

No. 634,388.

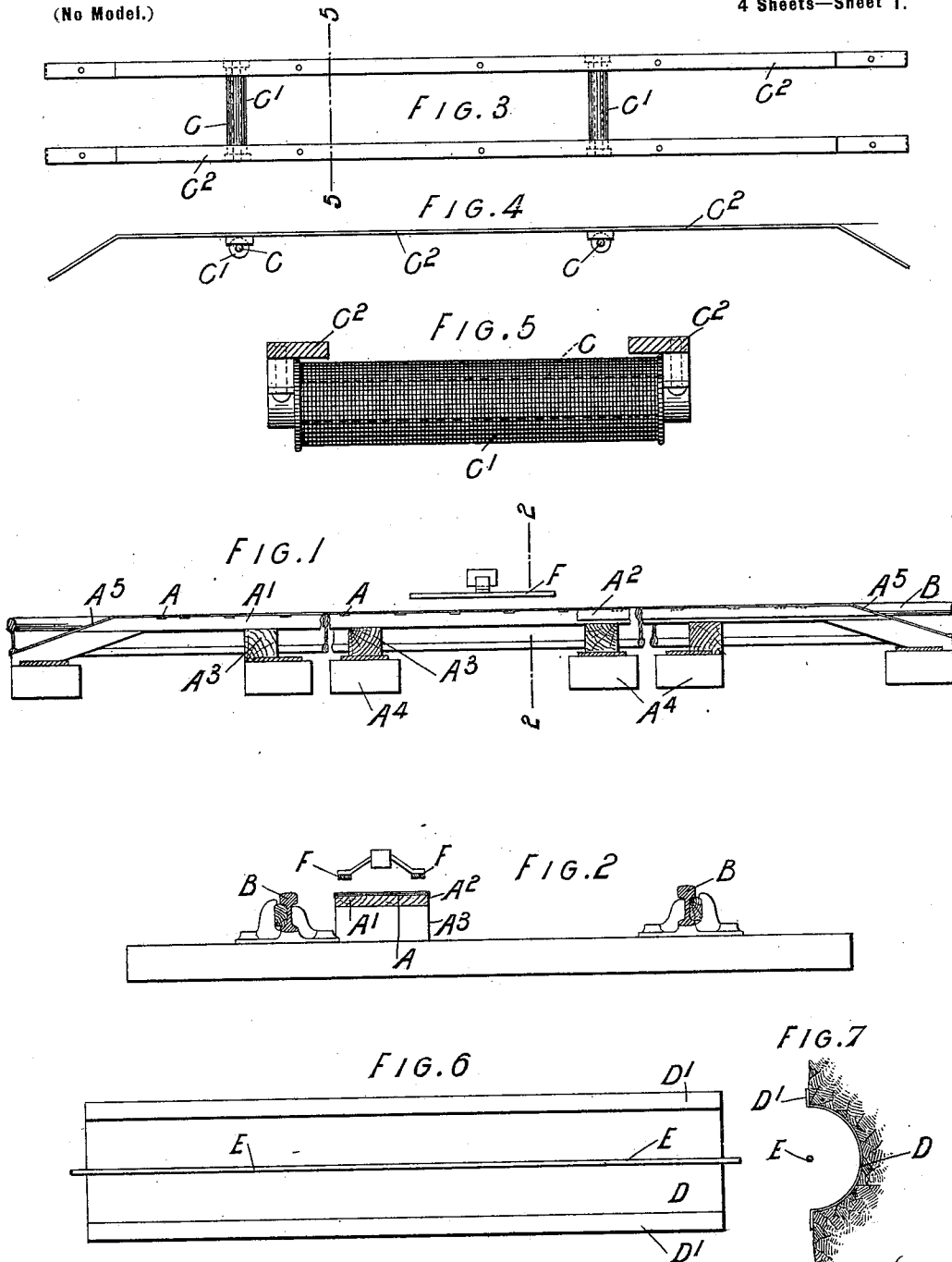
Patented Oct. 3, 1899.

W. S. BOULT.
RAILWAY SIGNAL.

(Application filed Dec. 30, 1897.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses:

J. M. Fowler Jr.
Thomas Durant

Inventor

W. S. Boulton
by Church & Church
his Attorneys.

No. 634,388.

Patented Oct. 3, 1899.

W. S. BOULT.
RAILWAY SIGNAL.

(Application filed Dec. 30, 1897.)

(No Model.)

4 Sheets—Sheet 2.

FIG. 9.

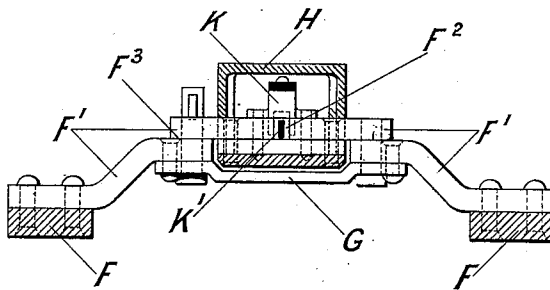
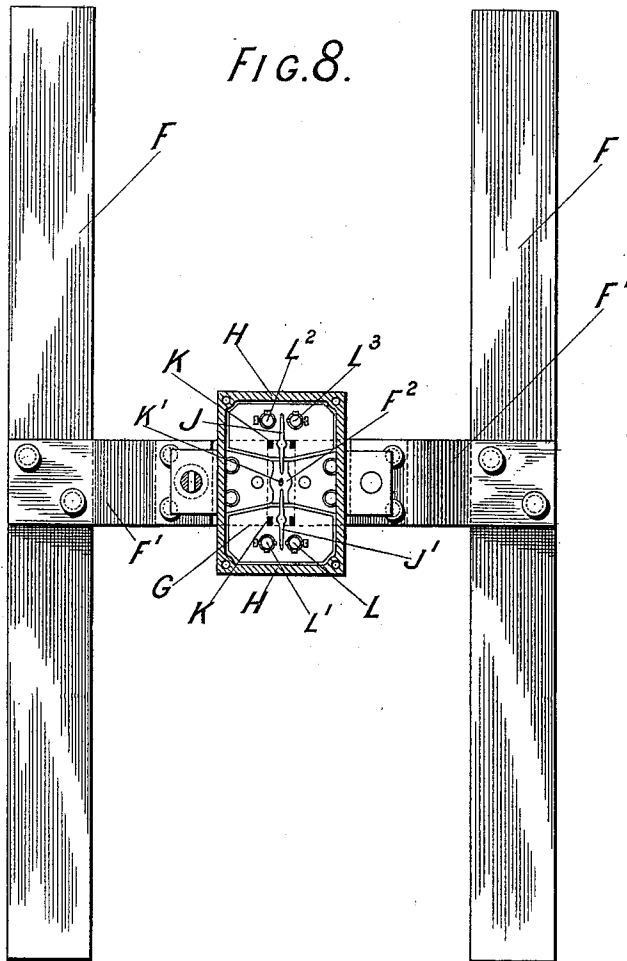


FIG. 8.



Witnesses:
J. M. Fowler Jr.
Thomas Durant

Inventor:
Welfred S. Boulton.
By *Chas. & Chas.*
his Attorneys

No. 634,388.

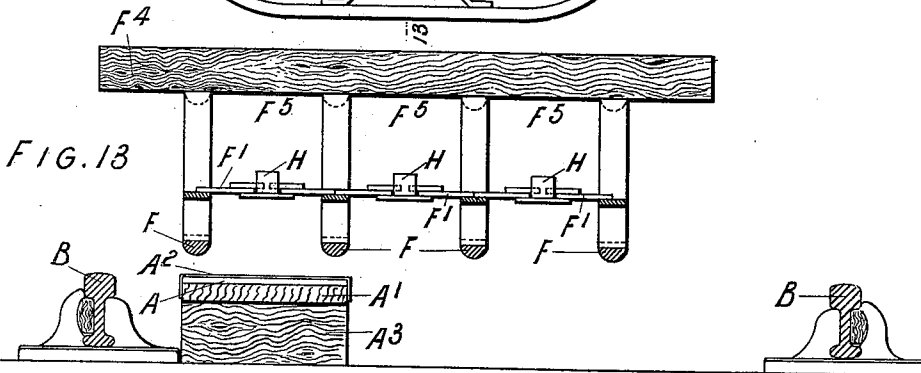
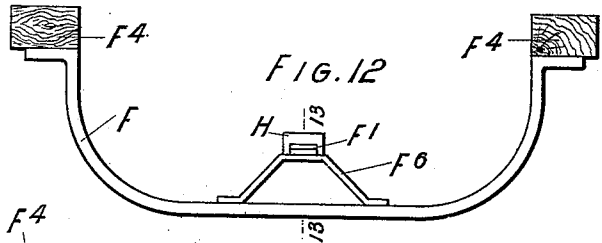
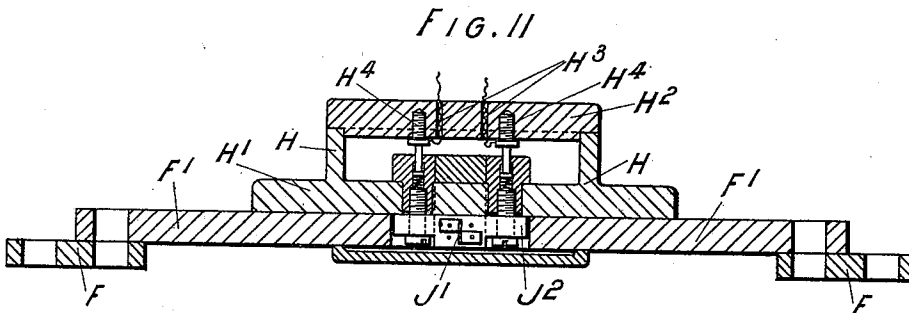
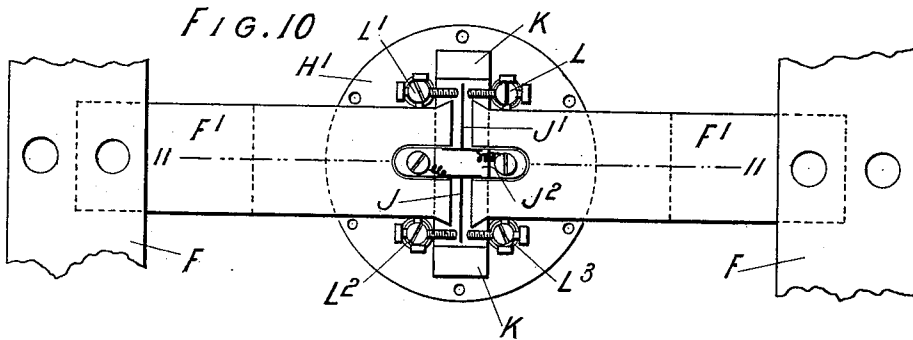
Patented Oct. 3, 1899.

W. S. BOULT.
RAILWAY SIGNAL.

(Application filed Dec. 30, 1897.)

(No Model.)

4 Sheets—Sheet 3.



witnesses:
J. M. Fowler Jr.
Thomas Durant

Inventor:
Wilfrid S. Boulton
by *Charles S. Church*
his Attorneys.

No. 634,388.

Patented Oct. 3, 1899.

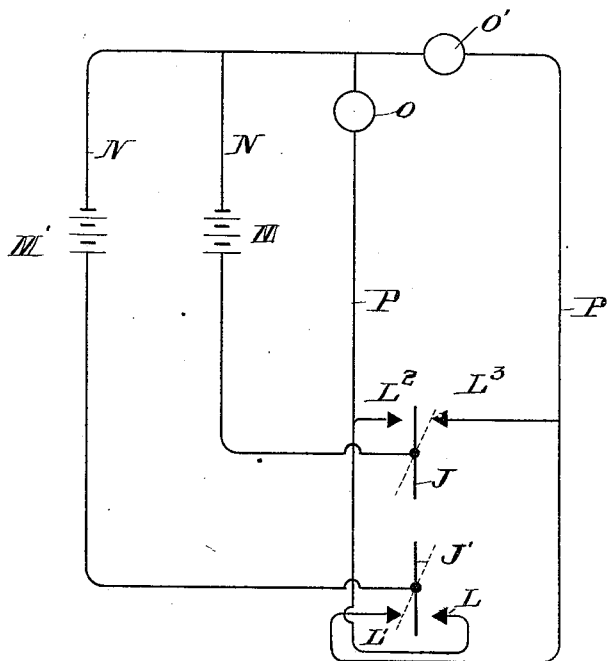
W. S. BOULT.
RAILWAY SIGNAL.

(Application filed Dec. 30, 1897.)

(No Model.)

4 Sheets—Sheet 4.

FIG. 14.



Witnesses:

J. M. Fowler Jr
Alexander Stuart.

Inventor:

Wilfrid S. Bond
By Church & Church
his Attorney.

UNITED STATES PATENT OFFICE.

WILFRID SWANWICK BOULT, OF LONDON, ENGLAND, ASSIGNOR OF ONE-HALF TO CEDRIC RANDAL BOULT, OF LIVERPOOL, ENGLAND.

RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 634,388, dated October 3, 1899.

Application filed December 30, 1897. Serial No. 664,585. (No model.)

To all whom it may concern:

Be it known that I, WILFRID SWANWICK BOULT, a subject of the Queen of Great Britain, residing at London, England, have invented certain new and useful Improvements in or Relating to Railway Signaling Apparatus, (for which I have made application for Letters Patent in Great Britain, No. 17,041, dated September 11, 1893; No. 11,773, dated June 18, 1894; No. 8,724, dated May 2, 1895, and No. 29,257, dated December 10, 1897,) of which the following is a specification.

This invention relates to railway signaling apparatus, its object being to provide improved means whereby signals may be given to or from a stationary or moving train without mechanical contact between any device upon the train and apparatus in the roadway.

The essential feature of this invention is the employment, in combination, of a magnet and apparatus which collects and focuses the lines of force from the magnet, thereby causing movement of a deflectable needle, such movement being utilized to give a signal, preferably by closing an electric circuit containing suitable signaling instruments. This apparatus for collecting and focusing the magnetic field is hereinafter called a "focusing-collector." Either member of this combination—that is to say, either the magnet or the collecting apparatus—may be placed in or near the roadway in any convenient position, the other member being carried past in close proximity to, but without touching it, upon the engine or other vehicle forming part of a train. For the sake of clearness, however, it is assumed throughout this specification that the magnet is placed in the roadway, the focusing-collector and other apparatus being carried upon a vehicle. It is to be understood that the focusing-collector is rigidly fixed upon the vehicle—that is to say, there is no necessary relative movement between it and the magnet. Moreover, its function is to collect and focus the field of the magnet upon a deflectable and preferably polarized needle.

In the accompanying drawings, which illustrate various forms of apparatus according to this invention, Figure 1 is a side elevation showing one arrangement of permanent road-

magnets. Fig. 2 is a transverse section on the line 2 2 of Fig. 1. Figs. 3 and 4 are respectively plan and side elevation of one form of road-electromagnets. Fig. 5 is a transverse section, to an enlarged scale, on the line 5 5 of Fig. 3. Figs. 6 and 7 show, diagrammatically, in plan and transverse section another form of road-electromagnet. Fig. 8 is a plan of one construction of focusing-collector. Fig. 9 is a transverse section on the line 9 9 of Fig. 8. Fig. 10 is a bottom plan of another construction of focusing-collector. Fig. 11 is a transverse section on the line 11 11 of Fig. 10. Fig. 12 is a side elevation of another form of focusing-collector, and Fig. 13 is a transverse section on the line 13 13 of Fig. 12, also showing the relative position of the track. Fig. 14 is a diagrammatic illustration of an arrangement of signaling connections controlled by the needles.

Like letters indicate like parts throughout the drawings.

A, Fig. 1, are permanent magnets placed in transverse grooves in a plank A', so that their similar poles lie in one direction. The magnets are provided with a cover A², preferably of zinc, part of this cover being removed in Fig. 1. The plank A' is supported by blocks A³, which rest upon sleepers A⁴, and the ends of the structure are ramped or sloped and provided with a plate A⁵ to protect them from blows. Fig. 2 shows the relative position of the magnets with regard to the rails B. A focusing-collector, the construction of which is hereinafter more fully described, is shown diagrammatically at F. The object of arranging a series of magnets in this way is to provide a magnetic field of considerable length, so that the collecting apparatus may be acted upon for a sufficient time even when the train is running at a high speed. On a trial, with a magnetic field twelve feet long, signals were taken at the highest speed attainable—viz., seventy miles an hour.

A convenient form of road-electromagnet is shown in Figs. 3, 4, and 5, where C are soft-iron cores surrounded by a winding C' and attached to extended pole-plates C². No supports are shown in these figures; but it will be readily understood that the road-electromagnets may be fixed upon an arrangement

of blocks and sleepers similar to that shown with reference to the road permanent magnets in Figs. 1 and 2.

Figs. 6 and 7 illustrate another form of road-electromagnet which may be used in situations where a large amount of current is available. It comprises an approximately semi-circular iron trough D, having flanges D', which act, like the parts C² in Figs. 3, 4, and 5, as extended pole-plates. Along the middle of the trough, and preferably nearly level with the flanges D', an insulated conductor E is placed. This is shown as a single conductor in Figs. 6 and 7; but it may comprise several turns passing around the length of the trough D. On the passage of current through the conductor E the trough D will be magnetized one flange D' becoming a north pole, the other a south pole, according to the direction of the current. This construction is suitable for forming continuous magnets when, owing to the heaviness of the traffic, it is specially desirable that no time should be wasted in letting a driver know that a signal has been taken off.

A convenient form of focusing-collector is illustrated in Figs. 8 and 9. This comprises an H-shaped frame of iron or steel formed of two pole-plates or collecting-bars F and a cross-bar F'. The cross-bar F' is, however, not continuous, being divided by a gap F² in the center. For convenience of adjustment the cross-bar F' is joined, as at F³, so that the ends adjacent to the gap F² may be attached to a box H, containing the deflectable needle, and thus be removed from the main portion of the collector when it is desired to adjust the needle. The focusing-collector is so proportioned that the distance between the collecting-bars F is approximately equal to the distance from pole to pole of the magnets with which the collector coöperates, and thus when a collector is carried into proximity to a magnet the field of the latter is collected by the bars F and focused upon the gap F². The two portions of the cross-bar F' are mechanically joined across the gap F² by a bridge G of non-magnetic material—say brass. In the gap F², preferably inclosed in an adjustable non-magnetic case H, are two pivoted deflectable needles J J', which are kept magnetized or polarized by means of a permanent magnet K and normally take the position shown in Fig. 8, owing to the presence of a piece of iron or steel K', fixed in the center between the needles, which acts as a controller. When, owing to the focusing-collector being in proximity to a magnet, a strong magnetic field is produced in the gap F², the polarized needles J J' will be deflected one way or the other, according to the polarity of the field, and when deflected will make contact with two of the four contact-pillars L L' L² L³, provided for that purpose. These pillars are insulated from the base upon which they are mounted and are severally connected to various local circuits, which are completed

through the needles J J' themselves. The needles J J' are not necessarily pivoted. For example, in Figs. 10 and 11 they are in the form of springy strips of iron or steel secured at their bases to an insulated block J², which is itself fastened to the base H' of the box H. This box in this construction is furnished with a top H² of insulating material through which wires H³ pass, and are connected to screws H⁴, which bear upon spring-plungers in electric connection with the needles and contacts. The other details of this form of focusing-collector are substantially similar to those described with reference to Figs. 8 and 9.

It is often desirable to have magnets on the roadway at different distances between the two rails—for example, to have the "distant-signal" magnets near the left-hand rail, the "home-signal" magnets near the right-hand rail, and, say, "route-indicator" magnets in the middle. This of course necessitates the employment of as many collectors as there are positions of the signaling-magnets. In such cases it is preferred to use a compound focusing-collector, such as is shown in Figs. 12 and 13. Here there are four collecting-bars F, hung from a non-magnetic support F⁴ and forming three bays F⁵, in each of which is a divided cross-bar F', supported upon iron trestles F⁶ and containing in its gap F² a deflectable needle and other devices, as previously described with reference to the single forms of focusing-collectors. In Figs. 12 and 13 the presence of the deflectable needle and the apparatus pertaining to it is merely indicated by the box H. The left-hand portion of the compound focusing-collector is shown in Fig. 13 in position over a permanent magnet A and the other portions would be operated by magnets placed at corresponding positions in the track. Thus instead of having to employ six collecting-bars, as would be necessary in the single forms previously described, only four are used. It is evident that on this plan similar compound focusing-collectors may be constructed for any desired number of signaling-magnet positions, there being in each case only one more collecting-bar upon the focusing-collector than there are positions of the magnets in the roadway.

It is to be understood that although the needles J J' have been described as polarized by a permanent magnet, yet they may, if desired, be of hard steel and themselves permanently magnetized. Further, although it is preferred to employ polarized needles to enable two separate signals to be given, according to the direction of flux through the gap, yet, if desired, soft-iron unpolarized needles may be used, which are merely deflected irrespective of the polarity of the road-magnet. Any of the forms of deflectable needles may be controlled by a separate spring, or, if desired, may be arranged with a gravity control. Again, although duplicate needles have been shown in the various forms of focusing-

collectors illustrated, it is to be understood that a single needle may, if desired, be employed.

Fig. 14 shows, diagrammatically and by way of example only, a set of signaling connections carried, say, on an engine, when the magnets are placed in the roadway. In this diagram J J' represent the polarized needles of a focusing-collector. These needles are pivoted and are normally kept, as hereinbefore explained, in a central position between contacts L L' and L² L³, respectively. M M' are batteries connected to the needles J J', their other poles being joined by wires N to indicators O O', which are severally connected by means of wires P P' to the contacts L L² and L' L³. If now the engine carrying the focusing-collector passes over a magnet the polarity of which is such that the needles are deflected, as indicated in dotted lines, against the contacts L' L³, the indicator O' will be placed in circuit with both the batteries M M', which will accordingly actuate it. If on the other hand the needles are deflected in the other direction—namely, into contact with the points L L²—the indicator O will be joined in circuit with the batteries. The signals on the indicator O' might mean "danger," while those on O might indicate "line clear." In the arrangement shown in Fig. 14 it is evident that the failure of one of the needles J J' need not affect the signal, the indicators O O' being so arranged that either of the batteries M M' will suffice to give the signal. It is to be clearly understood that Fig. 14 is merely a diagram showing a very elementary and obvious method of using the apparatus described in the specification. Many other systems of connections will at once suggest themselves to those conversant with the art, but these form no part of the present invention.

It is obvious that apparatus according to this invention may be arranged in many ways to form systems of signaling. For instance, the electromagnets may be energized by a

semaphores, or the current may be switched on direct from a signal-cabin, or the passage of the train itself may complete the circuit.

I claim—

1. In railway signaling the combination with a magnet of a focusing-collector having a deflectable needle, one member of the combination being in the roadway and the other upon a vehicle movable past the first member.

2. In railway signaling, the combination with a magnet of a focusing-collector having a gap wherein the deflectable needle is situated, one member of the combination being in the roadway and the other upon a vehicle movable past the first member.

3. In railway signaling the combination with an electromagnet having extended poles of a focusing-collector having a gap wherein a deflectable needle is situated, one member of the combination being in the roadway and the other upon a vehicle.

4. In railway signaling the combination with a magnet having an extended magnetic field of a focusing-collector comprising collecting-arms, a cross-bar having a gap in which two polarized deflectable needles are situated and contacts against which such needles are deflected, one member of the combination being in the roadway and the other upon a vehicle.

5. In railway signaling the combination with magnets in various positions transversely to the track, of a focusing-collector comprising a plurality of collecting-bars, divided cross-bars between the collecting-bars, and a deflectable needle in the gap in each cross-bar, one member of the combination being in the roadway and the other upon a vehicle.

In testimony whereof I have hereto set my hand in the presence of the two subscribing witnesses.

WILFRID SWANWICK BOULT.

Witnesses:

ALFRED J. BOULT,
HARRY B. BRIDGES.