the results might be damaging to the electrical apparatus of the car or train, and in the second case might endanger the lives of firemen or others by energizing the dead section about which they had been working.

The sections of the power conductor in a system of the kind just described are energized from the power plant in any convenient way. For example, there may be a feed line parallel with the track, from which taps are brought out to the several sections, while the sections may be connected with each other by circuit breakers, or not, as desired. This method of energizing a power conductor in sections is familiar to those skilled in the art and need not be further described herein. The sections are of course connected with the feed line through circuit breakers, either automatic or only hand operated, so that any section may be cut out at will.

The object of my present invention is to provide a signaling system which will be actuated automatically whenever the potential in a section shall have fallen to a predetermined point, thereby warning the operators of trains approaching the section of its condition. The ends of the sections may there-

fore be brought as close together as desired, since warning signals are always set when dangerous conditions arise.

The invention itself, which consists in the novel features and combinations hereinafter described, and more particularly pointed out in the claims, will be more readily understood in connection with the accompanying drawings, in which

Figure 1 shows a system in which my invention is embodied. Figs. 2, 3 and 4 are modified arrangements. Fig. 5 shows the system of Fig. 1 in detail. Figs. 6 and 7 illustrate simple applications of the invention, differing in minor details.

The system illustrated in Fig. 1 is one in which the signals serve both as the ordinary block signals and for the purpose of indicating the conditions of which it is the purpose of my invention to give warning. The track is divided into blocks, as shown, the block rail 1 being energized in sections in any suitable manner and from any suitable source. The signal actuating devices 2 are connected between the block rail 1 and the return rail 3, so that they are ordinarily continuously energized and normally hold the signals at clear. When, however, a train enters a block the current will be short circuited from rail to rail through the wheels, and the signal actuating devices being no longer energized will permit the signal to take the position which indicates danger. As soon as the car or train has moved out of the block the first conditions will be restored and the signal again set at clear. The conductor which supplies energy to the train is indicated by 4, and is arranged in sections, as shown. Between the sections is a relay 5 adapted to make or break the circuit of the signal actuating devices with which it is connected. The relay is arranged to operate when the difference of potential between the sections of the conductor has from any cause reached a predetermined point. The signal circuit will then be opened and the signal set at danger, in the same manner as if the current had been short circuited between the rails by a car or train entering the block. In the figure the relay is shown to have been energized, breaking the signal circuit, setting the signal to danger, and holding a train indicated by 6. As soon as normal conditions of potential are restored between the sections of the conductor, the relay 5 will no longer be energized, and its armature will therefore fall and restore the signal circuit, setting the signal at clear and permitting the train to proceed.

In Fig. 5 the system which I have just described is shown more in detail, combined with a block signaling system. The operation of the block system is as follows. The block rail 7 is energized from the source of current 8 through feed wire 9, wire 10, resistance 11, wire 12, thence through block rail 7, wire 13, magnet coils 14, 15, wire 16, armature 25 (dotted position), wire 26 to the return rail 27 and back to the source 8. The magnet coils 14, 15 are thereby energized, raising armature 28, which lifts the end of the contact spring 29. The latter is pivoted at its center, as shown, either to the armature 30, or to an independent support, but is arranged close to the flat top of the said armature. The lifting of the armature 28 by the magnets 14, 15 therefore turns the spring 29 on its pivot, and the spring, engaging the flat top of the pivoted armature 30, throws the same over to the left. At the same time the spring 29, having risen against contact 31, completes a circuit therethrough. Current then flows from the feed wire 9 through wire 32, magnet coil 33, contacts 31, spring 29, wire 34, and wire 35 to the return rail 27. The coil 33 is so wound that being thus energized a magnetic pole is produced at the lower end of armature 30 of opposite sign to that of magnet 15. Previously the armature 30 had not been magnetized, with the result that it was attracted by the two magnets 14, 15, equally, and therefore would have remained in the position originally occupied before the feed wire 9 was energized. It is, however, thrown to the left by the turn of spring 29 on its pivot, as before explained. Upon the closing of contacts 31 the coil 33 is energized, as explained above, causing armature 30 to be drawn over to the right, raising the right end of spring 29 and closing contacts 36, but without breaking contact at 31, by reason of the fact that the spring can bend up to contact 36, while its other end is held against contact 31 by the armature 28. Current now flows from the feed conductor 9, to wire 32, coil 33, contacts 31, spring 29, contacts 36, wire 37, signaling devices 38, wire 35, to return rail 27. The devices 38 may be of any suitable character so arranged that the flow of current through the circuit last traced will cause the signal 39 to be set at clear. Such devices are well understood by those skilled in the art and therefore need not be further described herein. If now a train enters the block 40, as indicated at 41, the current will flow from the feed wire 9, wire 10, resistance 11, wire 12, track 7, through the trucks of the train, to the return rail 27. The magnets 14 and 15 being thus short-circuited the armature 28 falls, breaking contact at 31, thereby cutting off the current from coil 33. The armature 30 being thus demagnetized it is no longer attracted by the magnet 15 with sufficient force to overcome the tension of the spring 29, the right end of which it previously held against contact 36, and the tension of the spring therefore causes it to fall away from the said contact, breaking the circuit at that point and carrying the armature 30 back to its original central position between the magnets 14, 15. Current is there-

fore cut off from the devices 38, by reason of the circuit being opened at 36, and being no longer energized the said devices 38 automatically raise the signal to danger. This is the condition of affairs shown in Fig 5.

My system is combined with that just described, as follows. 42, 43, represent the sections of the conductor or rail from which the train receives its power. Across the break 44 is connected a relay 45, set to operate at a predetermined difference of potential between the sections 42, 43. When this occurs the armature 25 will be drawn over to its full line position, thus breaking the circuit through the magnet coils 14, 15. The circuit through the signal controlling devices 38 is thereby broken as above described and the signal set at danger. It will thus be seen that a predetermined difference of potential causes the signal 39 to be set at danger, as does the entering of a train into the block 40. Restoration of potential in the section in which the potential had fallen to the predetermined limit will permit the armature 25 to drop back into contact with the wire 16, thereby restoring the circuit through magnet coils 14, 15, and signal devices 38, and restoring the signal to clear. It will be noted that the power which controls the signal devices 38 when the potential of section 42 or 43 falls below the predetermined limit,—that is, the power which energizes the relay 45, and draws the armature 25 over, breaking the contact with the wire 16,—is supplied by the section of higher potential, either 42 or 43 as the case may be. The block signal system above described is well known and widely used. Considered separately, it is not a part of my present invention, but may enter into the latter as an element of the combination. It is described in detail herein merely for the purpose of showing how readily my invention may be applied to existing systems. As before stated, a predetermined difference of potential between the sections of the power conductor has the same effect on the signaling devices, 38, 39, as does a train entering the block, and restoration of normal potential in the abnormal section restores the system, as does the train leaving the block. Fig. 2 shows a similar system in which the sections of the conductor or contact rail are connected through suitable switches or circuit breakers, as 17, so that the sections are in series with each other as well as in multiple with the feed line. When it is necessary to cut off the power from a section the switches 17, at the ends thereof are opened, as well as the circuit breakers in the taps from the feed line. Sufficient current will then flow through the relay 18 to actuate its armature, breaking the circuit of the signaling devices 19 and setting the signal to danger. Fig. 3 shows diagrammatically a simple embodiment of the essential principle of my invention, without including block signaling devices. Here lamps, as 20, 21, are arranged in a circuit between the sections of the conductor 4, but insulated therefrom. When the circuit breaker 22 is open and the section either cut off or short-circuited the current through the lamp circuit will be sufficient to cause the lamps to glow. Fig. 4 illustrates a system in which the two previously described are combined, the lamps being connected in the relay circuit. Figs. 6 and 7 show simple applications of the invention, in the former the signal actuating devices 23 being energized by power taken from the contact rail 4 and in the latter by any independent source indicated by 24.

The devices of course operate either when the circuit of a section is open, that is, when the power is cut off, or when the section is short-circuited. In the former case the leakage through the insulators allows sufficient current to pass to operate the relay or light the lamps.

It should be understood that the systems described above are typical merely of the invention, and that the same may be embodied in devices differing widely from those shown. The specific apparatus for actuating the signal, the kind of relay used, whether polarized or unpolarized, the manner of connecting the relay with the signal circuit, and other details of the system are immaterial to the spirit of the invention, which requires only that the operation of the signal depends upon a difference of potential between the sections of the power conductor. Nor is the application of the invention limited to railway use, as it obviously can be employed wherever difference of potential between sections of a conductor is to be indicated.

What I claim is:

1. In a signaling system for electric railways, the combination with a conductor for delivering power to a vehicle, said conductor being composed of sections normally alive and at substantially the same potential; of a relay between conductor sections, dependent for operation upon a predetermined difference of potential between said sections, a circuit controlled by the relay, and signaling devices in said circuit, as set forth.

2. In a signaling system for electric railways, the combination with a conductor for delivering power to a vehicle, said conductor being composed of sections normally alive and at substantially the same potential; of a relay between conductor sections, dependent for operation upon a predetermined difference of potential between said sections, a normally closed circuit controlled by the relay, and signaling devices in the circuit adapted to be actuated to indicate danger when the relay is energized, as set forth.

3. In a signaling system, for electric railways, the combination with a block signal-

ing system, including a circuit and a feed wire for supplying current to energize the same; of a power conductor for supplying current to a vehicle, said conductor being composed of sections normally alive and at substantially the same potential, a relay magnet between conductor sections, dependent for energization upon a predetermined difference of potential between said sections, and an armature for the relay magnet, said armature forming a part of the said block signaling circuit, whereby the energization of the relay magnet will control the said circuit, as set forth.

HARRY N. LATEY.

Witnesses:
M. LAWSON DYER,
S. S. DUNHAM.