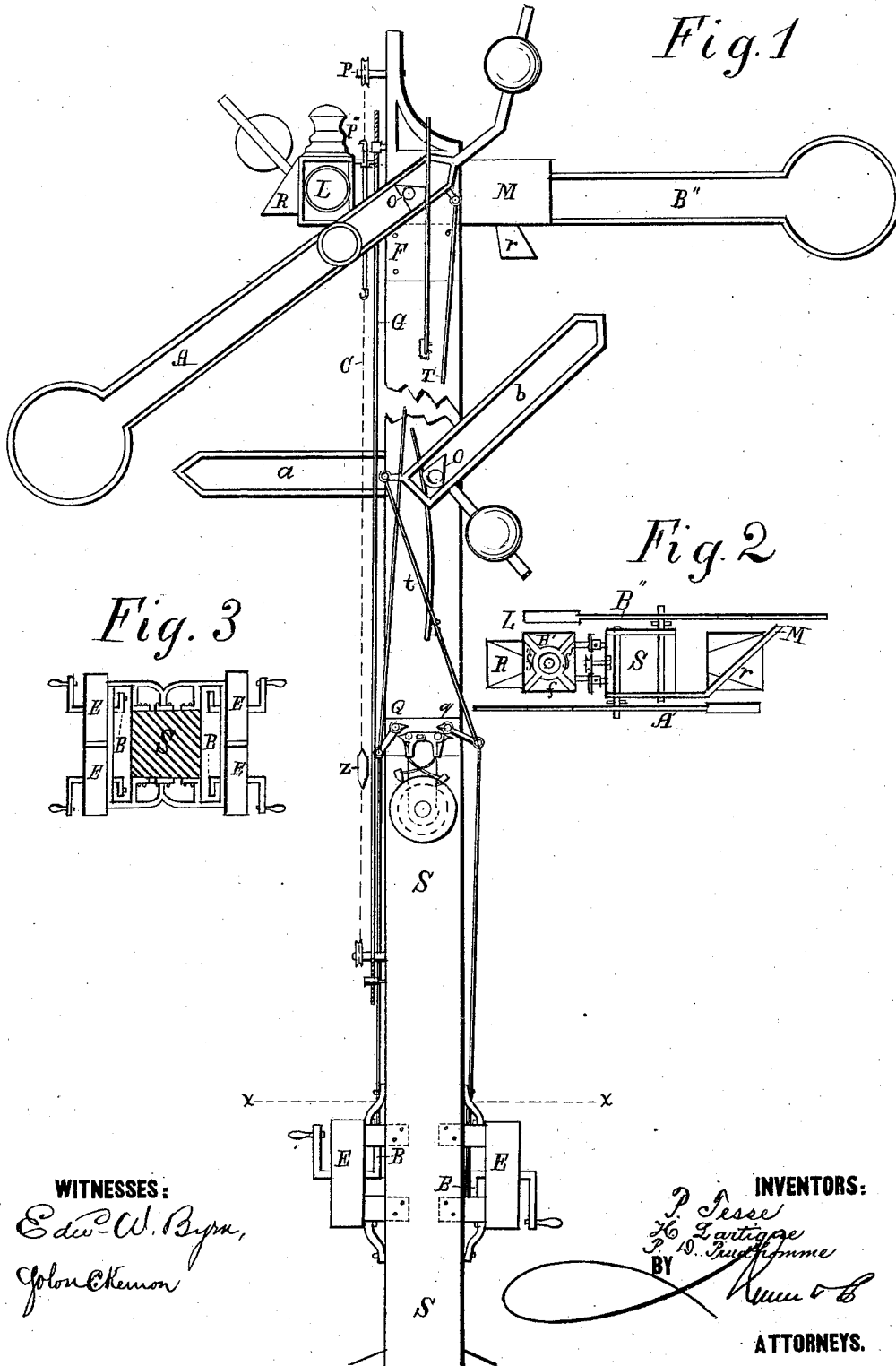


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Electric Railway-Signals.

No. 155,900.

Patented Oct. 13, 1874.



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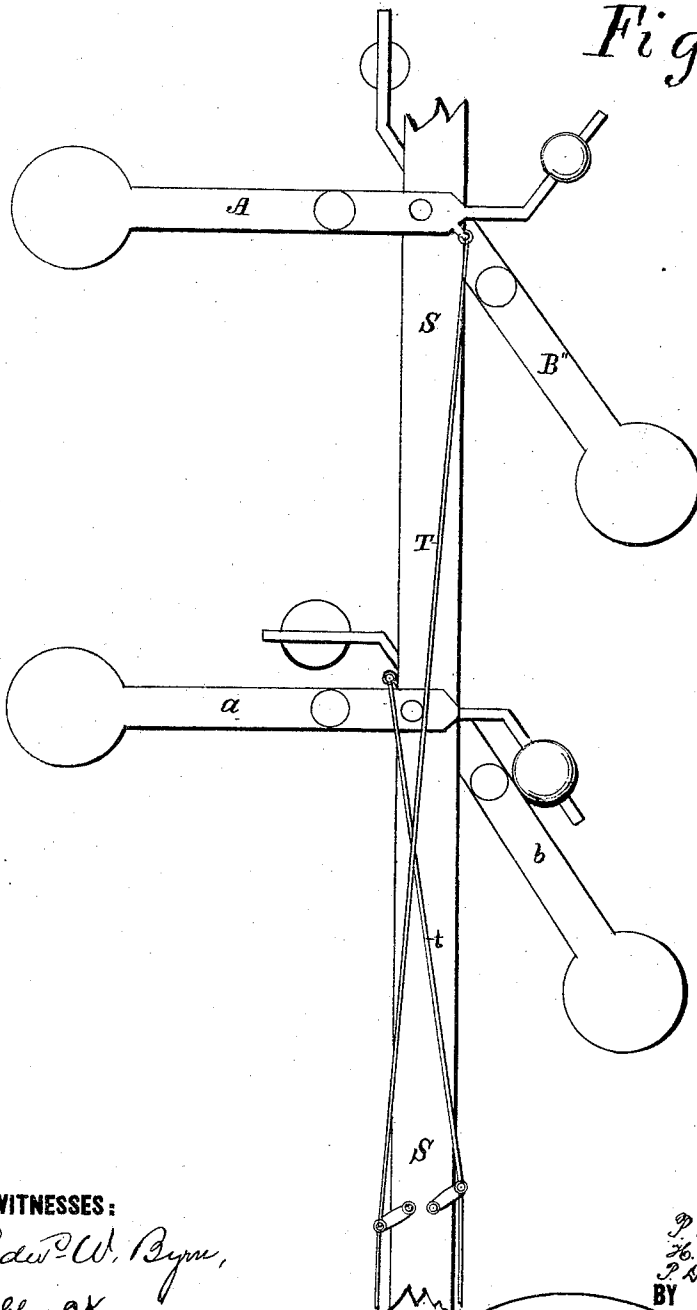
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Fig. 4



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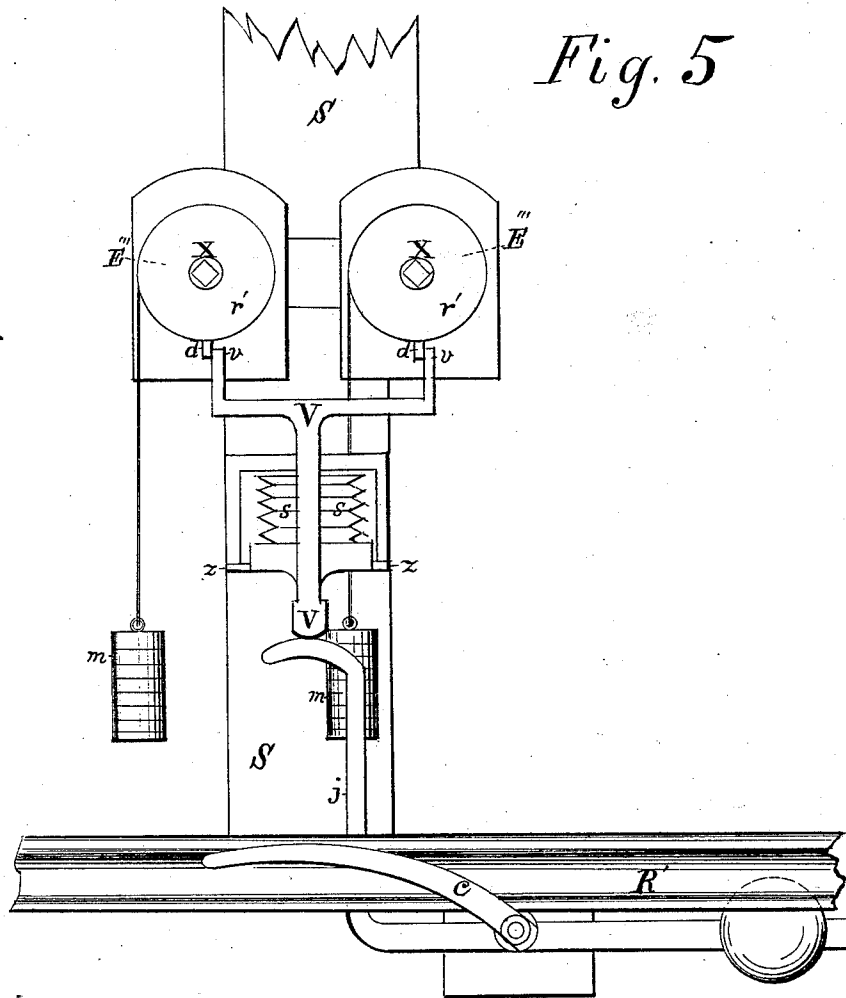
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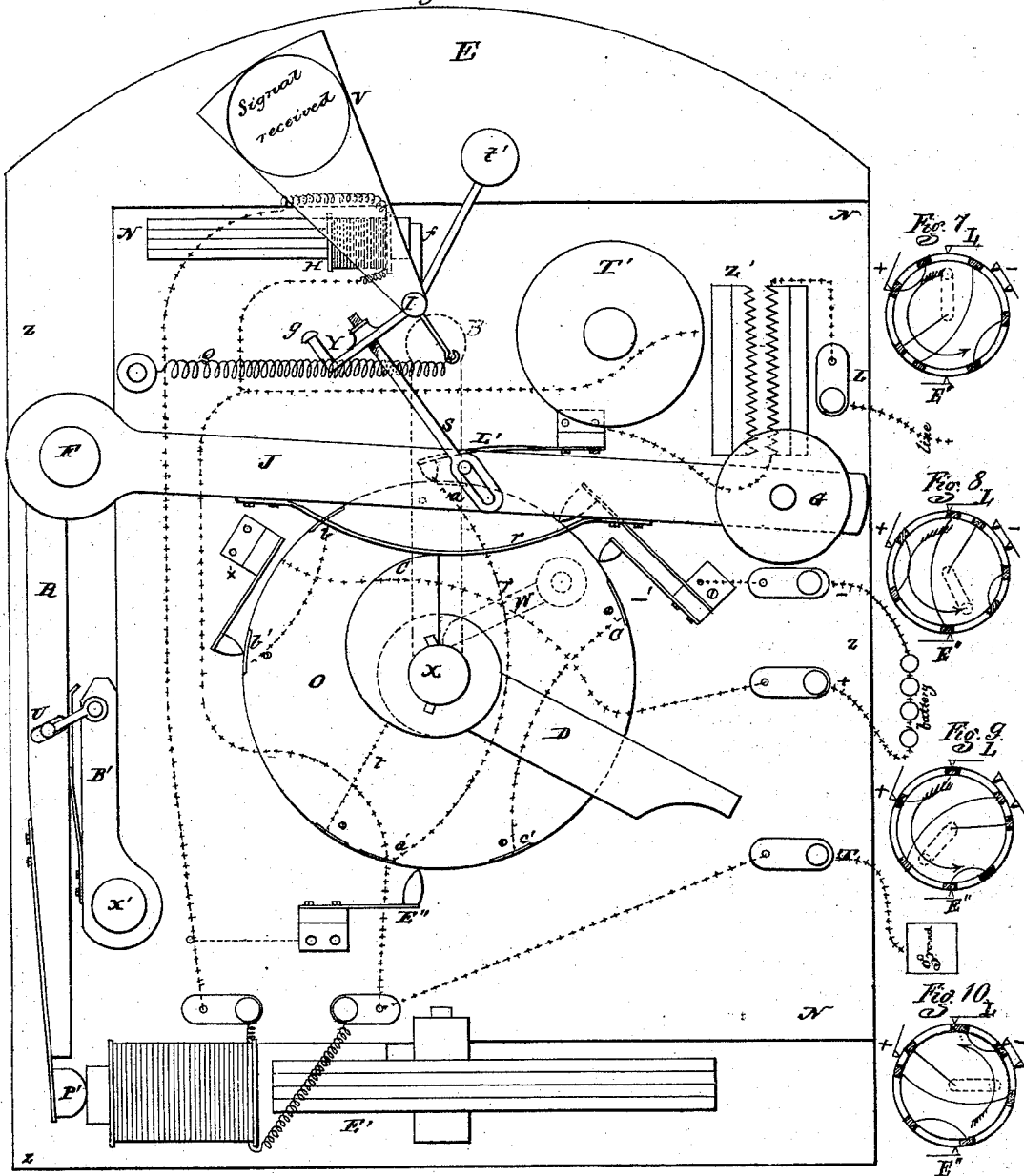
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Fig. 6



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UNITED STATES PATENT OFFICE.

PAUL TESSE, HENRY LARTIGUE, AND PIERRE D. PRUD'HOMME, OF PARIS, FRANCE.

IMPROVEMENT IN ELECTRIC RAILWAY-SIGNALS.

Specification forming part of Letters Patent No. **155,900**, dated October 13, 1874; application filed May 6, 1874.

To all whom it may concern:

Be it known that we, PAUL TESSE, HENRY LARTIGUE, and PIERRE D. PRUD'HOMME, all of Paris, France, have invented a new and Improved Electro-Semaphoric Apparatus; and we do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing forming a part of this specification.

The object of this invention is to secure a greater degree of accuracy and safety in the running of railway-trains, both on double and single railways, by the combination of semaphoric arms with an electrical apparatus, whereby the manipulation of the signals is rendered much more simple, precise, and effective. We will first describe the semaphoric apparatus as adapted to double railway sections, and then explain a modification of the same, which is used for single railways, the electrical apparatus being the same in both.

Figure 1, a side elevation of the mast as presented to the gaze of the engineer, showing arms, lanterns, electrical apparatus, and signal-bell; Fig. 2, a plan view of the lantern, showing construction of same, and its relative arrangement to the arms and mast; Fig. 3, transverse section of the mast through line *x x*, showing the relative arrangements of the electrical apparatus; Fig. 4, vertical elevation of a mast provided with arms adapted to single railway-sections; Fig. 5, a vertical elevation of apparatus for automatically operating the arms of the masts through the wheels of the locomotive; Fig. 6, a front view of one of the electrical apparatus, E, showing construction and arrangement of same; Figs. 7, 8, 9, and 10 represent the different positions of the commutator O in the electrical apparatus for two stations, of which Fig. 7 shows first position at station No. 1; Fig. 8 shows second position at station No. 1, and first position at station No. 2, line-wire connecting with the magnets; Fig. 9 shows one and two-thirds position at station No. 1, or a position occupied by commutator when crank B is moved from the first to second position, line-

wire being in connection with the + pole of the battery; Fig. 10 shows one and one-third position at station No. 2, or a position occupied by the commutator while the crank B is moved from first position of station No. 2 to second position, line-wire being in connection with the — pole of the battery.

It consists of a semaphoric mast, to the top of which is pivoted two large arms fulcrumed so as to hang vertically, said arms being attached to the cranks of two similar electrical apparatus below by traction-rod. Just below these two large arms are two small ones, fulcrumed to said mast so as to hang horizontally, and connected, each by traction-rods, with separate electrical apparatus similar to the first mentioned. The whole line consists of a series of these masts provided with arms and electrical apparatus, said arms being disposed vertically along the mast when not in use, and the electrical apparatus of the large arms of one station being connected by wires with the electrical apparatus of the small arms of the second station, &c. The large arms are locked or presented horizontally to the gaze of the engineer, mechanically by moving a crank of the electrical apparatus. Said motion also, by means of a commutator, brings into play a battery, which, by communicating with the electric apparatus of the small arms of second station, allows them to fall horizontally. The mechanical effect of said fall, through a commutator and battery of second station, sends a current back to first station, which acknowledges, upon a bell and an annunciator at first station, the receipt of the original signal sent from said first station. By means of this arrangement the large arms of a mast at the first station serve as a signal to an approaching train, and the elevation of them notifies the agent at second station, through the electric apparatus, battery, wires, and small arms of mast at second station, of the passage of the train past the first station. After the train has reached the second station the agent there allows the small arms of his station to fall, which mechanical action, through a commutator and battery of the

second station allows the large arm of the first station to fall. Said fall, through the commutator and battery of first station, sends another current to second station, which acknowledges, by a bell and annunciator, the receipt of original signal, and announces the fact that the large arm of first station has fallen. This combined electrical and mechanical apparatus is situated in between the two tracks, one large arm and one small one on same side of the mast being used for the trains passing up, and the other large arm and small arm on the opposite side for the trains passing down.

In the drawings, Fig. 1, S represents a mast, planted in or erected securely upon the ground. Near the top of said mast are pivoted the large arms A and B'', and just below them the small arms *a* and *b*, said arms being connected, respectively, with the crank-arms B B, of their appropriate electrical apparatus E by the traction-rods T t. Said traction-rods are jointed upon levers B g, which cause a bell to be struck whenever the large arms fall and small arms are extended, by operating upon a set of hammers, provided with the spring, and communicating with said bells. The upper portion of the mast S is made hollow, of metallic uprights F, Fig. 2, and to this hollow portion of the mast is hoisted, by means of a pulley, P, and weighted chain Z, a lantern, L. This lantern is used simply to illuminate the arms at night, so as to make them visible as signals. Said lantern is provided with three burners, *f f' f''*, with parabolic reflectors, and a receptacle, H', for oil. R is a mirror, inclined forty-five degrees to the horizon, for reflecting the light of burner *f''* down to the arm *a*. The burner *f* projects its light through the red-glass window of the arm A, when extended; and the burner *f'*, by means of a forty-five degree vertical mirror, M, through the colored-glass window of arm B'', a portion of the light from burner *f'* being reflected, by a forty-five degree horizontal mirror, *r*, down upon the arm *b*. The arms A B'' and *a b* are provided with a quadrant-shaped piece, 6, at the point where they are pivoted to the mast, whose arched surface moves against a flat spring, and forms thereby a brake for deadening the fall of the arms. The electrical apparatus E is attached to the mast S, at a convenient distance from the ground, by means of an iron frame, and corresponds in number to the number of arms on the mast—that is to say, four on the intermediate masts, and two on the masts at the terminal stations.

In the electrical apparatus E, Fig. 6, B represents the crank-arm, which is attached to the traction-rods T t of the mast. Said crank is keyed upon an axis, X, to which is attached a non-conducting circular disk, O, a cam, C, and an arm, D. Said disk has upon its periphery seven conducting-surfaces, one being connected, by a wire, *t*, with the axis, and the

other six grouped in pairs, *cc'*, *aa'*, *bb'*. Upon said periphery rest also four spring-contacts, L', being connected with post L of the line-wire —', with the post — of the negative pole of a battery, +', with the post + of the positive pole of a battery, and E'' with the coil-wire of the electro-magnet E'. W is a pawl, which opposes the rotation of the axis X in the wrong direction. Pivoted upon a second axis, F, is the lever J, which is in the same plane with cam C, and moves above the same upon a semi-elliptical spring, *r*, and is provided with an adjustable counter-weight, G. R is another lever, moving with J as an arm of an elbow-lever, and having a soft-iron armature, P', which rests upon the poles of the electro-magnet E'. B' is an upright arm upon a third axis, X', which acts as an abutment for the arm D to rest upon, and is connected with the lever R by a link and spring. H is a second electro-magnet, arranged symmetrically with E', and of a similar construction, and connected with it by wires. I is another axis, upon which move the armatures *f* and *g*, which alternately act as armatures or keepers of the magnet H, the annunciator V and hammer *t'*, which strikes the bell T', all of which oscillate upon the axis I, through the agency of the spiral spring Q and rod S connected with the lever J. Z' is a paratonnerre, or lightning-arrester, communicating with the post L of the line-wire, and the post T of the ground-wire.

To understand the operation of this electro-semaphoric apparatus we will conceive the apparatus to be set up at two intermediate stations, and, for the sake of perspicuity, confine ourselves to the operation of a single set of arms, in combination with the electrical apparatus; or, in other words, to the signaling of the train on one side of a double railway. Suppose the electrical apparatus of the large arm A of station No. 1 to be connected by a wire with the electrical apparatus of small arm *a* of station No. 2, &c. As soon as agent at station No. 1 is apprised of the approach of a train, he extends to the gaze of the engineer the large arm A of his station, which action, through the electrical apparatus, gives notice to the agent at station No. 2 that the train is just passing station No. 1, by allowing the small arm *a* of second station to drop horizontally. Electrical apparatus at station No. 2 then automatically sends back to station No. 1 an acknowledgement of the receipt of the signal. As soon as the train nears station No. 2 the agent then effaces the small arm of his station, thereby effacing the large arm of station No. 1, and then, by presenting the large arm of station No. 2 to the gaze of the engineer, notifies the agent at station No. 3 through the small arm of his station, &c.

We will now describe minutely the above action. The arms at stations Nos. 1, 2, and 3 are invisible. The electrical apparatus of arm A, station No. 1, is in the position shown in Fig. 6,

no communication with the line; and the apparatus of small arm *a* at station No. 2 in the position of Fig. 8, communication between the line and the magnet of apparatus, the arm D resting on the arm B', the armature *f* apart from magnet H, and the annunciator visible. Now, as agent at station No. 1 extends arm A he moves crank B over an arc of two hundred degrees, which brings the arm D to rest upon arm P, and the entire electrical apparatus of station No. 1 to assume a position similar to that first occupied by that of station No. 2. During the revolution of axis X, however, the commutator O comes to a position, as shown in Fig. 9, when the positive pole of the battery is put in connection with the line-wire L, and the negative pole with the ground-wire T. A positive current is therefore sent to the apparatus of station No. 2, which there enfeebles the magnet E'. The armature P' becomes loosened from the magnet, and the arm B' is drawn from under the arm D by the action of the counter-weight G. The arm D, becoming free, will allow the crank B, commutator O, to turn from the weight of the small arm *a* of the mast, which falls to a horizontal position, and notifies the agent by a chime upon the bells on the mast. The moment the lever J has been drawn downward the annunciator becomes invisible, and the armature *f* placed against the magnet H; but in the meantime the crank B was returning to its vertical position, the cam C was raising the lever J and placing the armature P' against the magnet E'. At the same time, too, the commutator of this second station was setting in connection the positive pole of the battery with the ground, and the negative pole with the line, as shown in Fig. 10. A negative current is therefore sent toward the apparatus at station No. 1, which there enfeebles the magnet H, which allows the armature to be drawn away by the action of the spring Q, the annunciator to appear, and the hammer *t* to strike the bell T', which constitutes the automatically returned acknowledgment of the receipt of the signal dispatched from first station and received at the second.

When the train approaches the second station, the small arm *a* of this station is allowed to fall by the agent, which, by a series of similar actions to those just described, operates back to the first station, and allows the large arm there also to fall, notifying the agent by a chime upon the bell on the mast. The agent then at the second station, by extending his large arm A, signals the engineer, and also notifies the agent at third station of the presence of a train at second station.

By means of this arrangement, the agent at any station signals the engineer, and at the same time notifies the stations on each side of him of the coming in and departure of his trains.

So far we have spoken only of the apparatus as adapted to double-railway sections. For single-railway sections the arms all constitute signals for the engineer, and are consequently all made large alike, and disposed upon the mast so as to be seen from afar, as is shown in Fig. 4, so that the engineer may see on the same side of the mast the upper arm, which shuts the way because a train running in the same direction has not yet reached the next station, and also the lower arm, which shuts the way because a train is coming in the opposite direction to the corresponding station, either of which signals impart a stopping—the form of the lower arms, their draw-motion, and the use of two lanterns at night being the only difference between the single and double way section masts.

The combined electro-semaphoric apparatus, as thus described, is supposed to be operated by the hand of the agent in charge of the station. Fig. 5, however, shows an apparatus by means of which the operation of the arms, in combination with the electrical apparatus, is rendered automatic.

E''' is a drum connected with the axis X of the electric apparatus, and provided with a cord and weight, *m*. Said drum is provided with a finger, *d*, which ordinarily rests against the arm of an abutment, V. Said abutment is supported upon a swan-neck, *j*, to which is attached a treadle, C, placed near the rails. The engine, in passing along, strikes, with the flange of its wheels, the treadle C, depressing swan-neck *j*, and allowing the abutment V to fall. The finger *d* then being free, the drum revolves by reason of the weight *m*, and the same motion is imparted to the axis X, which would ordinarily be effected by hand, through a crank.

What we claim as new is—

1. The combination of the large arms of a semaphoric mast of one station with the small arms of a similar mast at another, and their respective electrical apparatus E, as hereinbefore described, all constructed and arranged substantially as and for the purpose set forth.

2. The combination of the arms A B'' and *a b*, the chime-bells, and the electrical apparatus E, substantially as and for the purpose described.

3. In the electrical apparatus E, the commutator O, provided with the connections set forth, in combination with the crank B, spring contacts E'', L', +', and —', and a battery, substantially as and for the purpose described.

4. The combination of the arm D, cam C, and pawl W with the movable arm B' for locking the arms of the mast, the large arms in a horizontal and the small arms in a vertical position, substantially as and for the purpose specified.

5. The combination of the electro-magnet E', the armature P', levers R and J, and coun-

ter-weight G, for unlocking the arms of the mast, substantially as and for the purpose specified.

6. The combination of the electro-magnet H, the armatures *f* and *g*, the spring Q, the annunciator V, rod S, lever J, and bell T, for acknowledging the receipt of the signal, substantially as and for the purpose specified.

7. The combination of the treadle C, swan-neck *j*, abutment V, drum E''', pin *d*, and weight-cord with the axis X of the electrical

apparatus E, for the purpose of allowing the passing train to operate the signals automatically, substantially as and for the purpose described.

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