No. 871,538. PATENTED NOV. 19, 1907.

E. TYER.

APPARATUS FOR INSURING SAFETY OF TRAFFIC ON SINGLE LINES OF RAILWAY.

APPLICATION FILED NOV. 15, 1905.

4 SHEETS—SHEET 1.

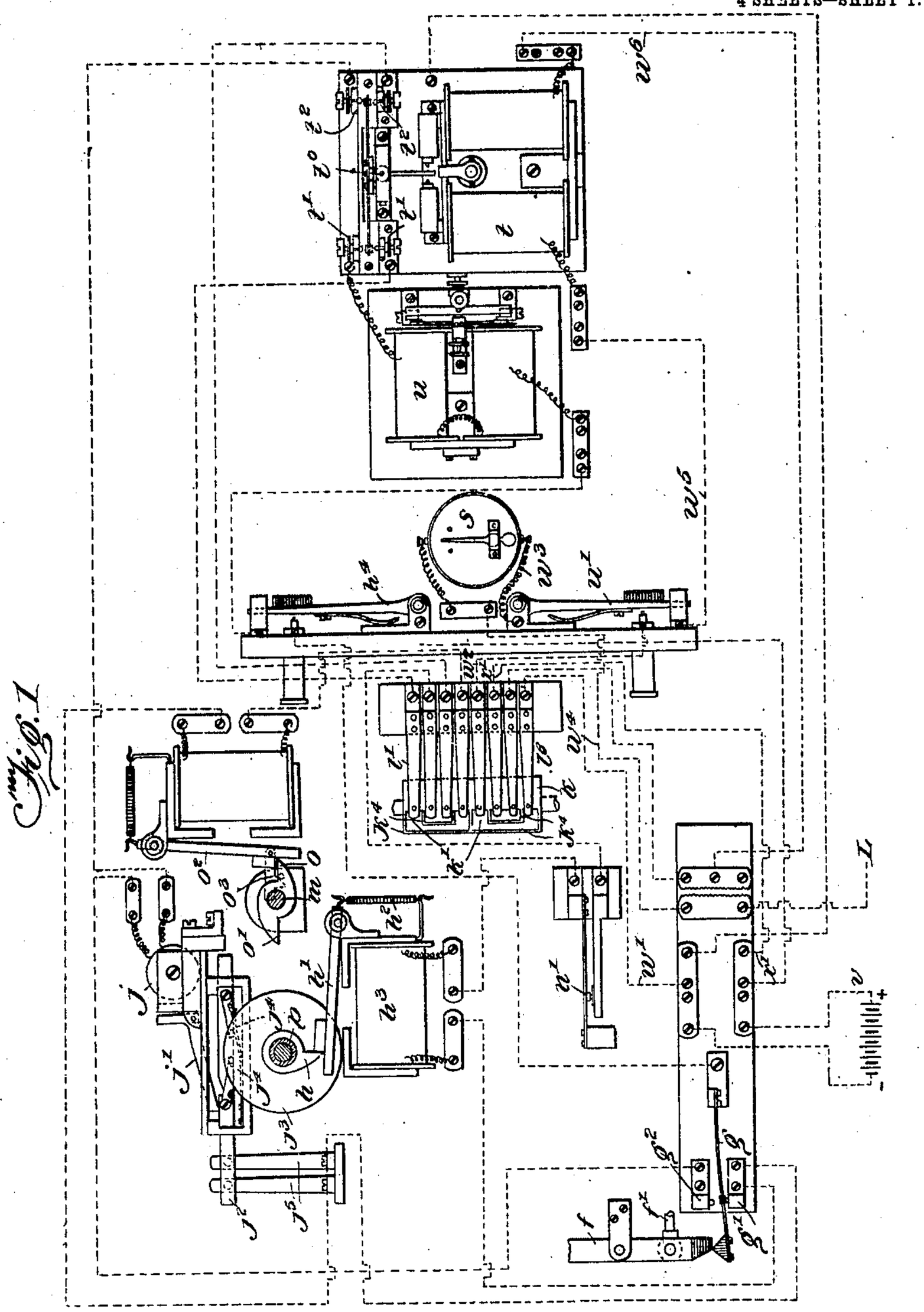

Fig. 1.

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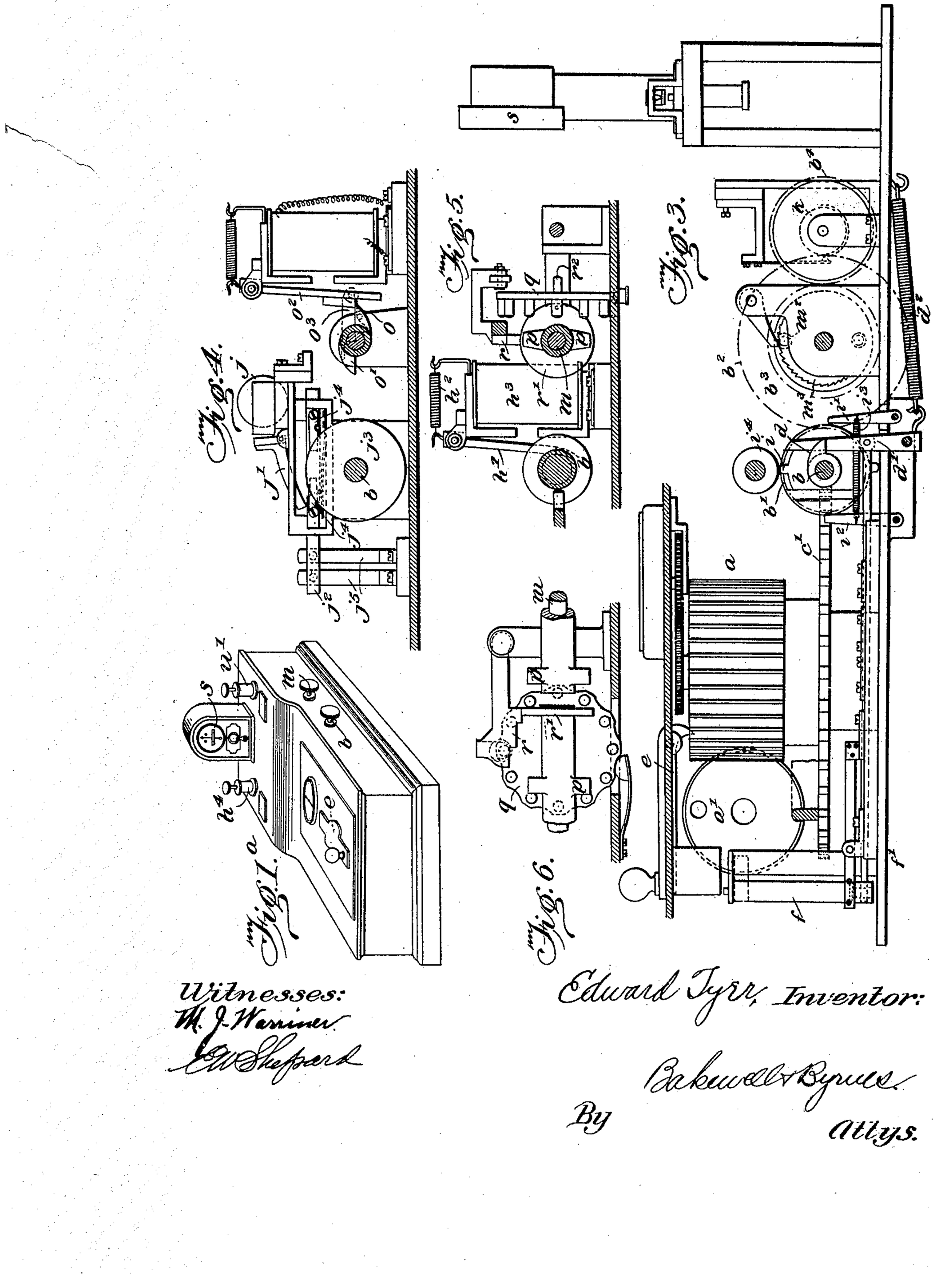
4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

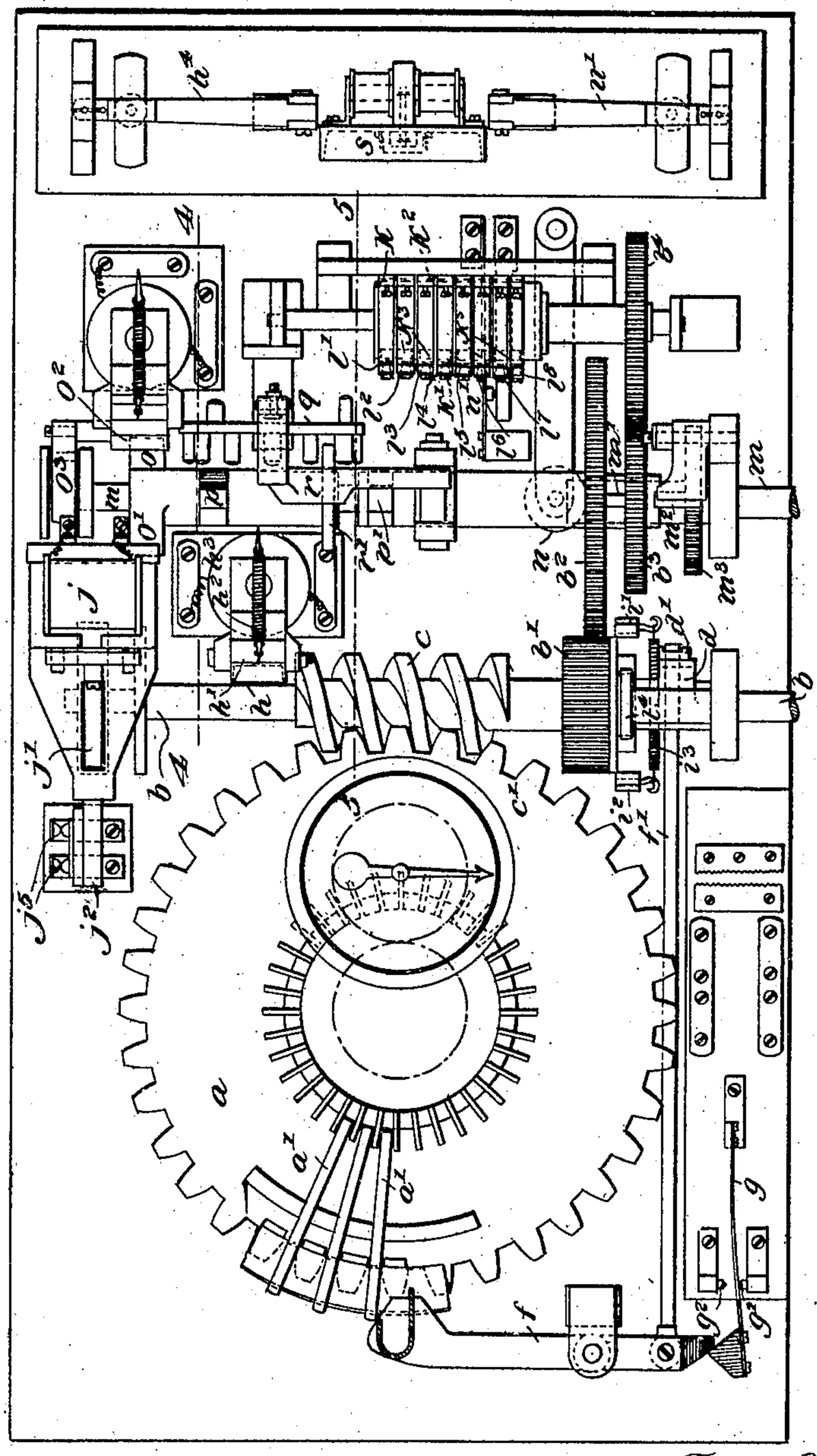

Fig. 2.

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4 SHEETS—SHEET 4.

Fig. 7.

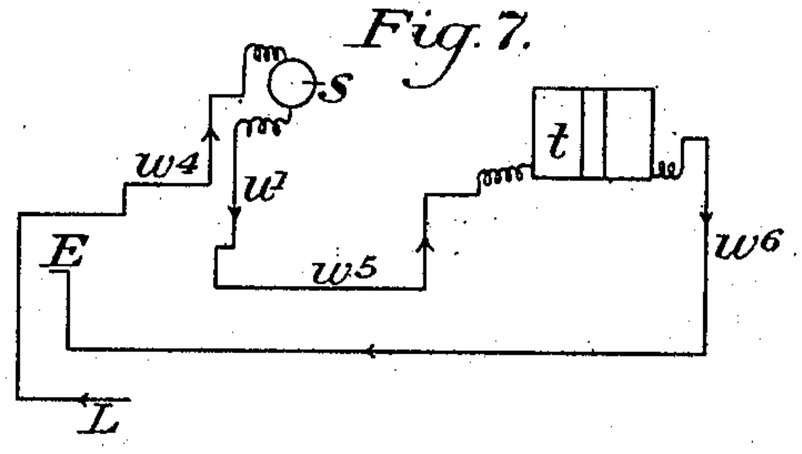


Fig. 8.

Fig. 9.

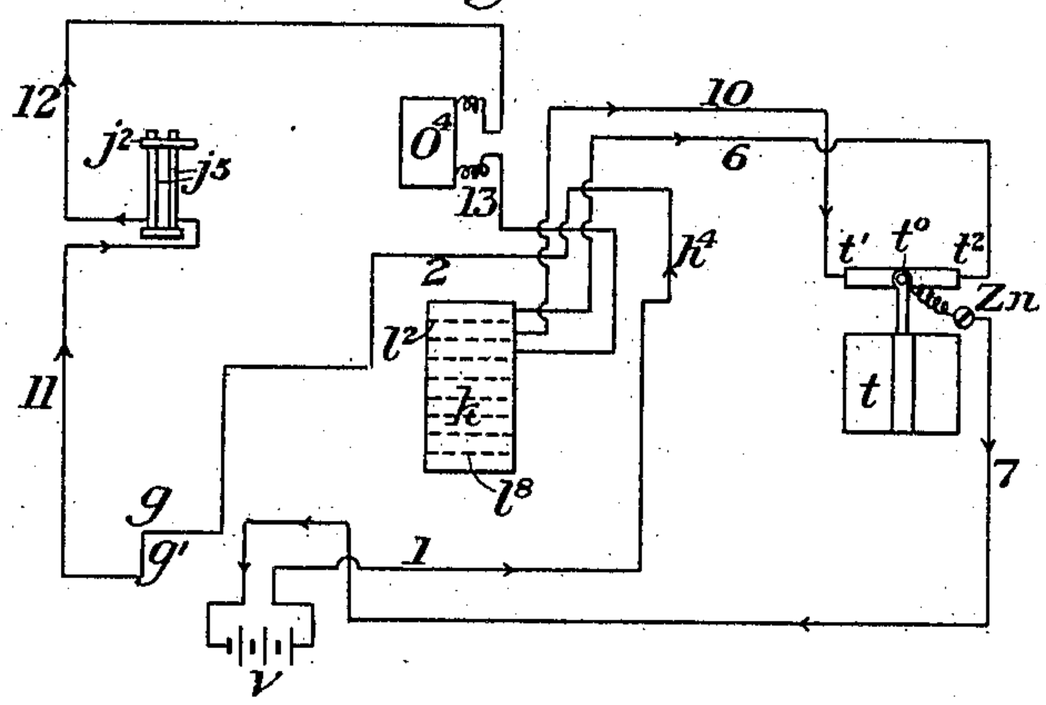
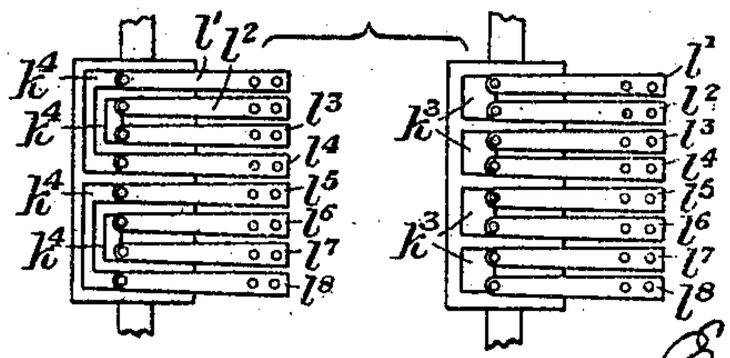


Fig. 10.



WITNESSES

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APPARATUS FOR INSURING SAFETY OF TRAFFIC ON SINGLE LINES OF RAILWAY.

No. 871,538. Specification of Letters Patent. Patented Nov. 19, 1907.

Application filed November 15, 1905. Serial No. 287,429.

To all whom it may concern:

Be it known that I, EDWARD TYER, a subject of the King of Great Britain, residing at Ashwin street, Dalston, in the county of London, England, engineer, have invented certain new and useful Improvements in Apparatus for Insuring Safety of Traffic on Single Lines of Railway, of which the following is a specification.

The method of working single lines of railway which is commonly called the staff system and in which a tablet issued from an apparatus which may be electrically controlled must be received by an engine driver before he can take his train into the next section of the line, may be conducted either on the absolute block system, in which only one train is allowed on each section at any time, or on the permissive block system, in which by permission of the signalman at the advance station two or more trains can be sent on to one section in the same direction, some such provision being practically necessary when the sections are long in order to avoid hanging up the traffic unnecessarily.

The present invention also deals with apparatus for electrically controlling the working of single lines of railway which allows the line to be worked alternatively on the absolute block or the permissive system, and has for its object the simplification of such apparatus while preserving efficiency in working. The improvements by which this object is attained and which constitute the present invention, will be described with reference to the accompanying drawings, in which

Figure 1 is a diagrammatic plan view showing the electrical parts and connections of the improved apparatus; Fig. 1ª a perspective view of the complete apparatus; Fig. 2 a general plan view of the apparatus with the casing removed; Fig. 3 a front elevation of the same; Figs. 4 and 5 sections taken on lines 4—4, 5—5 respectively of Fig. 2; Fig. 6 a detail view of the tell-tale device. Figs. 7 and 9 are diagrammatic views showing certain electric circuits at one of the stations, hereinafter termed the distant station; Fig. 8 is a diagram showing an electric circuit at another station hereinafter termed the home station; and Fig. 10 is a detail view showing top and bottom plan views of the commutator.

As herein illustrated the tablet carrier a is mounted to be rotated about a vertical axis by means of a manually operated spindle b through worm gearing c, c'. The rotation of the spindle b in one direction is controlled by means of a nib d and detent d' which normally lock the spindle and are disengaged by the insertion through the tablet slot e in the casing of a tablet a', which rocks a bell crank lever f and thereby through the rod f' displaces the detent d' against the action of the restoring springs d^2. At the same time the spring contact bar g, which is normally held against the contact g' by the tail of the crank lever, is allowed to spring backward against the contact g^2. The insertion of a tablet, by thus temporarily disengaging the detent from the nib d allows the spindle b to be turned through one revolution and the worm wheel c' through one tooth, thereby locking up the tablet within the casing. The rotation of the spindle b in the opposite direction is controlled by means of a nib h and an electromagnetic detent h', the latter being normally urged into contact with the nib to arrest rotation by a spring h^2 and being retracted when the magnet h^3 is energized. When the magnet is temporarily energized by the establishment of a current in a circuit which is closed by a switch key h^4 at the home station, and which includes battery v wire 1, switch h^4, wire 2, spring g, contact g', wire 3, magnet h^3, wire 4, switch n', wire 5, commutator fingers l^2 l^3 (for the position of commutator shown in Fig. 1), wire 6, one of the relay contacts t' t^2 relay pivot, relay base plate and terminal Zn, and wire 7, the operator is enabled to turn the spindle b in the reverse sense, thereby bringing the tablet which was last locked up in the casing opposite the slot, so that it may be withdrawn.

The nibs d, h are set so that the spindle b is normally locked, and provision is made to compel the operator to complete a revolution of the spindle b after he has turned it through a certain angle. The latter arrangement consists of a stop i i^0 rotating with the spindle b and mounted to slide in guides transversely to the axis thereof, which cooperates with a pair of diametrically opposed stops i', i^2 which are pivotally mounted to yield outwardly and are normally held by a spring i^3 in definite positions as shown in Fig. 2. The ends of the stop i i^0 successively encounter a fixed stop i^4 by which the stop i i^0 is displaced in its guides i^5, i^6 alter-

nately in either direction so as to cause one end to clear the stop i' or i^2 towards which it is advancing. If, however, it is attempted to reverse the rotation of the spindle during a revolution, the other end of the stops i, i^0 which by the preceding movement, were outwardly displaced will encounter the stop i' or i^2 towards which it is returning and arrest reverse rotation.

Near the rear end of the spindle b is an electromagnet j which, when energized, retracts a locking catch j' from engagement with a sliding-contact bar j^2. The sliding bar is actuated by means of a projection on a disk j^3 secured to the spindle b near its rear end which coöperates with a pair of pivoted stops j^4 on the bar so as to move the latter into position to disconnect the contact fingers j^5 when the spindle b is turned in response to a releasing current from the distant station, and to connect the said contact fingers when the spindle is turned in the direction to lock up a tablet within the casing. In the latter case the insertion of the tablet by closing the spring contact switch g, g^2 establishes a current in the coils of the magnet j through the circuit including battery v, wire 1, switch h^4, wire 2, spring g, contact g^2, wire 8, magnet j, wire 9, one of the relay contacts t t' t^2, relay pivot and terminal Zn, and wire 7, as shown in Fig. 1, whereby the locking catch j' is retracted to allow the bar j^2 to be moved in its guide.

The spindle b has fixed thereon a pinion b' which gears either directly or through intermediate gear b^2, b^3, b^4 with a drum commutator k as shown in Fig. 10 having two sets of contacts k', k^2 shown in Fig. 2 diametrically opposed to each other which coöperate with contact fingers l' l^2 etc. shown in Figs. 2 and 10, to control electric circuits in the manner hereinafter described, the gear ratio being such that one revolution of the spindle b produces a half revolution of the drum k. One effect of reversal of the commutator is to place the batteries of the stations at the ends of the section controlled by the apparatus out of unison so that if, for example, the operator at the home station has been enabled by the energizing of his magnet h^3 to turn the spindle b so as to withdraw a tablet and send a train on to the section, the reversal of the commutator has thrown the two stations out of unison, so that neither operator is able to send a releasing current to the other to permit the withdrawal of a second tablet until the stations are again brought into unison. This is done in the absolute block system when the train reaches the distant station by the operator at that station inserting the tablet which he receives and turning his spindle b to lock up the tablet in the casing, this operation reversing his commutator and thus again placing the batteries in unison, and enabling either operator to send a releasing current to the other station. When, however, it is required to work the line on the permissive block system, other means of establishing unison between the stations is necessary and according to the present invention this is effected in the following manner. The gear wheel b^2 is loosely mounted on a second manually operated spindle m, having an elongated boss through which the spindle m passes and is normally urged by a spring roller n into operative engagement to rotate with the gear wheel b^3 which is also loosely mounted on the shaft m but is secured against displacement longitudinally by suitable guides or stops, as for example a slot in the base plate within which it rotates. The engagement between the gear wheels b^2 b^3 may be effected by means of the pin m' which projects from the face of the wheel b^2 and engages in one or other of a pair of diametrically opposite holes in the wheel b^3, a similar pin clutch m^2 adapted to engage in the same holes serving to clutch the wheel b^3 with a disk m^3 fixed on the spindle m when the latter, which has a certain axial freedom, is displaced rearwardly, the arrangement being such that in one position of the spindle m the clutch m' and in the other position the clutch m^2 is in operation. In this case the commutator drum k is mounted on a separate spindle and is driven through the gear wheels b^3, b^4. It may thus be driven either from spindle b through gears b', b^2, b^3, b^4 or from spindle m through disk m^3 and gears b^3, b^4, depending on the position of the spindle m. Fixed near the rear end of this spindle and opposite each other diametrically are a pair of nibs o, o' which coöperate with an electromagnetic detent o^2 to control rotation of the spindle in one direction, while rotation in the other direction is prevented by a pawl which engages with ratchet teeth cut in the periphery of the disk m^3 for this purpose. The energizing coil o^4 of the detent o^2 is included in a circuit which is controlled from the distant station, and connected with the detent and moving therewith is a stop o^3 which is normally interposed in the axial path of the spindle m but which when the magnet is energized is retracted to allow the spindle m to be pushed rearwardly and rotated.

Secured on the rear part of the spindle m is a pair of diametrically opposed wings p adapted to engage and rotate the disk q of a tell tale device when the spindle is pushed to its rearward position and turned by the operator, and a similar pair of wings p' fixed on the boss of the gear wheel b^2 are adapted to rotate the tell tale disk in the reverse direction when the gear wheel b^2 is rotated by the operator turning the spindle b. The tell tale is thus turned in one direction when the operator establishes unison between the two

stations prior to sending a releasing current to the distant station to enable the operator there to send an additional train on to the section, and is turned in the opposite direction when the operator locks up the tablet received from the incoming train. Thus the tell tale will be returned to its zero position when as many tablets have been received and locked up by the operator at the home station as there have been additional trains despatched by the operator at the distant station. The number of additional trains on the section at any time is shown on an indicator disk q' suitably geared with the disk q. Further, the spindle m is retained in its rearward position during permissive working by means of a gravity catch r pivoted on the frame which drops in front of a disk r' fixed on the spindle m when the latter is pushed rearwardly and partially rotated so as to allow the tail of the catch, which normally rests on a projection r^2 on the back of the tell tale disk, to clear the said projection. The spindle remains in its rearward position until by the reverse rotation of the tell tale, the projection r^2 encounters and raises the catch r and allows the spindle m to be urged forwards by the pressure of the spring-urged roller n on the rear face of the gear wheel b^2. Thus, when the tell tale returns to the zero position, the apparatus is automatically restored to the condition for absolute block working. The movement of the spring arm which carries the roller n when the spindle m is pushed home rearwardly, also serves to open the spring key n' which is included in the energizing circuit of the absolute locking magnet h^3 and which is normally closed. There are also included in the apparatus a galvanometer s, a polarized relay t controlling the two pairs of contacts t', t' and t^2, t^2, a bell magnet u, and bell plunger key u', and local battery v. The functions of these parts and their relations with the apparatus hereinbefore described will be more conveniently dealt with by tracing the various operations performed and circuits established thereby in working the traffic of a section on the absolute block system and on the permissive block system respectively.

Calling the home station operator A and the distant station operator B, and assuming that A has a train ready to enter the section, A calls B by depressing his bell plunger u' the required number of times according to the code signal, thereby establishing a current in a circuit which is marked w', w^2, w^3, w^4 in Fig. 1 along line L to B's station, which it enters at line L, traversing wire w^4 galvanometer s, bell plunger w', wire w^5, relay t, wire w^6 to earth E as shown in Fig. 7. If B is in a position to receive the train and has no other or greater urgency approaching his end of the section from the other direction, he signifies his acceptance by signal and depressing his bell plunger he establishes a current in the circuit marked line L, w^4, w^3, w^5, relay t, w^6 to earth E (Fig. 1) whereby a local current is established when A depresses his switch h^4, traversing battery v, wire 1, switch h^4, wire 2, spring g, contact g', wire 3, magnet h^3, wire 4, switch n', wire 5, commutator, wire 6 or 10 according to the position of the commutator, relay contacts, terminal Zn, and wire 7, thereby exciting the absolute locking magnet and attracting the detent h' at A's station, who is now able to turn the shaft b through one revolution so as to bring a tablet into position for extraction. As the commutator bars are arranged so that in one position of the commutator the contact fingers are connected in the pairs l', l^2; l^3, l^4; l^5, l^6; l^7, l^8 as shown at b^3 (Figs. 2 and 10); while in the other position they are connected in the pairs l', l^4; l^2, l^3; l^5, l^8; l^6, l^7 as shown at k^4, (Figs. 1 and 10); this movement of the spindle b, by rotating the drum k through half a revolution, alters the interconnections of the contact fingers l', l^2, l^3, l^4 in such manner that if the + and − terminals of the battery were previously connected respectively with line and earth, they will now be connected with earth and line respectively, and the batteries at the two stations will thereby be thrown out of unison. When this is so, neither A nor B is able to send a releasing current to the other and neither of them is therefore able to obtain another tablet. When, however, B receives the tablet on the arrival of the train at his station and, after inserting it in the tablet aperture, turns the spindle b of his apparatus in the free direction, the movement of his commutator restores unison and enables either operator to send a releasing current to the other station. If, while the first train from A's station is on the section, A asks permission to send a second train and B signifies that he is prepared to work "permissively", A holds down his bell plunger key u', thereby establishing a current in the circuit marked x', w^2, w^3, w^4 line L to relay at B, whereby a local current is established in the circuit which includes B's battery v, wire 1, switch h^4, wire 2, spring g, contact g' wire 11, contacts j^2 j^5, wire 12, permissive locking magnet o^4, wire 13 commutator, wire 6 or 10 according to position of commutator, relay contacts, terminal Zn, and wire 7, which energizes the permissive locking magnet o^4 at B's station and retracts the detent o^2 and stop o^3, thereby allowing B to push the spindle m of his apparatus rearwardly and rotate it through half a revolution, by which the batteries v are brought into unison, the tell tale rotated to show an additional train on the section, and the circuit of the absolute locking magnet broken at key n'. B is now able to send a releasing current to A by depressing his bell plunger u', thereby energizing the abso-

lute locking magnet. These operations are repeated for each additional train allowed on the section.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim:—

1. Apparatus for working single lines of railway on the staff or tablet system, comprising a tablet magazine, an operating spindle geared therewith, an absolute locking magnet controlling said spindle, a local circuit including said magnet, a relay and line circuit controlling said local circuit from the distant station, and a commutator operating to throw the batteries of the home and distant stations out of unison when the operating spindle is turned to release a tablet; substantially as described.

2. Apparatus for working single lines of railway on the staff or tablet system, comprising a tablet magazine, an operating spindle geared therewith, an absolute locking magnet controlling said spindle, a local circuit including said magnet, a relay and line circuit, a commutator operating to reverse the polarity of the station battery with respect to the line, a permissive locking magnet, and a second spindle controlled thereby and operating when released to turn the commutator; substantially as described.

3. In apparatus of the character herein described, a tell-tale device comprising two operating shafts, a mechanically released detent controlling one of said shafts, an electrically released detent controlling the other shaft, a disk adapted to be turned in one direction by the rotation of one shaft and in the opposite direction by the rotation of the other shaft, and an indicating device geared with said disk; substantially as described.

4. Apparatus for working single lines of railway on the staff or tablet system, comprising at each station an absolute locking magnet and a permissive locking magnet, and means whereby the circuit of the absolute locking magnet at the distant station is broken during permissive working; substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD TYER.

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