(No Model.) 2 Sheets—Sheet 1.

W. A. MURRAY.

RAILWAY SIGNAL.

No. 327,962. Patented Oct. 6, 1885.

Fig: 1.

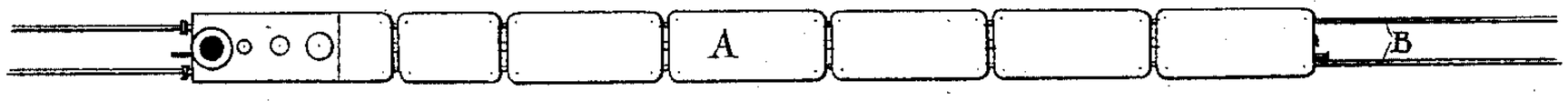


Fig: 2.

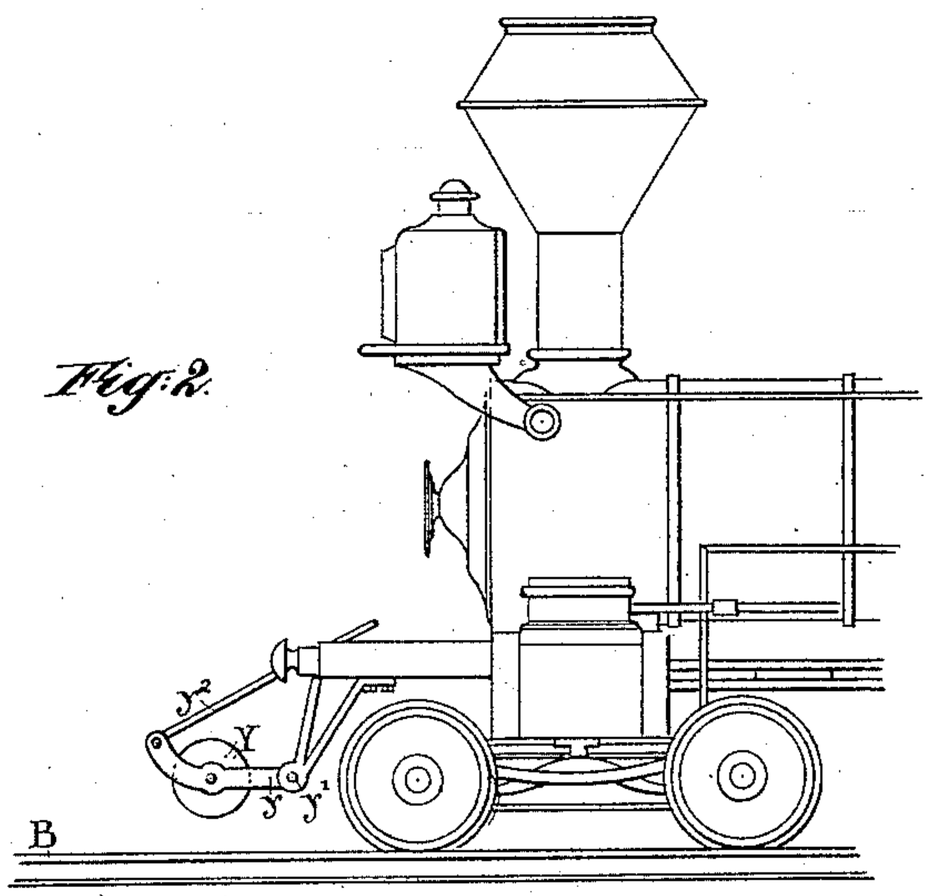


Fig: 3.

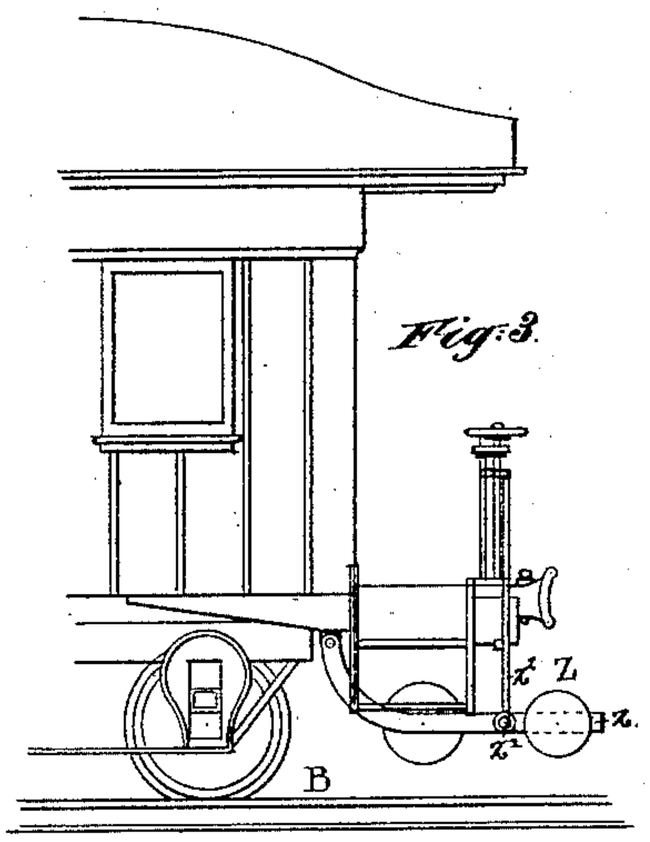


Fig: 4.

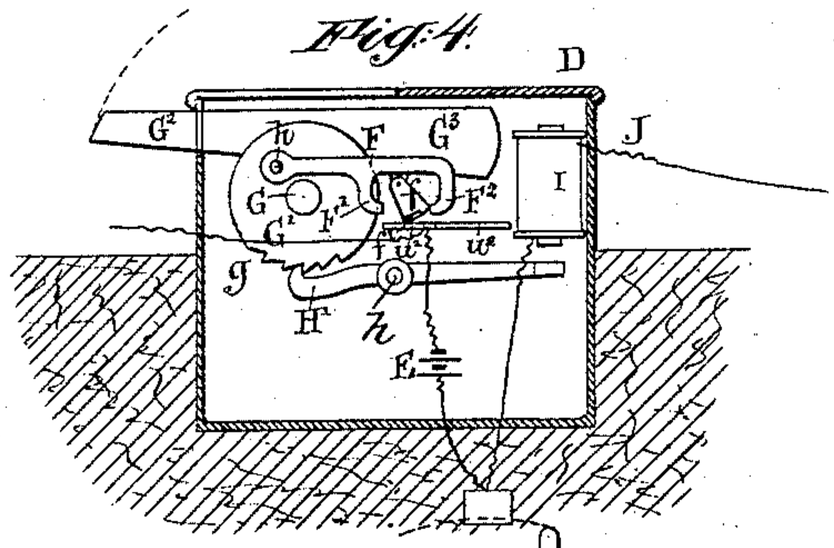


Fig: 5.

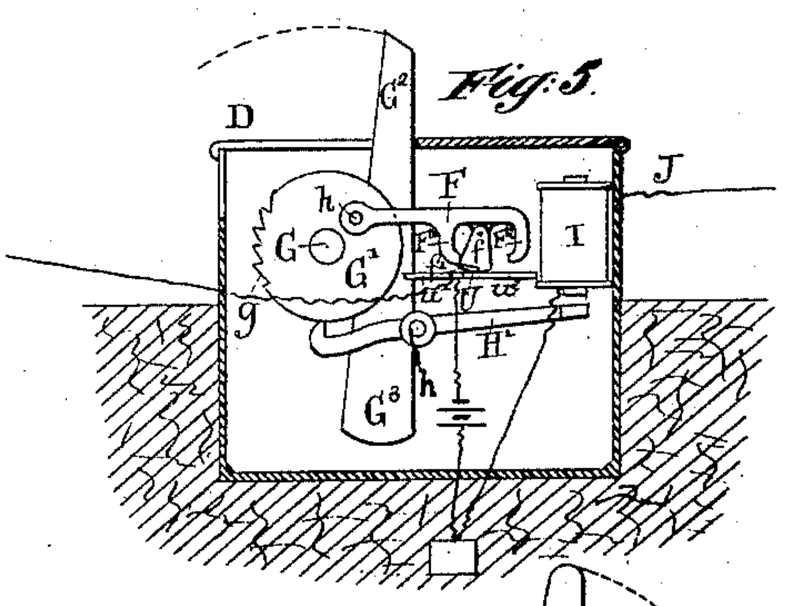


Fig: 6.

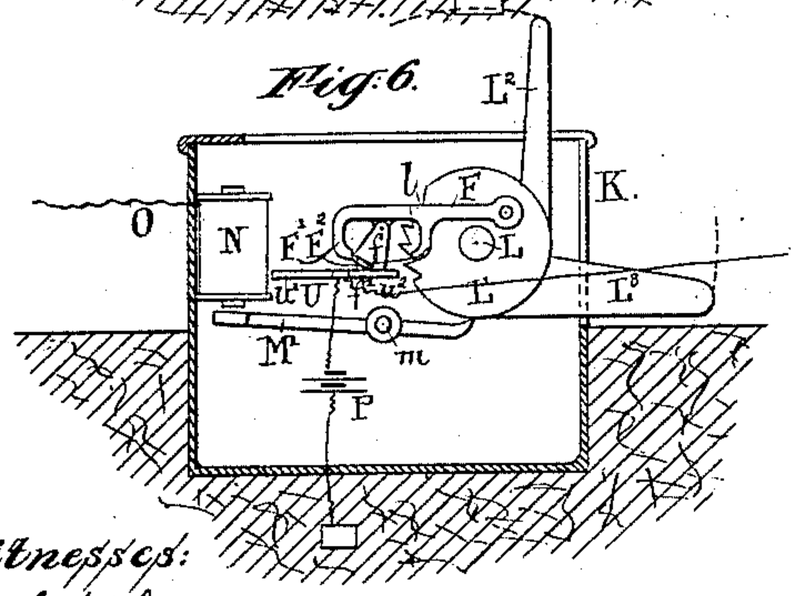
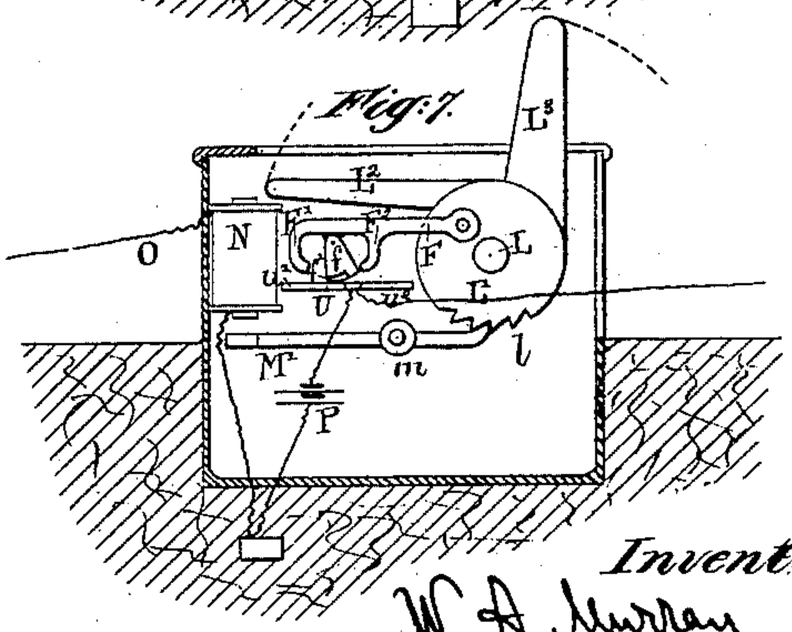


Fig: 7.



Witnesses:
Louis H. A. Whitehead.
M. F. Boyle.

Inventor:
W. A. Murray
by his attorney T. L. Stetson

(No Model.) 2 Sheets—Sheet 2.

W. A. MURRAY.

RAILWAY SIGNAL.

No. 327,962. Patented Oct. 6, 1885.

Fig: 8

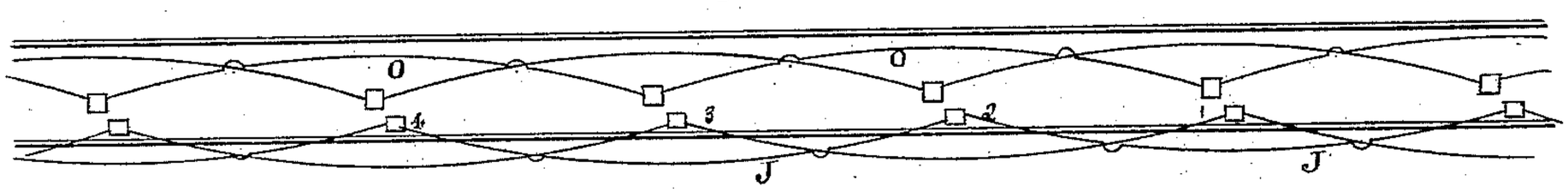
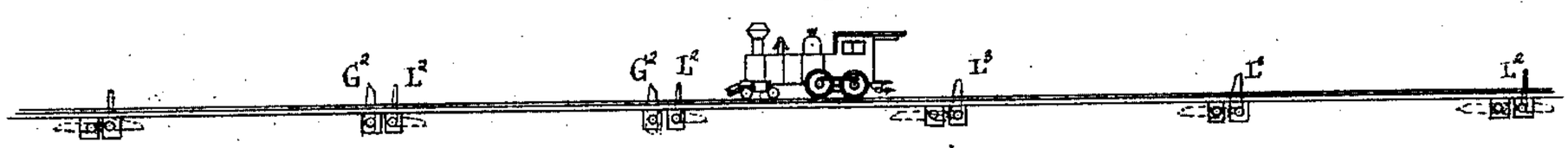


Fig: 9.



Witnesses:
Louis M. T. Whitehead.
M. F. Boyle.

Inventor:
W. A. Murray
by his attorney
T. L. Stetson.

UNITED STATES PATENT OFFICE.

WILLIAM ARCHIBALD MURRAY, OF PIAKO, NEW ZEALAND.

RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 327,962, dated October 6, 1885.

Application filed April 15, 1884. Serial No. 128,049. (No model.) Patented in New Zealand October 2, 1883, No. 932.

To all whom it may concern:

Be it known that I, WILLIAM ARCHIBALD MURRAY, a subject of the Queen of Great Britain, residing at Piako, in the county of Auckland, New Zealand, have invented certain new and useful Improvements Relating to Electric Railway-Signals, of which the following is a specification.

It has long been desired to communicate by signals to a distance in front of a railway-train. It is also desirable to communicate by signals to a considerable distance in the rear. It is important that the signals be such as shall indicate whether the train is moving toward or from the point where the signal is displayed. It is important that the signals be made automatically; but it has been found difficult to effect this by the passage of trains at high speed without danger of fracturing some portion of the apparatus or giving too violent a motion to the signal. I have devised means for storing power at the signal-stations by the passage of trains and holding it stored for an indefinite period, allowing it to act at the required moment. The devices which operate the signals are carried on the train, the one which communicates ahead being carried on the forward end of the train, and the one which communicates backward being carried on the rear end of the train. The same device which serves as a signal at a given station to be operated by an approaching train at a distant point serves, also, as a means of receiving the force, when the train passes this station, to signal farther ahead to the next station and set the danger-signal there, and so on. So, also, the same device which serves as a signal at a given station to be operated by a distant train which is moving away, served a few minutes earlier, when the train passed this station, as a means of signaling back to set the corresponding signal at a station still farther in the rear.

The accompanying drawings form a part of this specification, and represent what I consider the best means of carrying out the invention.

Figure 1 is a plan view of a train of railway-cars equipped to serve according to my invention. The succeeding figures are on a larger scale. Fig. 2 is a side elevation of the forward end of the locomotive. Fig. 3 is a side elevation of the rear end of the brake-van or the last car of the train.

The remaining figures show the devices on the ground in and near the track. Figs. 4 and 5 are vertical sections through the advance indicator. Fig. 4 shows it in the condition in which it was left by the last preceding train, which may have been yesterday or any other period in the past. This condition indicates "all right"—no train approaching in the near vicinity. Fig. 5 shows, on the contrary, the same or a similar advance signal in the condition indicating "danger."

The same devices, Figs. 4 and 5, serve as an advance-signal and as a means of afterward receiving an impulse from the passing train and operating the rear signal.

Figs. 6 and 7 are vertical sections through the rear indicator. Fig. 6 shows it in the condition indicating "danger"—a train has passed very recently, too near to justify following yet. Fig. 7, on the contrary, shows the same or a similar rear indicator in the condition it finally assumes. This is in the condition indicating "all right." The device is the means of receiving action from the train and setting the advance signal and afterward serves as the rear signal. Fig. 8 is a plan of a railway-track shown much contracted longitudinally to bring the principal parts for a number of stations near together. Fig. 9 is a corresponding side elevation.

Similar letters of reference indicate corresponding parts in all the figures where they occur.

A is a train of cars, and B are the rails of an ordinary single track.

D, Figs. 4 and 5, is a box of cast-iron or other suitable material, and G a transverse shaft having a wheel, G′, equipped with notches *g*, and also a lever, G^2 G^3, the end G^3 of which is weighted sufficiently to turn the lever, with its attachments, into the upright position shown in Fig. 5 whenever it is liberated.

H′ is a hook-pawl turning on a shaft, *h*.

I is an electro-magnet arranged to be excited by a current received through a wire, J, which, properly insulated, leads any required

distance along the track, where may be arranged a contact mechanism, to be described further on, actuated by the passage of a train.

A suitable battery, E, is mounted in the box D, or at other convenient point in the circuit, and properly connected to give the required force to the magnet I when the contact is made at the distant station. The battery may be placed in a neighboring building.

As the figures are here shown, the train is moving from the right to left. In Fig. 4 the lever G^2 G^3 is horizontal, or nearly so, with the weighted end G^3, exerting its force by gravity to endeavor to turn the lever into the upright position. This force is resisted by the hook-pawl H′, which stands engaged with one of the teeth *g*. The other end of the hook-pawl is sufficiently near to the electro-magnet I to be drawn by it when the latter is excited. When an approaching train passes the distant connected station and makes the contact, the current through the wire J excites the magnet I and attracts the adjacent end of the hook-pawl H′. This detaches the pawl from the tooth *g*, and the shaft G and its attachments instantly turn by the gravity of the heavy end G^3, and the lever G^2 G^3 assumes the upright position shown in Fig. 5, indicating "danger; train approaching." When the train reaches and passes any point, the advance signal is no longer required.

Y is a roller mounted on an axis on the locomotive, supported on a lever, *y*, which turns on a center, *y′*, and is raised and lowered by a rod or chain, y^2.

Z is a roller mounted on an axis carried on a lever, *z*, turning on a center, *z′*, supported on the brake-van or last car of the train. It is raised and lowered as required, by a rod or chain, z^2. The passage of the locomotive strikes by its roller Y the upper end, G^2, of the lever G^2 G^3, and, notwithstanding the superior gravity of the heavy portion G^3, gives a quarter-revolution to the shaft G and its connections, throwing it into the position shown in Fig. 4, in which position the hook-pawl H′ engages with one of the notches *g* and holds until, the proper contact being made by the next succeeding train, an electric current is again communicated through the wire J, to again energize the magnet I.

Referring to Figs. 6 and 7, K is a box of cast-iron or other suitable material, which may be very nearly similar to the box D.

L is a shaft mounted in fixed bearings therein and having rigidly connected a wheel, L′, equipped with notches *l*, and also a bell-crank lever, L^2 L^3. The arm L^3 is weighted, and exerts a constant force tending to turn the shaft L and its attachments into the position shown in Fig. 6, in which position the arm L^2 is upright.

M′ is a pawl turning on a shaft, *m*, and adapted to engage in the notches *l*.

N is an electro-magnet arranged near the pawl M′, and O is a wire conductor, properly insulated, leading to a station in advance at a distance of a mile, more or less. A battery, P, of suitable strength and properly connected, may be located in the box K, or at any other convenient point, arranged to give the current through this wire O whenever the circuit is closed. The train, as before, is understood to be moving from the right to the left. An upright position of the lever L^2 indicates "all right." The passage of the train causes the roller Z to strike the arm L^2 and turn the shaft L and its connections into the position shown in Fig. 7, in which position it is engaged and held by the pawl M′. This position indicates "danger," by showing that a train has but recently passed, and has not yet got a sufficient distance away to allow another train to follow with impunity. When the train, after thus setting the signal for "danger" to prevent a following train from colliding with it, has moved over the whole space to the next connected station, a mile, more or less, it presses down the lever L^2 there and operates a suitable contact-piece, making a connection to send a current back through the wire O, which excites the magnet N at this station. This attracts the adjacent end of the pawl M′, and moves the pawl out of engagement with the notches *l*. In this condition of the parts the gravity of the heavy arm L^3 turns the shaft L and its attachments into the position shown in Fig. 6, indicating "all right." This condition is retained until the passage of the next succeeding train again strikes the arm L^2, and again sets the "danger" signal, to be again liberated when the train has passed the proper distance away. The effect may be promoted by making the arm L^3 not only heavier but also much wider than the arm L^2, so as to aid in instantly recognizing which lever is up. It will now be understood, supposing a train going westward, when it passed a station east of this it sent a current to excite the magnet I, and set the advance signal at this station, "train coming." (See Fig. 4.) The subsequent knocking down of the lever G^2 G^3 at this station (see Fig. 4) by the passage of the train rocked the shaft G, and transmitted the current to the westward, liberating the lever G^2 G^3 there, and consequently setting the advance danger-signal there. It also, by knocking down the lever L^2 here, transmitted a current back to the proper station eastward from this, and restored the signal L^2 L^3 there to its position of "all right." When the train arrives at a station west of this, it will in its turn transmit the current to another station westward, and set the advance signal there, while the knocking down of the lever L^2 there will set the rear signal here in the position "all right."

The turning of the several shafts G L in the opposite direction to that described does not transmit the current. To each wheel G′ and L′ is pivoted a rod, F, having on its lower side

two arms, F′ F², between which is loosely mounted a segment, *f*, which rests on a horizontal plate, U, supported in a fixed position. At each partial turning movement of the shaft G or L in either direction the segment *f* first rolls a little distance on the plate U, and then its further rolling being resisted by its striking one of the arms, it slides on U. The main surfaces of the segment *f* and of the plate U are hard rubber or other non-conducting material, but certain portions of each are brass or other good conducting material There are two brass points, *u′ u²*, in the plate U. There is a brass piece, *f′*, in the segment *f*, sufficiently wide to touch both the points *u′ u²* at the same time. One of the points, *u′*, is in connection with the ground. The other connects with the line. When by the passage of a train the lever G² was depressed, and the connection F moved to the left, as shown in Fig. 4, the segment *f* was first rolled into the position which brought the brass *f′* down upon the plate U, and then slid across the points *u′ u²*. In the passage it formed an electrical contact and allowed the current to pass from one point to the other, and thus over the line, to actuate the magnet at the proper station westward, with the results above described, leaving the parts in the position shown in Fig. 4. When by the movement of the train past the next station westward, a signal is sent here from that station, the shaft G turns in the opposite direction, to raise the lever into the position shown in Fig. 5. The movement first rolls the segment *f* until its brass piece *f′* is lifted, and then slides it across the points *u′ u²*. It follows that the turning of the lever in this direction does not send any signal westward.

The same conditions obtain with regard to the devices shown in Figs. 6 and 7. In each the partial rotation of the segment *f* insures that a signal is sent when the shaft G is turned in one direction, and that no signal is sent when the shaft makes its reverse movement.

There are two or more sets of the apparatus overlapping each other—that is to say, supposing the stations to be numbered 1, 2, 3, 4, in succession, the station 1 operates the signals farther westward, not at station 2, but extending idly past station 2 it operates the signal at station 3. So the passage of the train at station 2 operates the signal at station 4. The passage of the train past station 3 sets the advance signal at station 5 and sets the rear signal at station 1. Thus we proceed. The movement of the train past station 7 sets "danger" at 9 and sets "all right" at 5. When, a little farther on, the train passes 9, it sets "danger" at 11 and "all right" at 7. The intermediate stations, 2, 4, 6, 8, &c., are precisely similar. Their connecting-wires reach past the stations at 3, 5, and 7, and connect the stations intermediate. When the train passes 6, it sets the signal at 8 to, say, "danger," and the signal at 4 to, say, "all right."

It will be understood that the rollers Y and Z may be adjusted nicely up and down, by means of the rods *y² z²*, to make them act properly on the respective levers G² L², and also that these rollers may be raised entirely out of action, when desired in any case—as, for example, when the proper working of the apparatus may be obstructed by snow or ice.

Modifications may be made in forms and proportions. I can use part without the whole.

In operating with electricity there may be two wires, J, one carrying the electricity in each direction; or the return-circuit may be through the earth.

Other means than the segments F, with their conducting and non-conducting surface, may be used to insure a conductor of the current when the respective shafts are turned in one direction, and no current when they are turned in the other direction. I have shown these devices as sufficient for the purpose.

The electricity may be supplied by batteries at local points, or by a main electric cable charged by machinery at distant points, where water or other power may be available.

The invention is peculiarly important at critical points in a line, as at tunnels, bridges, and at stations which may be near curves which are concealed by deep cuts or forests.

I propose to make a separate application for patent for the specific arrangements herein shown and described for working the signals by mechanical connections extending along the track, and pulled and released so as to effect thereby the changes at the distant points. Such are not claimed in this patent.

I claim as my invention—

1. A series of electric signals, comprising, essentially, shafts G, levers G² G³, and partially-toothed wheels G′, a magnet, I, a pawl, H, and suitable circuit-closers, combined with electrical connections J and battery E, and the whole adapted to be operated by a device, as Y, located upon a passing train, as and for the purposes set forth.

2. The combination of the wheel Y and its supporting and adjusting means *y²*, with the series of magnets I, batteries E, toothed wheels G′, levers G² G³, pawls H, and circuit-closers, the whole arranged and operating to give advance signals, as and for the purposes set forth.

3. A system of electric signals arranged along the line of a railway-track, and comprising toothed wheels L′, elbow-levers L² L³, pawls M′, batteries P, magnets N, and connecting-conductors, combined with a suitable circuit-closing apparatus, and with a contacting device, as Z, located upon the rear of a passing train, as and for the purposes specified.

4. The advance signal devices comprising the wheels G′, levers G² G³, pawl H, and magnets I, and the rear signal devices, L² L³, wheels L′, pawls M′, and magnets N, arranged

along the line of a railway-track, as described, combined with each other and with batteries E P, conductors J O, proper circuit-closers, and with devices, as Y Z, located upon a passing train, as set forth.

In testimony whereof I have hereunto set my hand, at Auckland, this 4th day of March, 1884, in the presence of two subscribing witnesses.

WM. ARCH. MURRAY.

Witnesses:
GEORGE F. STUART,
SHIRLEY E. W. BAKER.