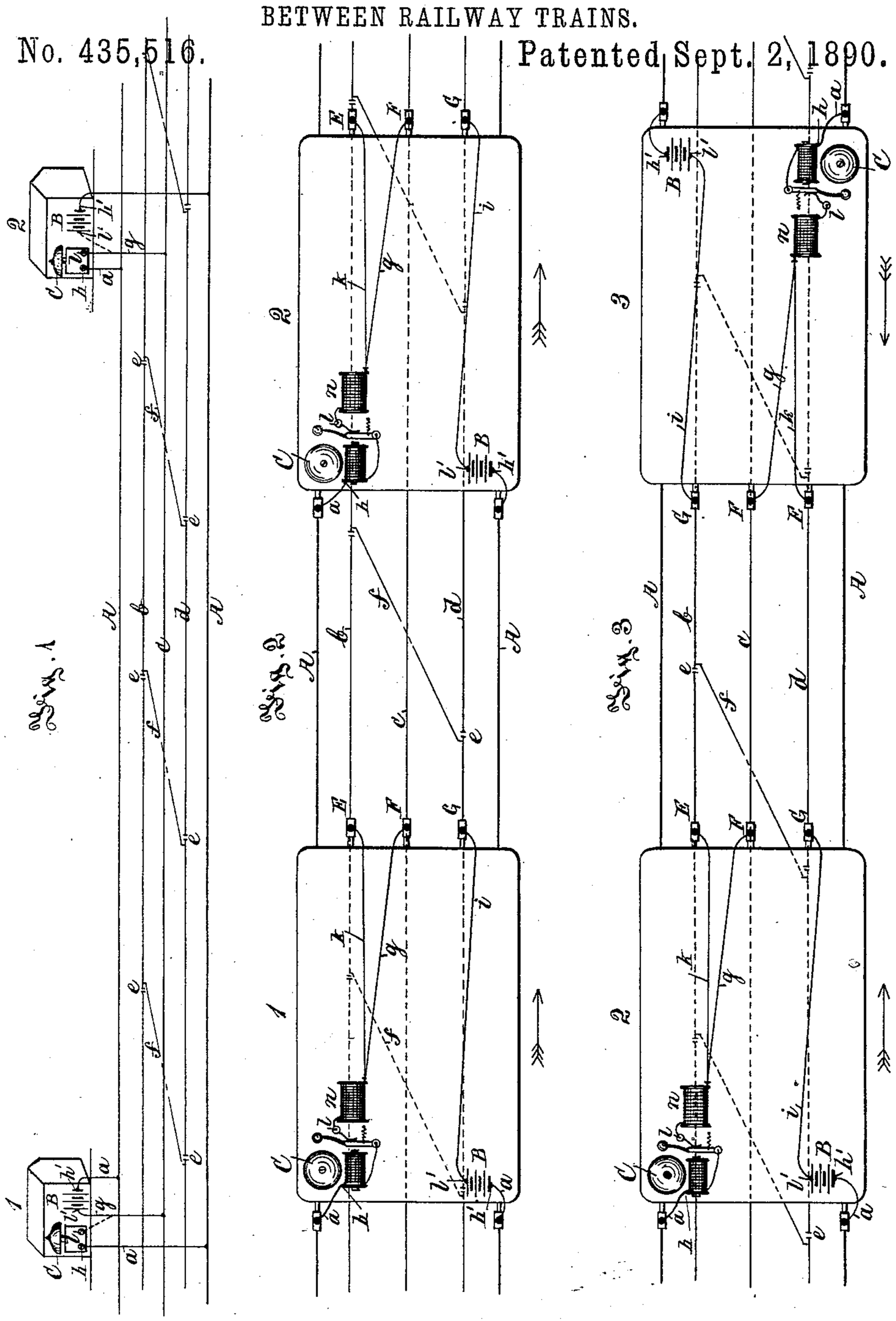
(No Model.) 3 Sheets—Sheet 1.

T. PERLS.

ELECTRIC SIGNALING APPARATUS FOR PREVENTING COLLISIONS BETWEEN RAILWAY TRAINS.

No. 435,516. Patented Sept. 2, 1890.



Witnesses:-
W. Harvey Muzzy
E. K. Sturtevant.

Inventor:-
Theodor Perls
By Wm. H. Babcock
Attorney

(No Model.) 3 Sheets—Sheet 2.

T. PERLS.

ELECTRIC SIGNALING APPARATUS FOR PREVENTING COLLISIONS BETWEEN RAILWAY TRAINS.

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Fig. 5.

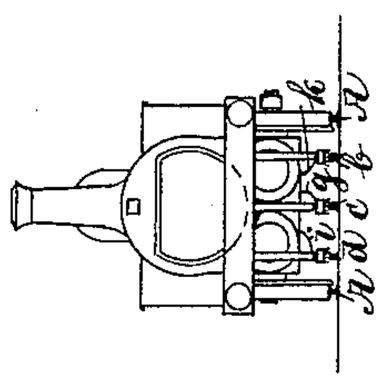


Fig. 4.

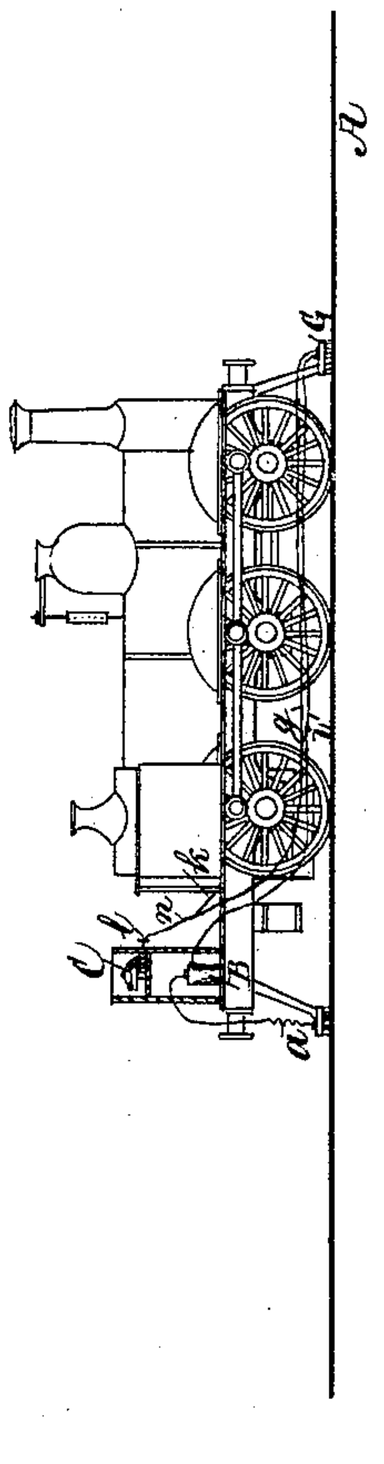
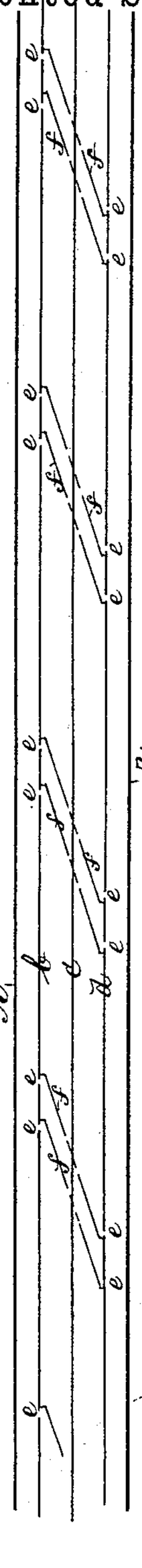


Fig. 6.



Witnesses:-
William H. Muzzy.
James McSpen

Inventor:-
Theodor Perls
by Wm H Babcock
Attorney

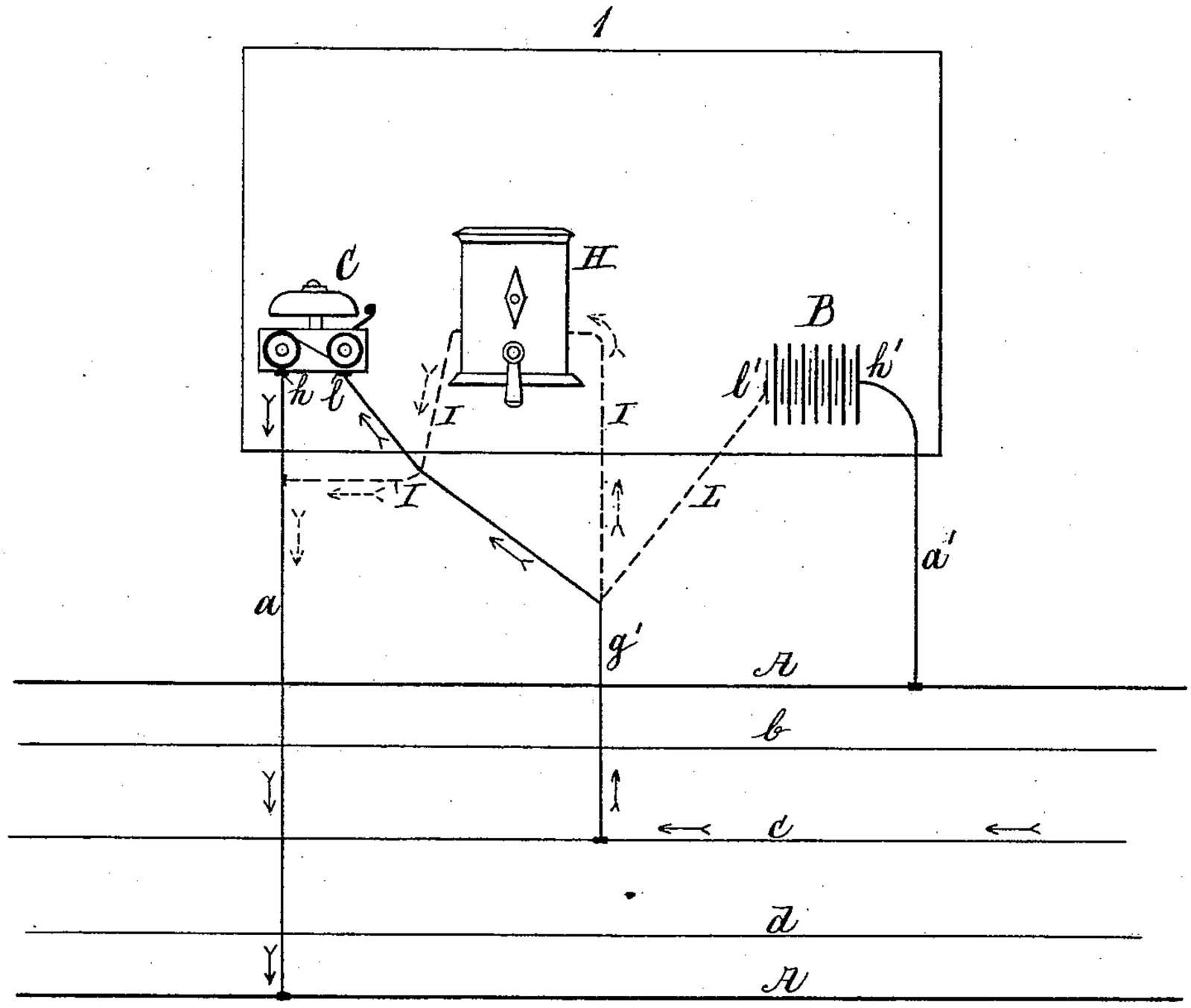
(No Model.) 3 Sheets—Sheet 3.

T. PERLS.

ELECTRIC SIGNALING APPARATUS FOR PREVENTING COLLISIONS BETWEEN RAILWAY TRAINS.

No. 435,516. Patented Sept. 2, 1890.

Fig. 7



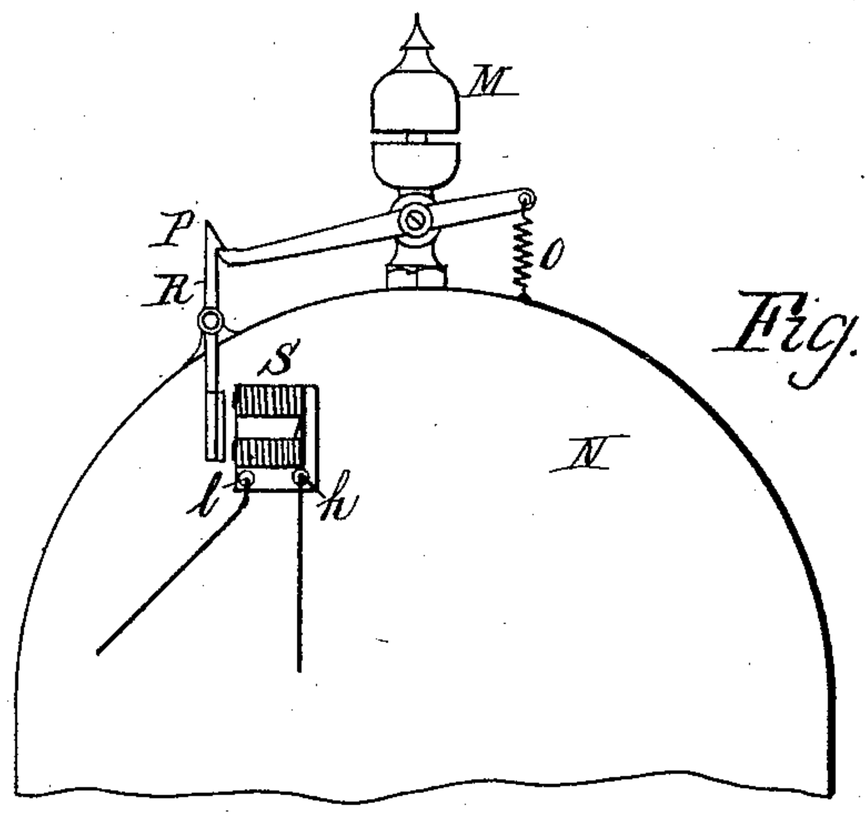


Fig. 8.

Witnesses:-
Wm. A. Mazzy
H. G. Conn,

Inventors:-
Theodor Perls
By Wm. A. Babcock
Attorney

UNITED STATES PATENT OFFICE.

THEODOR PERLS, OF WURZBURG, GERMANY, ASSIGNOR OF ONE-HALF TO MARTIN PERLS, OF LONDON, ENGLAND.

ELECTRIC SIGNALING APPARATUS FOR PREVENTING COLLISIONS BETWEEN RAILWAY-TRAINS.

SPECIFICATION forming part of Letters Patent No. 435,516, dated September 2, 1890.

Application filed January 31, 1890. Serial No. 338,730. (No model.) Patented in France February 4, 1889, No. 195,828; in Belgium February 4, 1889, No. 84,874; in Germany February 5, 1889, No. 50,258; in Italy March 31, 1889, No. 24,852, and in Austria-Hungary June 13, 1889, No. 6,115.

To all whom it may concern:

Be it known that I, THEODOR PERLS, engineer, a subject of the King of Bavaria, and a resident of Wurzburg, in the Kingdom of Bavaria, have invented certain new and useful Improvements in Electrical Signaling Apparatus for Preventing Collisions between Railway-Trains, (for which I have obtained Letters Patent in France, dated February 4, 1889, No. 195,828; in Belgium, dated February 4, 1889, No. 84,874; in Germany, dated February 5, 1889, No. 50,258; in Italy, dated March 31, 1889, No. 24,852, and in Austria-Hungary, dated June 13, 1889, No. 6,115,) of which the following is a specification.

My invention relates to improvements in electrical signaling apparatus upon railways; and the objects of my improvements are, first, to provide means by which signals are automatically given between two railway-trains moving in the same or in opposite directions when they have approached within a certain determined distance from each other; second, to enable such automatical signals to be also given simultaneously to stations upon the line of railway; third, to enable the stations to communicate with each other, and at the same time with any train or trains which may be between them; fourth, to enable the drivers or conductors of two or more trains upon the same line of railway to communicate with each other; fifth, to provide means by which signals are automatically given to prevent trains from running into sidings, and, sixth, to provide means by which electrical signals are automatically given to the drivers or conductors of trains when the line upon which they are moving is blocked by carriages or wagons. I attain these objects by the means illustrated in the accompanying drawings, in which—

Figure 1 is a plan of a line of railway, showing the rails, the electrical conducting-wires, and two adjoining signal-stations. Fig. 2 is a plan showing two locomotive-engines following each other in the same direction upon the same line of rails, and Fig. 3 is a plan showing two locomotive-engines meeting each other when running in opposite directions upon the same line of rails. Fig. 4 is a side view, and Fig. 5 a front view, of an engine. Fig. 6 is a plan of a modified arrangement of the track and conductors. Fig. 7 is a diagram illustrating the electrical connections. Fig. 8 is a view in elevation of a part of the boiler, the steam-whistle thereon, and certain devices for operating the latter.

Similar letters refer to similar parts throughout the several figures.

A A are the main rails, between which is placed on each side an insulated electric conducting wire or rod *b* and *d*, parallel with the rails A A and interrupted at determined distances apart at *e e e* by non-conductors in such a way that the interruption of one wire is just opposite to the middle of the length of the other wire, and so on. Another insulated wire *c*, which is placed between the two *b* and *d*, is uninterrupted and reaches continuously from station to station, as shown in Fig. 1. The two interrupted wires *b* and *d* are connected by diagonal insulated wires *f*, arranged in such a way that always shortly before any interruption *e* in the wire *d* an electrical connection is established with a point just in advance of the next interruption *e* in the wire *b*, or vice versa.

Upon the foot-plate or in any other convenient position on each engine an electrical battery B, consisting of a sufficient number of elements, is placed. Separate from this battery B is also fixed upon each engine an electric bell C or an electro-magnet, which, when a current of electricity is sent through its wire, sets in operation a brake acting upon the wheels in the usual way, and also, if desired, opens a steam-whistle.

In front of the leading-wheels or behind the trailing wheels of each engine three insulated copper brushes E F G or wheels or rollers are arranged so that they press upon the insulated wires *b*, *c*, and *d*, respectively. From one pole *h'* of the battery B proceeds a connecting-wire *a*, which is in metallic connection with a similar copper brush pressing upon one of the main rails, and so communicating

with earth. From the pole l' of the battery B an insulated wire i is connected with the brush G, which is on the right-hand side in relation to the direction of movement of the engine and train. One binding-screw h of the electro-magnetic bell C is connected with the main rail A and with earth in the same way as the pole h' of the battery B—that is to say, by an insulated wire a, connected with a copper brush or wheel pressing upon the rail A. To the other binding-screw l is fixed at n a resistance-coil or other equivalent device of the well-known kind, to the opposite end of which are attached two insulated wires g and k. The wire k is connected with the left-hand brush E, which presses upon the interrupted wire b, and the wire g is connected with the brush F, which presses upon the middle uninterrupted wire c.

The arrangement of the battery, electrical bell, conducting-wires, and brushes is absolutely the same upon every engine. Supposing that two engines coming in opposite directions have approached each other so nearly, as illustrated in Fig. 3, that only one of the insulated conducting-wires b and d between them remains interrupted, the electrical circuit is completed through the wire which is not interrupted (d in the figure) and through the rails A A or earth. In this case the current from battery B of engine 2, Fig. 3, passes through the pole l' on the right-hand side of the engine, and through the wire i, brush G, and wire d to the brush E, wire k, and resistance n on engine 3 to the binding-screw l of the electro-magnetic bell C of the same engine, and from the other binding-screw h through the wire a to the main rail A and earth. The circuit being thus completed, the bell C on engine 3 will sound, and if a brake and whistle be used, as already described, the latter will be sounded and the engine will be stopped. The resistance n is so adjusted that only a part of the current passes to the bell C, while another part passes back through the wire g on engine 3 to the brush F on the same engine, and along the central wire c to the brush F on engine 2, and along the wire g and resistance n to the binding-screw l on the electrical bell C on the same engine, and through the binding-screw h and wire a to main rail A and earth, and the bell upon engine 2 accordingly rings. A part of the current also proceeds along the central uninterrupted wire c to the nearest stations on both sides, as illustrated in Fig. 1, by means of insulated wires g', connected with the binding-screws of electrical bells in the stations, which accordingly ring, and the stations are automatically informed that something is wrong upon the line. Should it happen that other engines are on the same line when two engines have already come so near each other that they are electrically connected, as described, the former likewise receive a signal from their bells by means of part of the electrical current, which passes on along the central wire c through the binding-screws of their bells and back from the latter to the main rails A A and earth. This will happen even if such engines have not come so near the engines which have already been stopped that only one interruption e is left between these latter and themselves in the wires b and d. The central wire c and the main rails A A are also utilized for the purpose of telephonic or telegraphic communication between the stations, as well as between the latter and any engines which may be upon the line, whether in motion or at rest. Thus the drivers of engines which happen to be upon the same line may communicate with each other through the telephonic or telegraphic instruments carried upon their engines. They can also communicate with the stations in the same way by connecting their battery with the insulated wire g and through the brush E with the central wire c, the current passing from the battery B through the wire g, brush E, and central wire c to the bell, telephone, or telegraph instruments in the stations, and thence back through the main rail A and wire a to the other pole of the battery.

Fig. 1 shows the connection which has to be made if station No. 1 wishes to communicate with station No. 2 or with a train which is on the main line between them. To do this the wire g', which is otherwise always connected with the binding-screw l of the electric bell C, as shown by the dotted lines, is transferred at station No. 1 to the pole l' of the battery B, as shown, and as the other pole h' of the battery is in connection with the main rail A by the wire a', and as the binding-screw h of the bell C has the same connection, the electric current proceeds from station No. 1 from h' through a', A to a', h of station No. 2, and through g'' to the central wire c and the wire g' to the pole l' of the battery in station No. 1, and the circuit being completed the bell C in station No. 2 will be sounded. Should there be an engine on the line between the stations, a part of the current passes through it from the central wire c and brush F to the bell upon the engine, and thence to the main rail A and to the battery in station No. 1, and the bell upon the engine will also be sounded.

Fig. 2 illustrates the course of the electric current when one train is following another upon the same line. In this case the current proceeds from the pole l' of the battery B on engine No. 1 and through the wire i to the brush G. As indicated by the small arrows, it then proceeds along the wire d, through the diagonal conducting-wire f, and along the wire b to the brush E upon engine No. 2, and along the wire k to the resistance n, and to the bell c upon engine No. 2. A part of the current also proceeds by the wire g to the brush F, and along the central wire c to the brush F on engine No. 1, and through the wire g and resistance n to the bell C upon

the same engine, and through *h a* to the main rail A. The remainder of the current passes along the central wire *c* to the bells in stations Nos. 1 and 2, as illustrated in Fig. 1, and thus all the bells on the engines and in the stations are sounded. The return-current always passes through the main rails A.

As the batteries B and bells C are arranged in the same position upon all the engines, if one train is following another they are on the same side on both engines, and it is therefore necessary that the electrical current should be transferred from the wire *b* to the wire *d*, and vice versa. This is accomplished by the diagonal wires *f*, as already set forth. It will be seen that in the case as shown in Fig. 2 the current acts and sounds the bells at double or more the distance which it does when the trains are coming together from opposite directions, as shown in Fig. 3. This is advantageous, because if one train is approaching another which is traveling in the same direction or is standing on the line, and if the leading train is very long, then, as the apparatus is only fixed upon the engines, it might happen that the engine of the following train might come in collision with the last carriage of the leading train before it has been stopped by the sounding of the bell. If, however, it is desired to reduce the distance at which the signals come into operation in the case of one engine following another in the same direction, the modification shown in Fig. 6 is used. In this the sections into which the interrupted wires *b* and *d* are divided are not of equal length, but each two long sections are separated by a short one a few feet only in length. By this means the distance at which the bells sound when one engine is following another is reduced in the proportion of about three to five as compared with the original arrangement shown in Fig. 2; but additional diagonal wires *f* are in this case required. The operation in the case of two trains meeting would remain unaltered. It is of course understood that the distance between the interruptions in the wires *b* and *d* and the length of the diagonal wires is much greater than it is possible to show in the drawings. The distance between the interruptions may be a mile or more, if desired. In the case where two engines are approaching in opposite directions, as shown in Fig. 3, the bells will continue to sound until they meet. If, on the other hand, one is following the other, as shown in Fig. 2, the bells will sound much sooner, so as to give ample warning, and may cease to sound before the trains absolutely touch. Should carriages or wagons be standing on the main rails, an iron or other bar is placed in front and behind them, so as to connect the conducting-wires *b* and *c*, and thus to give notice in the same way to a train approaching too near. The interruptions *e* in the conductors *b* and *d* are arranged at a shorter distance apart in the neighborhood of stations than at a distance from the latter.

In Fig. 7 the central wire *c* is shown communicating through the wire *g'* with the bell C, and thence through the wire *a* with the main rail A, the current taking the course indicated by the arrows. This is the normal position of the connections.

H represents a telegraphic instrument, by which signals can be received and sent, the bell C being then switched out of the circuit and the conducting-wires being connected with the instrument H, as shown by the dotted lines I I, and the current taking the course shown by the dotted arrows.

The dotted line L shows the battery B connected with the wire *c* instead of the bell C. If the instrument H be connected into the circuit on the wire L, signals can be sent by it from the station to the other stations or to the engines on the line, as already described.

It is evident that instead of a telegraphic instrument a telephone may be used at H and similar instruments operated in the same way upon the engines.

In Fig. 8 a steam-whistle M is shown upon the boiler N of a locomotive. This whistle is opened by a spring O, but is ordinarily kept closed by a catch P upon a lever R. An electro-magnet S, operating upon the lever R, withdraws the catch P and opens the whistle when an electric current passes the wires *l h*, as described.

Instead of opening the steam-whistle M, a valve may be opened in the same way to admit steam to operate a brake or to admit air to an atmospheric brake.

The normal position of wire *g''* at station 2 is shown in the plain line connected with the bell C, and the dotted line shows it when transferred from the bell C to the pole I' of the battery B in order to transmit signals from the station 2.

Engines used for shunting cars or making up trains or other service not requiring the transmission of signals, but only receiving them, need not be supplied with batteries, but only with electric bells.

I claim—

1. The combination of the alternately-interrupted conductors *b d* and the continuous conductor *c* with the electrical batteries B, signaling devices C, conducting brushes or rollers E F G, conductors *i*, *g*, and *k*, and resistance devices *n*, arranged upon the engines, and all operating substantially as set forth and shown.

2. The alternate long and short sections of the interrupted conductors *b* and *d*, in combination with the corresponding diagonal conductors *f* and continuous conductor *c*, substantially as and for the purpose set forth.

3. In combination with the interrupted conductors *b* and *d*, continuous conductor *c*, diagonal conductors *f*, main rails A A, and engines provided with batteries B, signaling ap-

paratus C, conducting-brushes E F G, conductors *i g k*, and resistances *n*, the signal-stations on the line provided with signaling apparatus C, and conductors *g' g''*, connected with the continuous conductor *c*, and *a'* connected with the main rails A A, substantially as and for the purposes set forth and shown.

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

THEODOR PERLS.

Witnesses:
SAMUEL MËYER,
FRANZ ANTON EGSTEIN.