No. 672,830. Patented Apr. 23, 1901.

W. W. HOFFMAN & F. W. POWERS.

RAILWAY SIGNAL SYSTEM.

(Application filed June 6, 1900.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

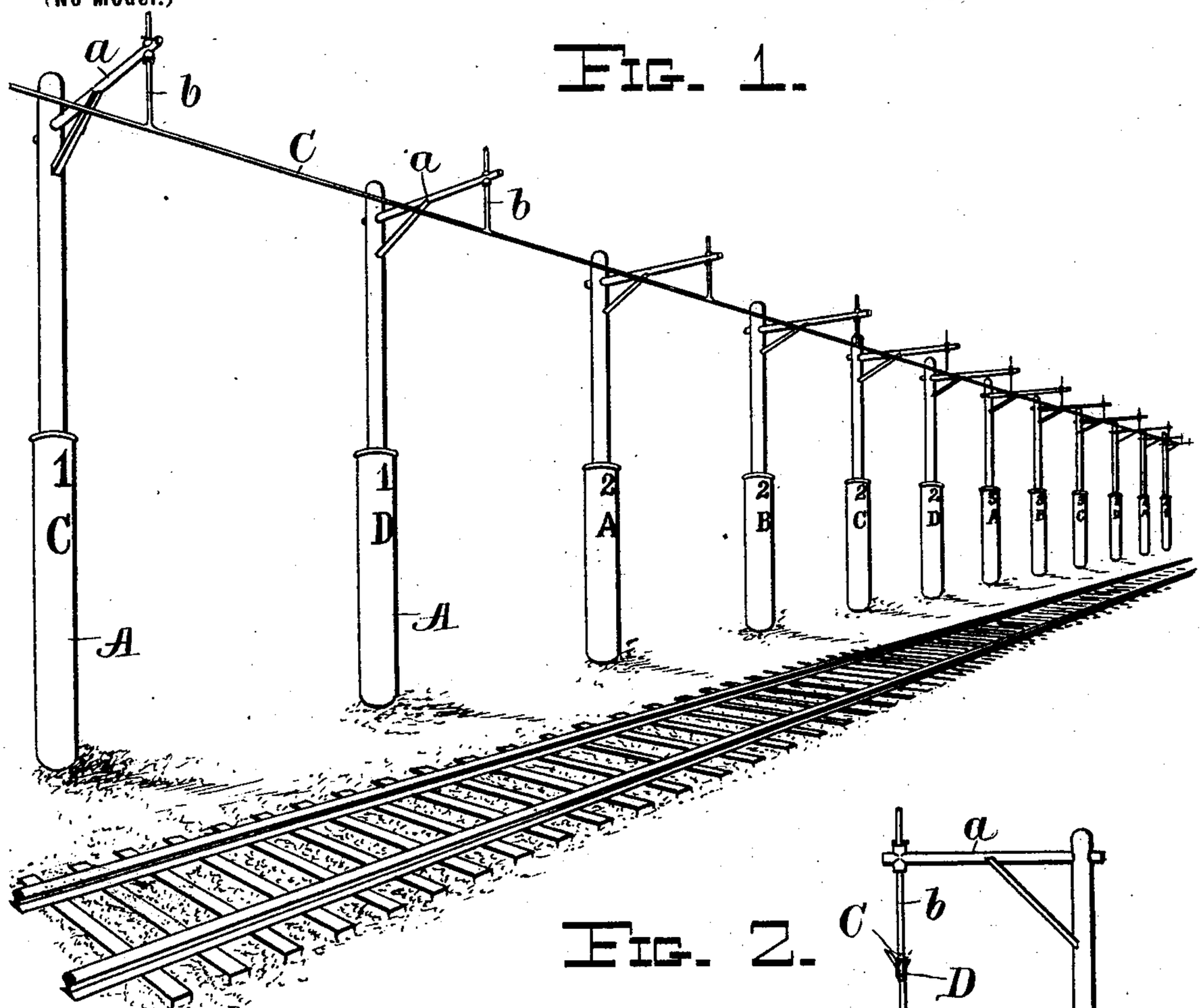

FIG. 2.

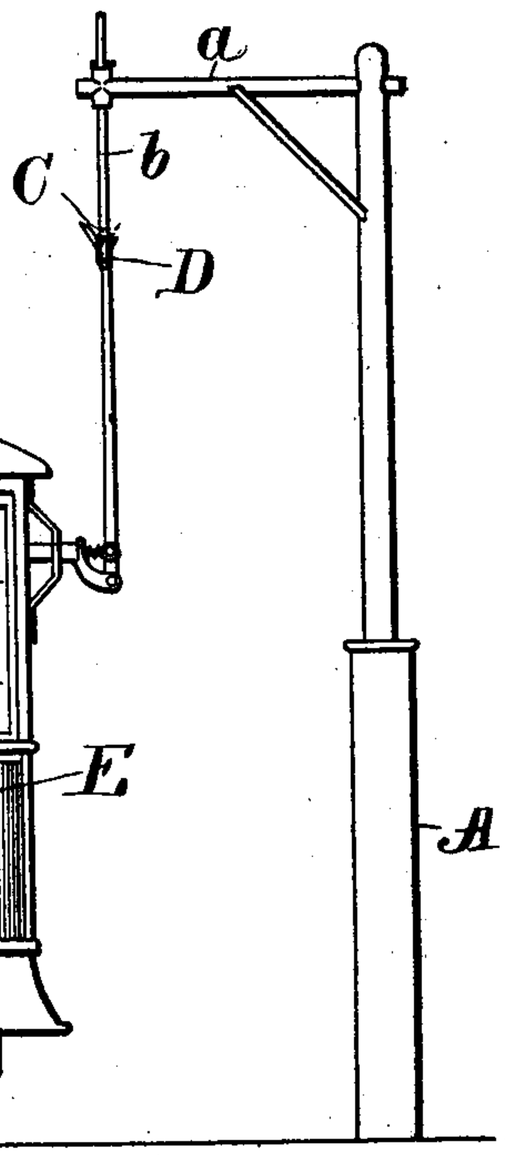

FIG. 4.

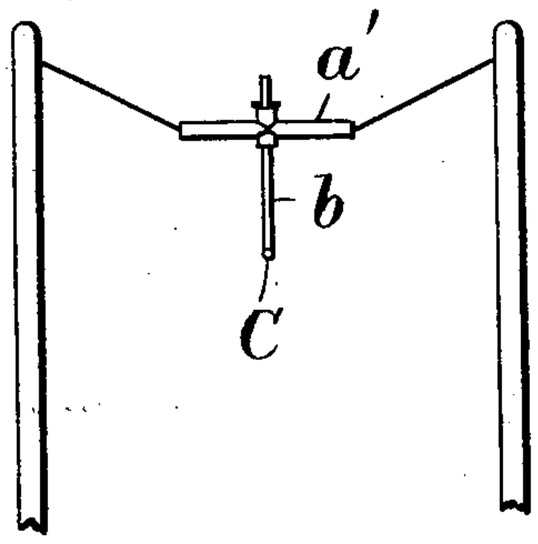

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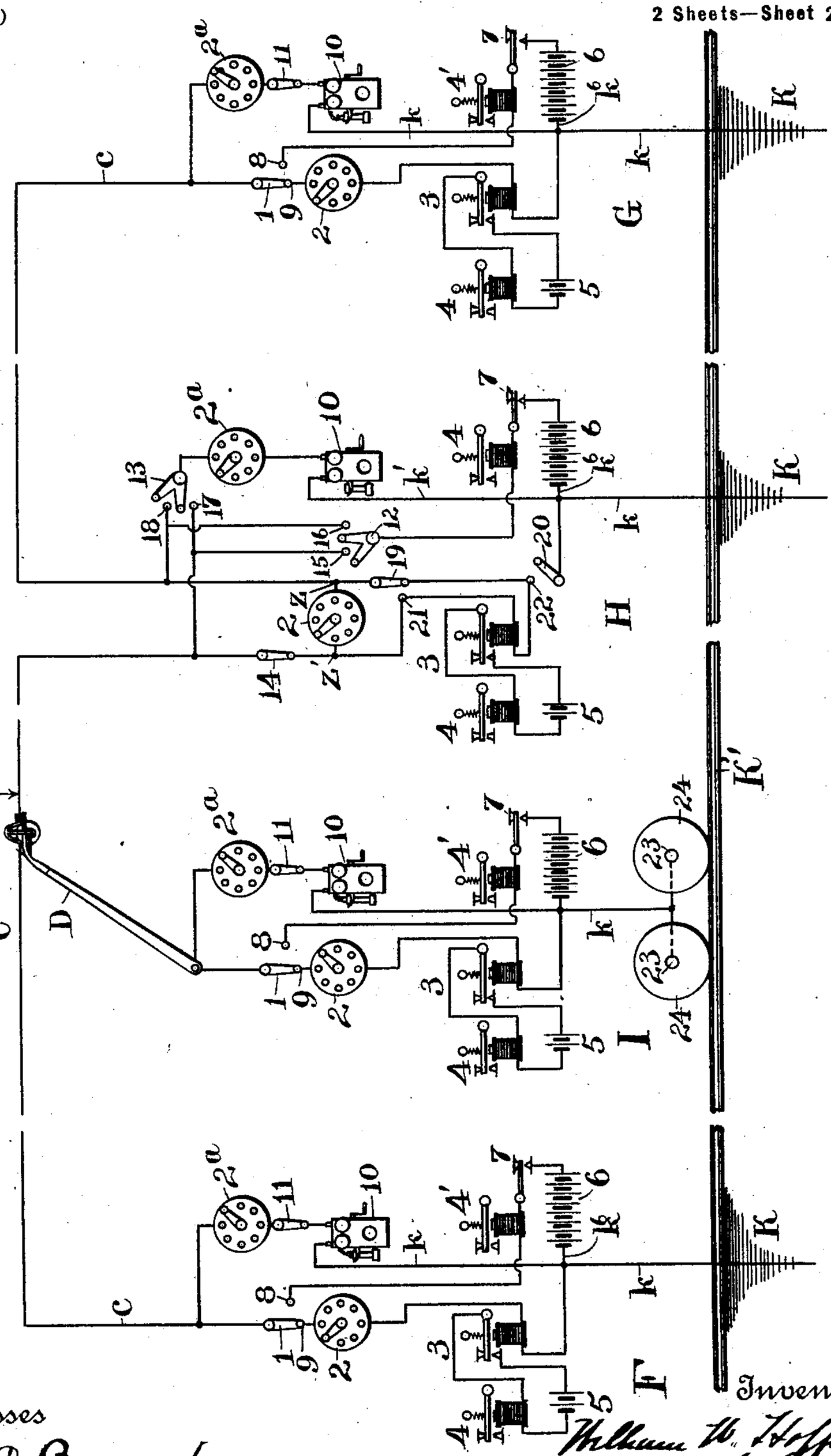
FIG. 3.



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UNITED STATES PATENT OFFICE.

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RAILWAY SIGNAL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 672,830, dated April 23, 1901.

Application filed June 6, 1900. Serial No. 19,311. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM W. HOFFMAN and FRANCIS W. POWERS, citizens of the United States, residing at West Lafayette, in the county of Tippecanoe and State of Indiana, have invented certain new and useful Improvements in Railway Signal Systems; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to improvements in railway signal systems; and it has for its object certain improvements in the art of signaling to and from moving trains by means of electricity, hereinafter described and claimed. This object we attain by use of the telegraph and telephone in connection with the several novel features combined and constituting our railway signal system.

This system consists, first, of a trolley or line wire continuous along the whole route and supported along the side of the track on depending arms adjustably secured to horizontal brackets, which latter are supported in any suitable manner at a sufficient height to be out of the way of the trolley should it leave the wire; second, of a trolley attached to one side of the car, so that it is always in control of and easily adjusted by a person on the inside of the car; third, an open electric circuit for signaling on moving trains by telegraph and by telephone, each office along the line being supplied with battery or other electromotive force for sending signals independent of any other office and each train also being provided with an office in a car supplied with telegraph and telephone instruments and with electromotive force of its own for signaling.

This system also consists of certain novel features and details of construction and arrangement of parts hereinafter fully described and claimed.

Our invention will be understood by reference to the accompanying drawings, wherein the same parts are indicated by the same characters throughout the several views.

Figure 1 is a perspective view of a portion of a car-track, showing trolley-poles arranged along the side thereof and a wire supported below the arms on the poles, the poles being divided into groups and designated by suitable characters. Fig. 2 represents a section through such a track, showing in end elevation a car thereon, having a trolley secured to its side and making contact with the said wire. Fig. 3 is a diagrammatic view showing the trolley-wire and the arrangement of instruments and circuits in the two terminal stations, an intermediate station, and an office on a moving car. Fig. 4 is a detail view showing a modified method of hanging the trolley-wire when it is more convenient to place two poles some distance away from the track, one on each side thereof.

In carrying our invention into practice we use a line of poles A, set along one side of the railway-track. Each pole has a horizontal bracket *a* extending toward the track, to which is attached, so as to be adjustable, a depending arm *b*, properly insulated, which supports the trolley or line wire C. The object of the depending arms *b* is to suspend the trolley-wire so far below the brackets *a* that the latter will be above the reach of the trolley, even if it should get off the trolley-wire.

At places where it is not convenient to have poles near the track a pole may be set at a convenient distance on each side of the track (see Fig. 4) and a horizontal bar *a'* suspended across and above the track, to which the depending arm *b* is attached, the main object being to support the trolley-wire C at a uniform distance above and to one side of the track, so that a trolley D, attached to one side of the car E, as shown in Fig. 2, will travel smoothly along said wire.

The terminal stations F and G at each end of the line have receiving instruments which consist of a rheostat 2, a relay 3, sounder 4, and a small battery 5 to work the sounder. A switch 1 connects the rheostat 2 with the end of the main-line wire C. The current of electricity transmitting a signal from a distance passes from the line-wire C through the wire *c*, the switch 1, the rheostat 2, the relay 3, and the wire *k* to the ground at K. The object of the rheostat is to regulate the current to the proper working of the relay which connects the sounder to the small battery 5.

The instrument or means for sending a signal by telegraph consists of a strong battery or other electromotive force 6, with its negative pole grounded through the wires k^6 and k, its positive pole connected with a key 7, which is connected through a sounder 4′ to a button 8. To send a telegram, the switch 1 is to be moved from the button 9 to the button 8, which connects the sending instruments with the main line and disconnects the receiving instruments. The message is then sent by manipulation of the key 7 in the usual manner. The switch 1 should normally be on the button 9, except while sending a message, when it should be moved to the button 8.

The office is also supplied with a telephone 10, which is connected with the main-line by the switch 11. The negative pole of the telephone-battery is grounded through the wires k', k^6, and k. A rheostat 2^a is placed in the connection of the telephone with the main line to balance the resistance with the telegraph and to regulate the current to the telephone. While using the telegraph the telephone must be disconnected, and while using the telephone the telegraph must be disconnected to prevent short-circuiting.

The instruments in the intermediate offices H are the same as in the terminal stations at the end of the line and are designated by the same characters of reference. The line-wire C passes through the office H, as shown in Fig. 3. As the current passes through the office it is divided at the point z into two branches, one of which passes through the switch 19 and the relay 3, which operates the sounder 4. The other branch passes through the rheostat 2, the two branches then uniting at the point Z′ and passing through the switch 14 along the line. The rheostat is to regulate the current that passes through the relay, as the greater the resistance in the rheostat the greater will be the current that passes through the relay. The instruments for sending telegrams are the same as in the terminal stations—the battery or other electromotive force 6, with negative pole grounded, and the positive pole connected through key 7 and sounder 4′ to the double switch 12. To send a telegram, the double switch 12 is first moved onto the two buttons 15 and 16, which are connected with the main line in such a way that the current will go in both directions on the line without passing through the relay or rheostat. The message is then sent by manipulation of the key 7 in the usual manner. The message may be sent in one direction only by opening the switch 14 and connecting the switch 12 with one button only. The telephone 10 in this office has the negative pole of its battery grounded and the positive pole connected with the double switch 13 through a rheostat 2^a. The button 17 is connected to the line running one way and the button 18 with the line running the other way from the office. By connecting the double switch 13 with both buttons a signal or message can be sent in both directions at the same time; but if it is desired to send in one direction only it can be done by opening the switch 14 and connecting the switch 13 with one button only. The rheostat 2^a is to regulate the current to the telephone. Normally the switch 13 should be connected with one button only, and switch 12 in the telegraph should be left open.

If the line should be broken between two offices, as at the point x, a signal could be sent from those offices in the direction away from the break without the line being grounded from the relay; but neither could receive a telegram. To make it possible to receive a telegram in such a case, switch 19 is placed so as to unite the line-wires before they reach the relay by moving the switch 19 to the button 21 and by moving the switch 20, which is connected with the ground-wire k to the button 22. (See station H in Fig. 3.) With this arrangement of switches the line from either direction is grounded after passing through the relay 3. It is not the design that this connection should constantly be used, but only in case of a break in the line that would otherwise destroy the circuit for that office.

Each train has an office I, located in a car, supplied with a switch 1, a rheostat 2, and a relay 3, sounder 4, and a battery 5 for receiving signals by telegraph, and a strong battery or other electromotive force 6, a key 7, and a sounder 4′ for sending telegraphic signals; also, a complete telephone 10, with a switch 11 and a rheostat 2^a, all being of similar design and connections substantially as those described for the offices H and terminal stations, only the connection with the main-line wire is by means of the trolley D, attached to the side of the car, as is shown in Fig. 2.

The connection with the ground, which acts as a return-wire in our entire system, is effected by connecting the wire k with the car-axles 23, which are connected through the wheels 24 and rails K′ to the ground.

Now with the means of perfect communication at hand the operator on a swift-moving train, with its ever changing position, could not intelligently designate to a distant office or train just where his train is. To obviate this difficulty, we divide the route into sections of one mile each and number each section, as "1," "2," "3," "4," &c., all the way along the route and place the number of each section conspicuously on each pole in that section, and that greater accuracy may be given when desired we subdivide each section into any number of parts and letter each part, as "A," "B," "C," "D," placing the letters also upon the poles, as shown in Fig. 1, so that the operator upon the car can at any time give by number the section and by letter what part of that section his train is in, and thus notify every train operator on the line of the exact location of his train.

Having thus described our invention, what we claim, and desire to secure by Letters Patent of the United States, is—

1. In a railway signal system, the combination with a main-line wire, a car in constant electrical connection with said main-line wire, and terminal stations at the end of said line-wire; of intermediate stations, a rhoestat in each of said intermediate stations having both ends of the line-wire connected therewith, receiving instruments connected in multiple with the said rheostat, a switch 19 connected with one end of the line-wire and adapted to connect with either of the wires from the receiving instruments, a switch 20 connecting said receiving instruments with the ground, an electric generator, and sending instruments at the intermediate station, connected with said line-wire, substantially as described.

2. In a railway signal system, the combination with a main-line wire, a car in constant electrical connection with said main-line wire, and terminal stations at the end of said line-wire; of intermediate stations, a rheostat in each of said intermediate stations having both ends of the line-wire connected therewith, receiving instruments connected in multiple with the said rheostat, a switch 19 connected with one end of the line-wire and adapted to connect with either of the wires from the receiving instruments, a switch 20 connecting said receiving instruments with the ground, an electric generator, a sending-key 7 connected with said generator, and a two-pole switch connecting said key with the main-line wire; substantially as described.

3. In a railway signal system, the combination with a main-line wire, poles arranged in groups designated by numbers, and the poles in the groups designated by letters, said poles supporting said wire, a car in constant electrical connection with said wire, and terminal stations at the end of said wire; of intermediate stations, a rheostat in each of said intermediate stations having both ends of the line-wire connected therewith, receiving instruments connected in multiple with the said rheostat, a switch 19 connected with one end of the line-wire and adapted to connect with either of the wires from the receiving instruments, a switch 20 connecting said receiving instruments with the ground, an electric generator and sending instruments at the intermediate station, connected with said line-wire, substantially as described.

4. In a railway signal system, the combination with a main-line wire, a car in constant electrical connection with said main-line wire, a rheostat and receiving instruments in said car connected with the ground, a battery and sending instruments in said car also connected with the ground, and a switch adapted to connect either the rheostat and receiving instruments for the battery and sending instruments, with the line-wire; of terminal stations at the end of said line-wire, intermediate stations, a rheostat in each of said intermediate stations having both ends of the line-wire connected therewith, receiving instruments connected in multiple with the said rheostat, a switch 19 connected with one end of the line-wire and adapted to connect with either of the wires from the receiving instruments, a switch 20 connecting said receiving instruments with the ground, an electric generator and sending instruments at the intermediate station, connected with said line-wire, substantially as described.

5. In a railway signal system, the combination with a main-line wire, a car in constant electrical connection with said main-line wire, a rheostat and receiving instruments in said car connected with the ground, a battery and sending instruments in said car also connected with the ground, and a switch adapted to connect either the rheostat and receiving instruments or the battery and sending instruments, with the line-wire; of terminal stations at the end of said line-wire, intermediate stations, a rheostat in each of said intermediate stations having both ends of the line-wire connected therewith, receiving instruments connected in multiple with the said rheostat, a switch 19 connected with one end of the line-wire and adapted to connect with either of the wires from the receiving instruments, a switch 20 connecting said receiving instruments with the ground, an electric generator, a sending-key 7 connected with said generator, and a two-pole switch connecting said key with the main-line wire; substantially as described.

6. In a railway signal system, the combination with a main-line wire, poles arranged in groups designated by numbers, and the poles in the groups designated by letters, said poles supporting said wire, a car in constant electrical connection with said wire, a rheostat and telephonic instruments in said car connected with the ground, a battery and sending instruments in said car also connected with the ground, and a switch adapted to connect either the rheostat and receiving instruments or the battery and sending instruments, with the line-wire; of terminal stations at the end of said wire; intermediate stations, a rheostat in each of said intermediate stations having both ends of the line-wire connected therewith, telephonic instruments connected in multiple with the said rheostat, a switch 19 connected with one end of the line-wire and adapted to connect with either of the wires from the receiving instruments, a switch 20 connecting said receiving instruments with the ground, an electric generator and sending instruments at the intermediate station, connected with said line-wire, substantially as described.

7. In a railway signal system, the combination with a main-line wire, supports for said wire, depending arms connecting said wire to said supports, a car in constant electrical connection with said main-line wire, terminal

stations at the end of said line-wire, intermediate stations, a rheostat in each of said intermediate stations having both ends of the line-wire connected therewith, receiving instruments connected in multiple with the said rheostat, a switch 19 connected with one end of the line-wire and adapted to connect with either of the wires from the receiving instruments, a switch 20 connecting said receiving instruments with the ground, an electric generator, and sending instruments at the intermediate station, connected with said line-wire, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM W. HOFFMAN.
FRANCIS W. POWERS.

Witnesses:
HERMAN ROTH,
JOHN W. MCBEE.