(No Model.) 4 Sheets—Sheet 1.

I. A. TIMMIS.

STAFF APPARATUS FOR WORKING SINGLE LINE RAILWAYS.

No. 547,820. Patented Oct. 15, 1895.

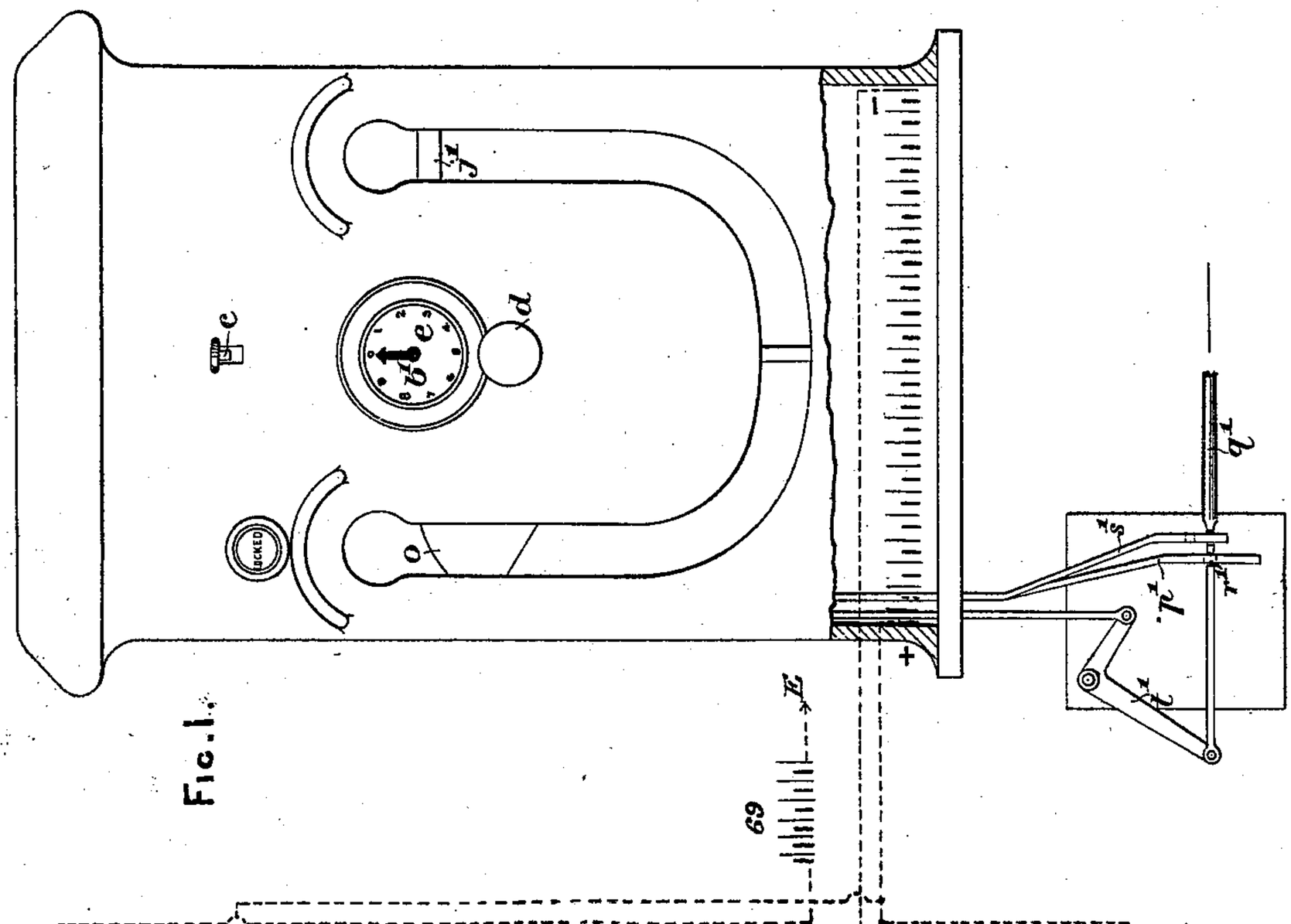

FIG. 1.

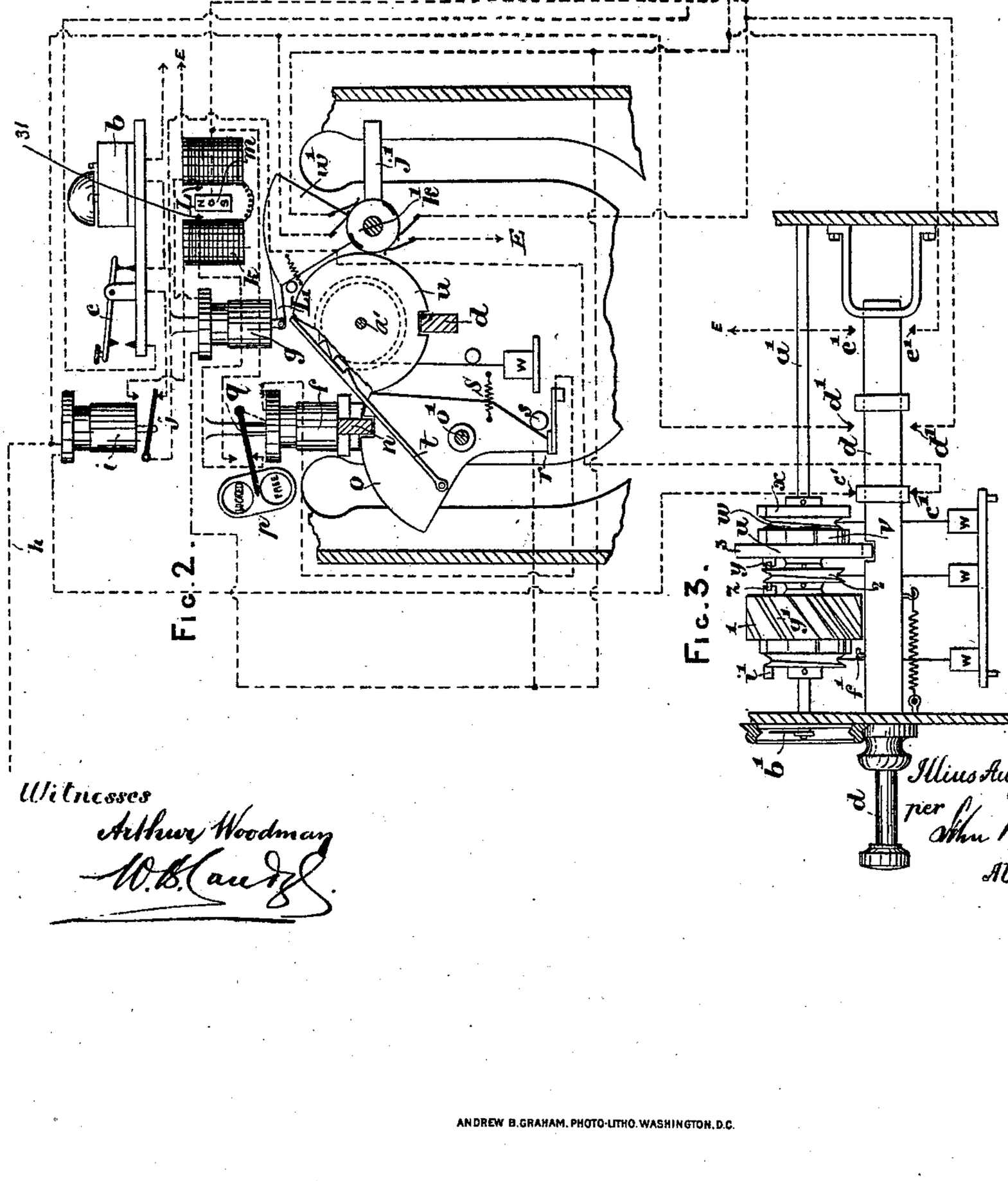

FIG. 2.

FIG. 3.

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(No Model.) 4 Sheets—Sheet 2.

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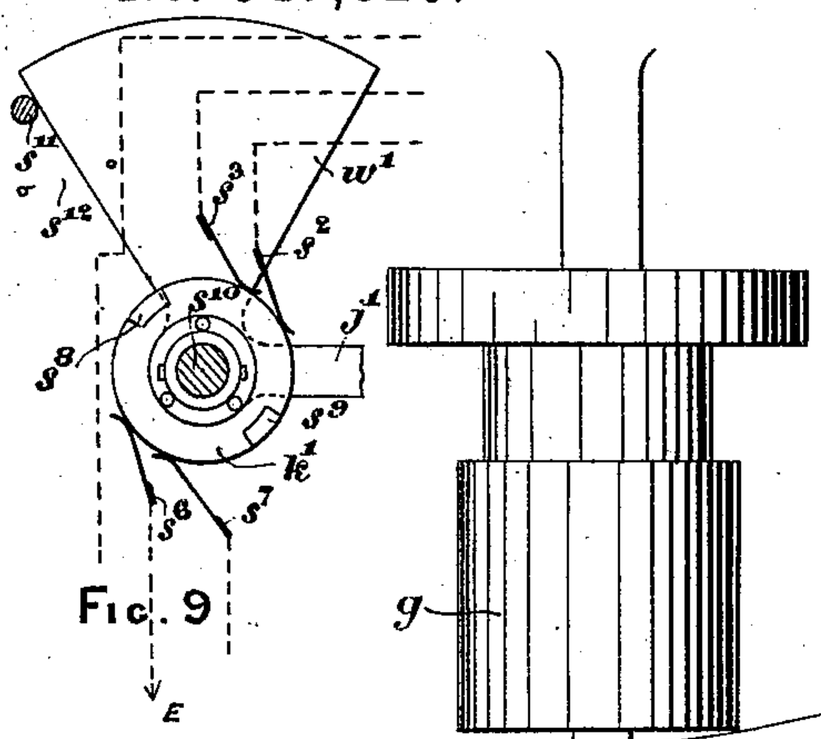


Fig. 9

Fig. 5.

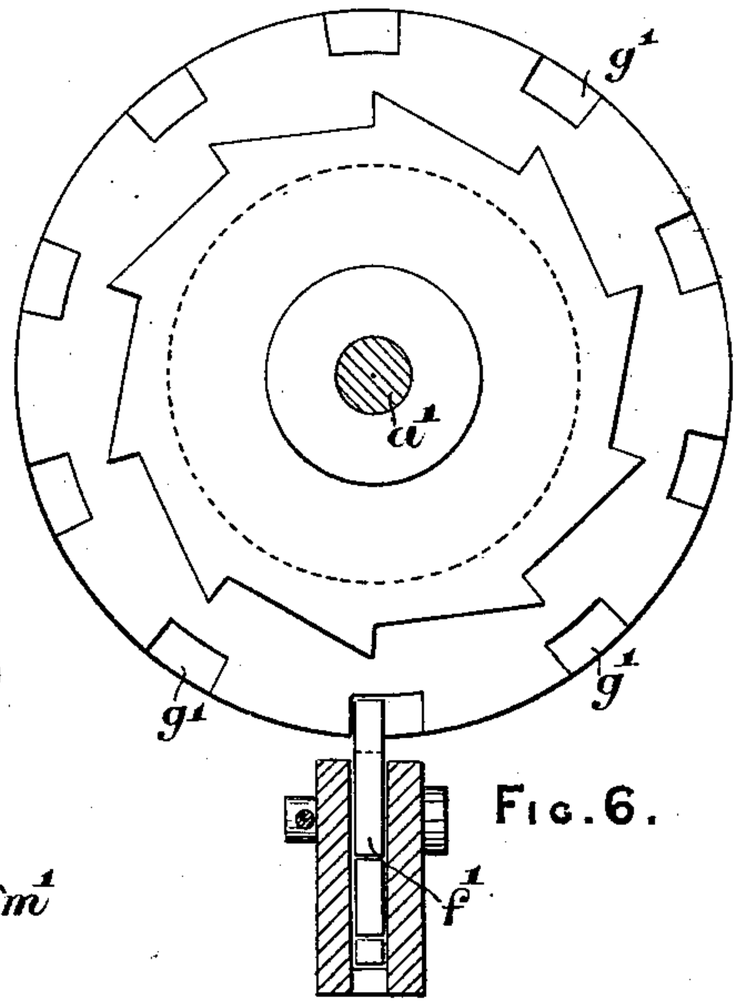


Fig. 6.

Fig. 7.

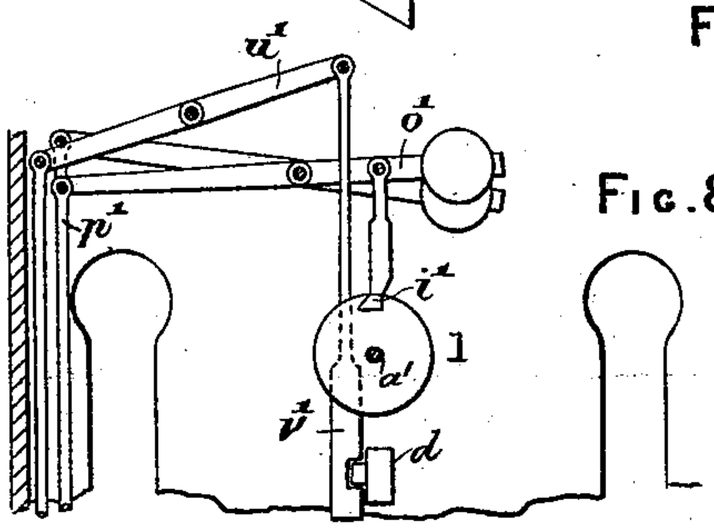
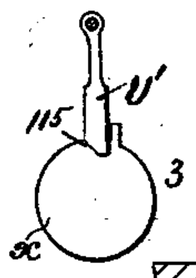
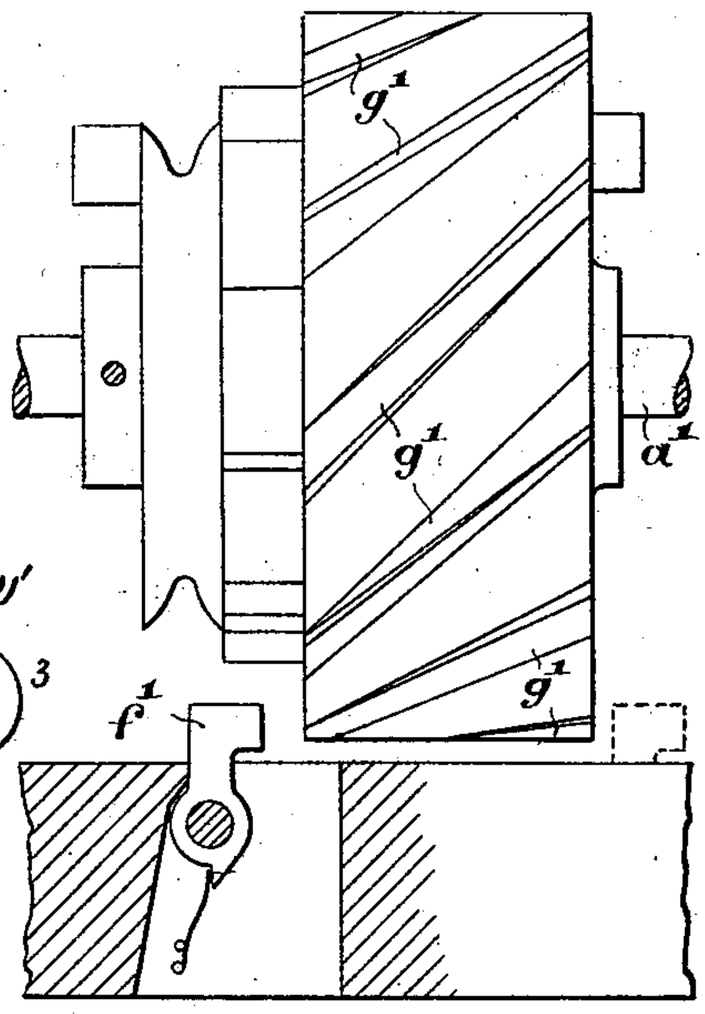


Fig. 8.





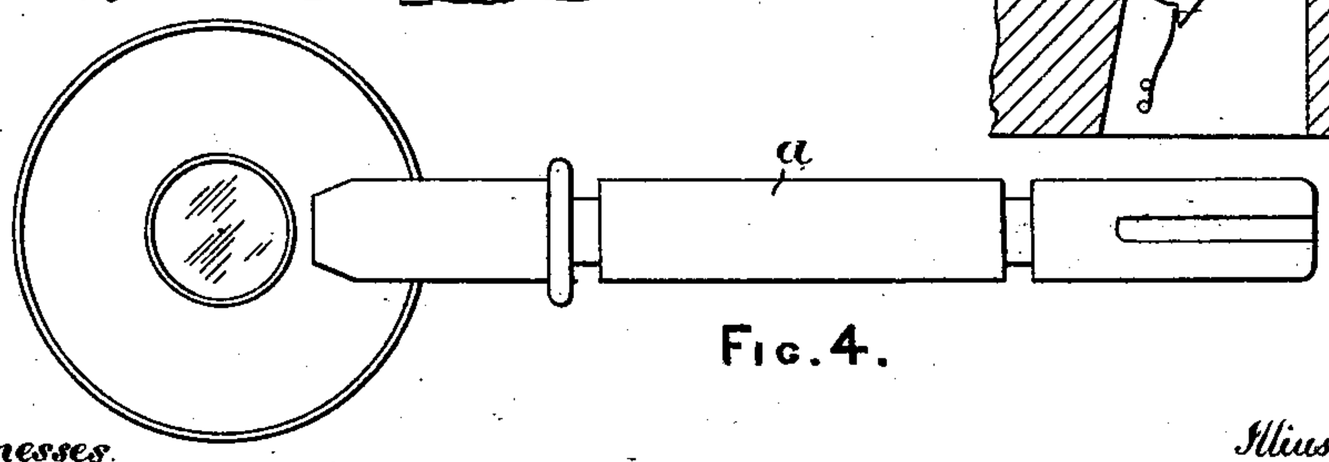


Fig. 4.

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I. A. TIMMIS.

STAFF APPARATUS FOR WORKING SINGLE LINE RAILWAYS.

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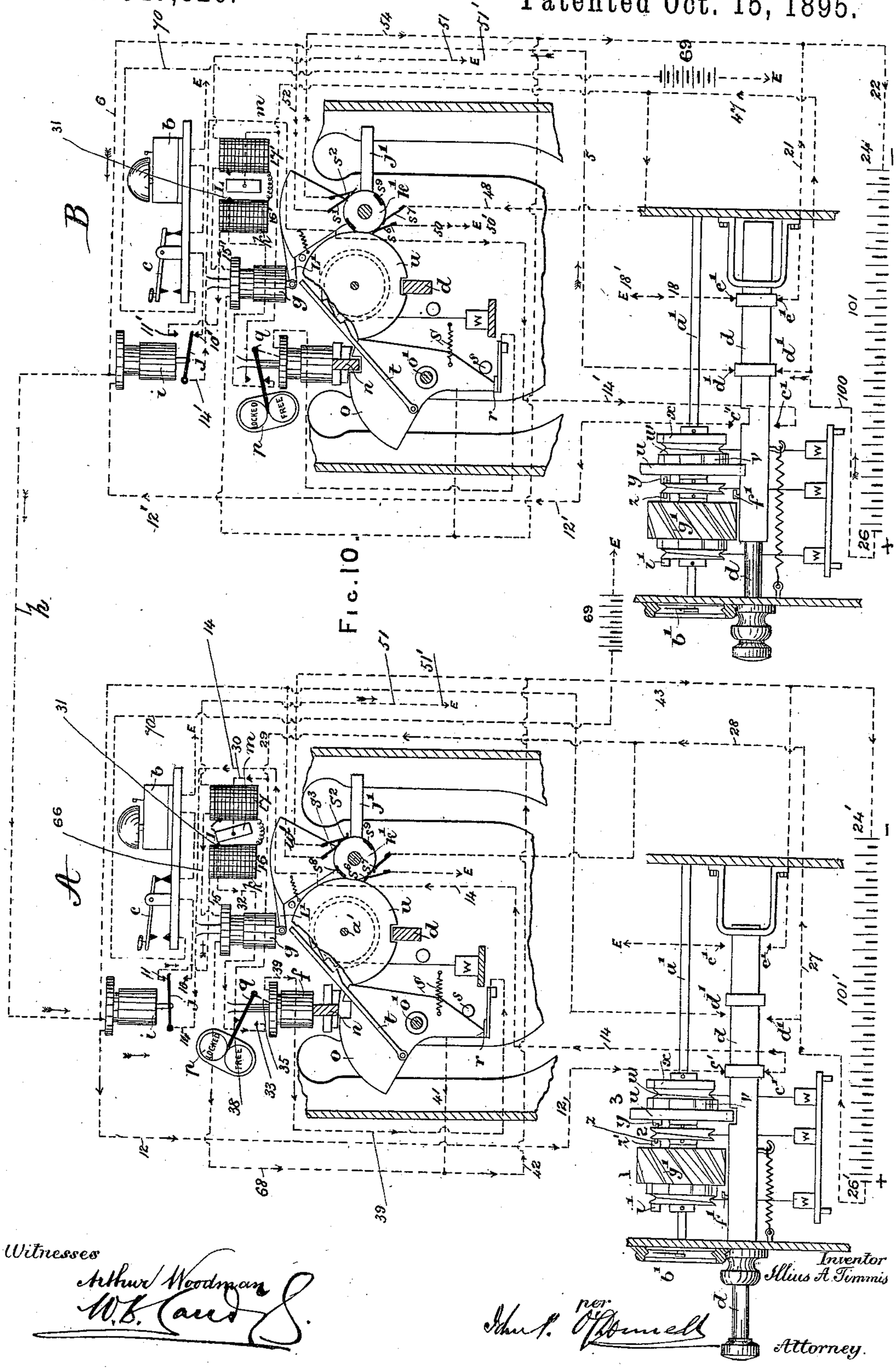

FIG. 10.

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STAFF APPARATUS FOR WORKING SINGLE LINE RAILWAYS.

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FIG. 11

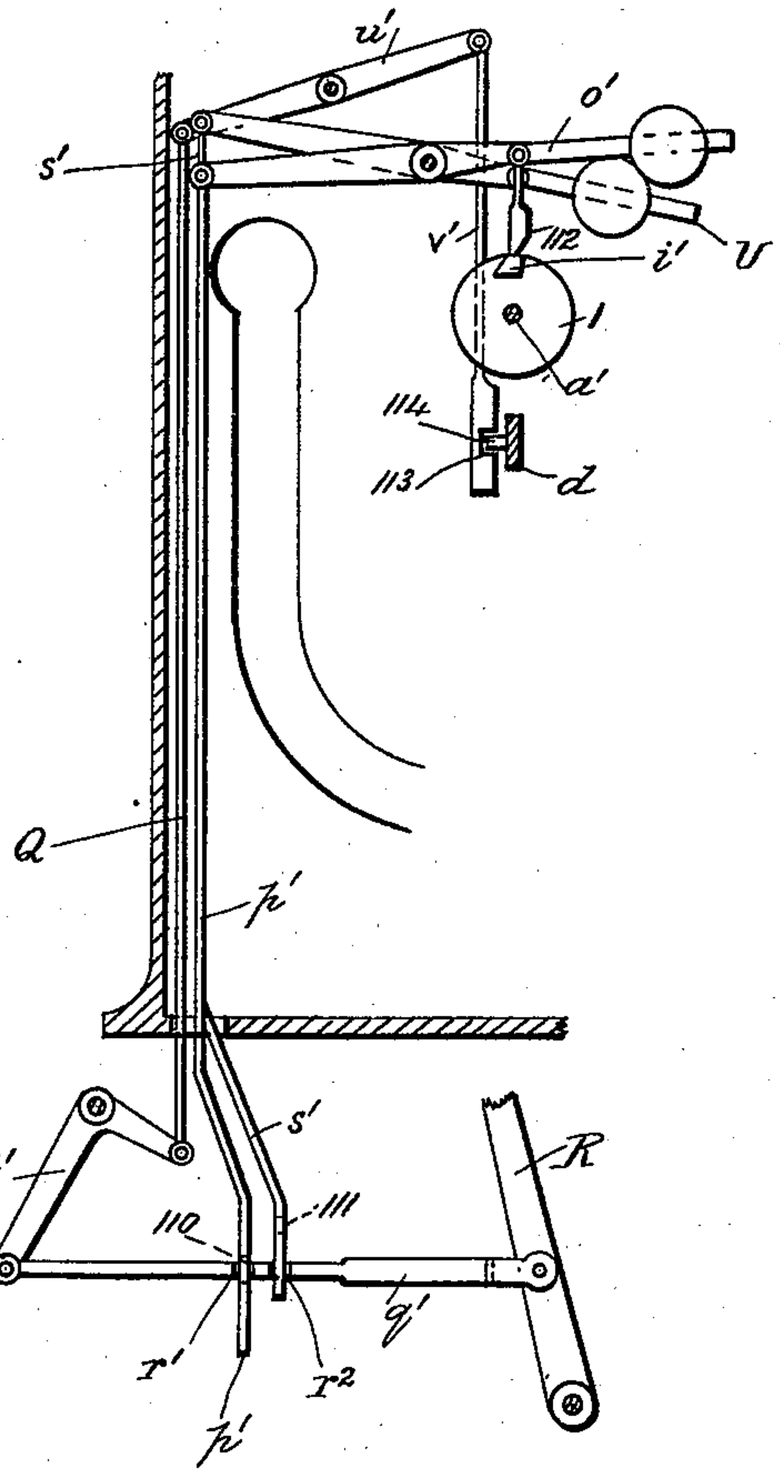


FIG. 12

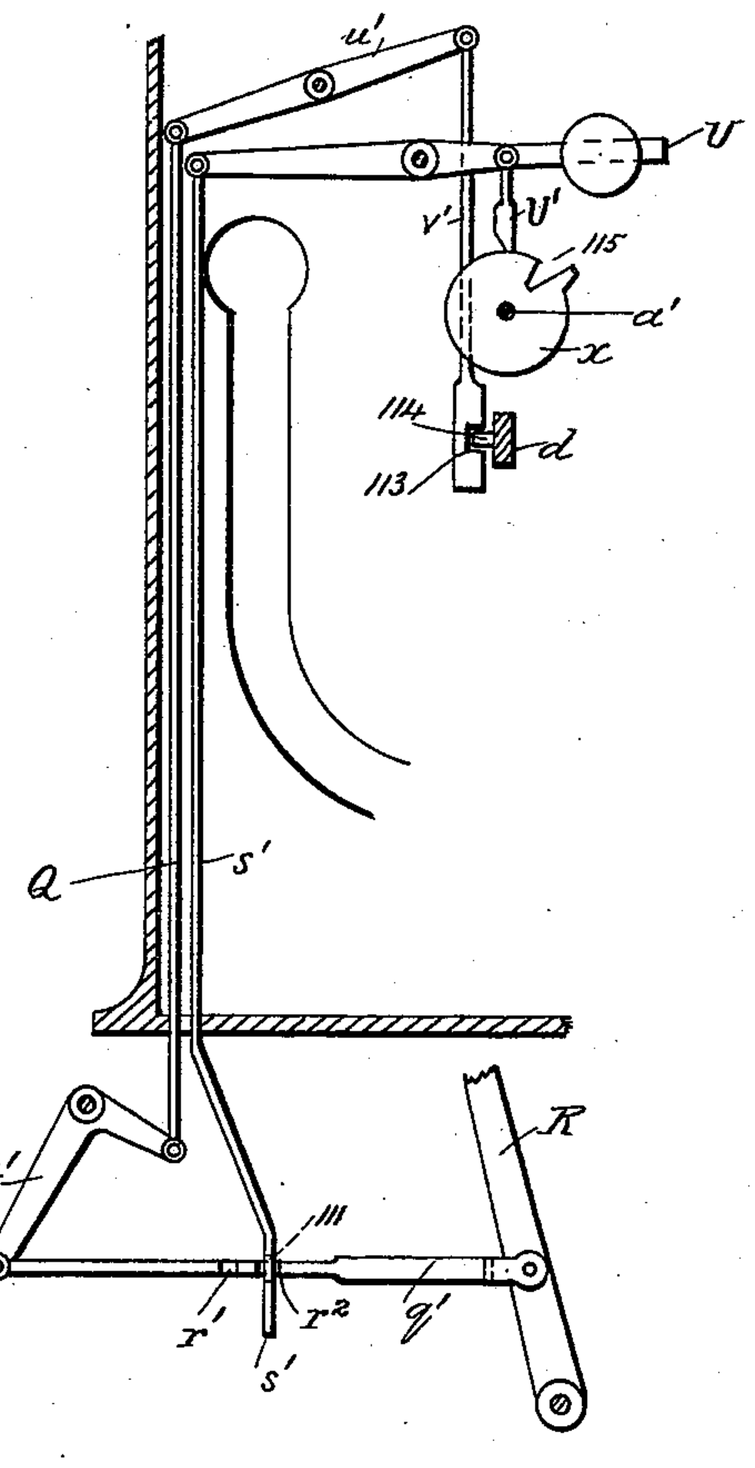
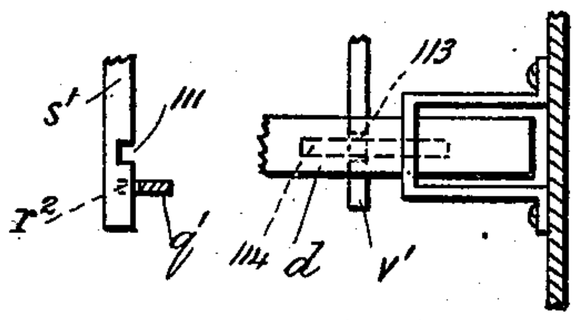


FIG. 13



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Inventor
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By Attorney Herbert W. Jenner.

UNITED STATES PATENT OFFICE.

ILLIUS AUGUSTUS TIMMIS, OF LONDON, ENGLAND.

STAFF APPARATUS FOR WORKING SINGLE-LINE RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 547,820, dated October 15, 1895.

Application filed December 1, 1893. Serial No. 492,503. (No model.) Patented in England January 1, 1894, No. 45.

To all whom it may concern:

Be it known that I, ILLIUS AUGUSTUS TIMMIS, a subject of the Queen of Great Britain and Ireland, residing at No. 2 Great George Street, Westminster, London, in the county of Middlesex, England, have invented new and useful Improvements in Staff Apparatus for the Working of Single-Line Railways, of which the following is a specification.

Letters Patent for this invention have been obtained in England, No. 45, dated January 1, 1894.

The objects of my invention are to provide an efficient and economical method of working a single-line railway by a staff system in conjunction, where required, with a bell telegraph or telephone system, and interlocking the staff-instruments themselves with the starting-signals, the whole apparatus to work with one line-wire only.

My apparatus consists of an instrument called a "staff-instrument" and is provided with staffs, bars, or tablets. A staff is a permit or "pass" to allow a train to proceed from a station into a section or block ahead. At each end of a section to be worked on this system there is provided a staff-instrument connected by a wire called the "line-wire," both alike and each supplied with a suitable number of staffs, the numbers being decided by the character and quantity of the traffic. The staffs for each section or block and for each pair of staff-instruments should be made specially and unlike those belonging to any other section or pair of staff-instruments. Each staff-instrument is provided with a plunger and gearing, by means of which a current of electricity may be sent along the line-wire to the other staff-instrument at the end of the section, also a tapper for ringing the bell in the other instrument, also releasing-gear and indicator, and also plunger locking and unlocking gear.

The traffic facilities allowed by this invention are that one or more than one (according to the number of staffs at the sending section) train or trains may proceed in the same direction; but until the last train has arrived and the whole of the staffs have been placed in the instrument at the end of the section no staff can be drawn from the other instrument allowing a train to proceed in the opposite direction from this instrument. It is understood that the staff withdrawn from, say, section A need not necessarily proceed to B before B can send a train to A, because it may be replaced in the instrument, thereby freeing B.

In order that my invention may be better understood and more readily carried into effect, I will describe the drawings hereunto annexed, in which similar letters and figures refer to similar parts in the several views.

Figure 1 is a front elevation of a staff-instrument. Figs. 2 and 3 show the details of the apparatus and the electrical connections. Fig. 4 is a staff. Figs. 5, 6, and 7 are enlarged views of parts of my apparatus. Fig. 8 shows details of the interlocking-gear. Fig. 9 shows details of the switch *k'* and lever *j'*. Fig. 10 shows a diagram of the connections of two stations A and B. Figs. 11 and 12 are side views of the devices for interlocking the staff-instrument with the signal-operating lever. Fig. 13 shows detail views of parts of the said interlocking devices.

According to my invention I provide two instruments, both exactly alike, and I place one at station A and one at station B, and I connect these two instruments with one line-wire, thus forming a section A B. I provide batteries at each station giving two different potentials.

With reference to Figs. 1, 2, and 3, *b* is an electric bell. *c* is a tapper or commmunication-key. *d* is a plunger which actuates the contacts *c'*, *d' d'*, and *e' e'*. *i* is an electromagnet which operates a switch *j*. *k* is a two-way polarized automatic switch. This consists of two coils of wire with a needle *m* swinging between. The needle *m* works a two-way switch 31 L. The lock *n* is actuated by the electromagnet *f*. The operation of the lock *n* actuates an indicator *p* and switch *q*. The staff-releasing gear consists of a quadrant *o*. The lock *n* engages with a slot in the quadrant *o* and locks it. *r* is an elecric contact. The quadrant *o* is pivoted at *o'*, and the spring S holds it in contact with the pin *s*. To the quadrant *o* is pivoted a catch-rod *t*, which causes a disk 3 (see Fig. 3) to revolve. The disk 3 consists of four parts, a large disk *u*, ratchet *v*, with which *t* engages, a groove *w*, around which a weighted cord passes, and

the disk x, these four parts being all cast together and are loose on the spindle a'. (See Fig. 3.) Cast on the disk 3 is a lug y, which engages with a pin z. This pin passes through the disk 2. The disk 2 is fixed to the spindle a'. To a' is fixed the dial-pointer b'. The plunger d is locked by the revolution of the disk u. When the plunger d is operated, it first of all breaks the contacts c' and makes the contacts d' d' and e' e'. The lug f', fixed to d, causes the disk 1 to revolve by means of the grooves g', cut in its periphery. (See Fig. 7.) The disk 1 has a groove and ratchet the same as disk 3, also a lug z', whereby the dial-needle b' may be operated. The disk 1 is loose on the spindle a'. A spring takes the plunger d back to its normal position. The weights W W W, attached to the disks 1, 2, and 3, effect a similar purpose. A lever j' (see Fig. 2) is connected to a switch k'. (See Figs. 2 and 9.) An electromagnet g (see Fig. 5) operates a lever L', and the connecting-rod m' operates the escapement n' and also a similar escapement attached to disk 1. The said rod m' operates simultaneously two escapements similar to n', so that the disks 1 and 3 are operated together. The quadrant w' (see Figs. 2 and 9) is used to prevent two staffs being inserted at the same time. The switch k' (see Fig. 9) is pivoted at s^{10}, the lever j' being fixed to the wood disk k'. Fixed to k' are two brass contact-pieces s^8 and s^9, which make contact with springs s^2 s^3 s^6 s^7. The quadrant w' is fixed to k' and revolves with it. With the lever j' in its normal position the quadrant w' presses against the stop-pin s^{11}. When a staff is replaced in an instrument, the lever j' is pressed down and the switch k' revolves together with the quadrant w'. The contacts s^2 and s^3 are completed by means of s^8, and the contacts s^6 and s^7 are completed by means of s^9. The quadrant w' covers the staff-entrance hole, and so prevents two staffs being inserted at one operation. On the staff passing from off the lever j' the quadrant w', together with the switch k' and lever j', return to the normal position by means of a spring.

R in Fig. 11 is a signal-operating lever, and q' is a rod pivoted thereto and to the pivoted bell-crank lever t'. Q is a vertical rod also pivoted to the said bell-crank lever and to one end of the lever u', which is pivoted inside the case of the instrument. A rod v' depends from the other end of the lever u', and is provided with a notch 113, which engages with a projection 114 on the plunger d and forms an auxiliary locking device. The rod q' is provided with two notches r' and r^2. A weighted lever o' is pivoted in the case, and 112 is a rod pivoted to one end of it and resting on the lug i', which projects from the disk 1, which is journaled on the shaft a'. A vertical locking-rod p' is pivoted to the other end of the lever o' and has a notch 110 at its lower end, which slides in the notch r' of the rod q'. U is a weighted lever pivoted in the case, and U' is a rod depending from one end of the said lever and entering the notch 115 of the disk x, which is journaled on the shaft a'. A vertical locking-rod s' is pivoted to the other end of the lever U. The lower end of the rod s' slides in the notch r^2 of the rod q' and is provided with a notch 111.

The instruments are connected as shown in Fig. 10. When the plunger d at B is pushed in and held in by hand, a current flows from the positive pole 26 of the battery 101 through the wire 100, contacts d', wires 5 and 6, down the main wire h to the instrument at A. This current passes into the magnet i, energizes it, and raises the switch j into contact with the contact-piece 11. From the magnet i at A this current passes through the wire 12, contacts c', wire 14, switch j, contact 11 and wire 15 through the coils 16 and 17 of the switch or magnet k, and thence to earth at 51' through the wire 51. The current through earth to the other instrument at B passes in at 18' through the wire 18, contacts e', wires 21 and 22 to the negative pole 24 of the battery 101. In flowing through the coils 16 and 17 of the switch or magnet k at A, this current causes the needle m to deflect to the left, causing a current to flow from the positive pole 26' of the battery 101' through the wires 27, 28, 29, and 30, needle m, contact 31, wire 32, contact 33 to the switch q, which is in its lower position, the magnet f not having been energized. From the switch q the current passes through the wire 35 into the magnet f, which it energizes, causing the lock n to be drawn out of the notch in the quadrant o and raising the switch q into contact with the contact 38. From the magnet f the current passes through the wire 39, contact r, wires 41, 42, and 43 to the negative pole 24' of the battery 101'. The switch q being now in contact with the contact 38, a local current passes from the positive pole 26' through the wires 27, 28, and 29 to the switch q and back to the negative pole, as hereinbefore described, through the magnet f, wire 39, contact r, and wires 41, 42, and 43. This local current keeps the magnet f energized, and thereby holds the lock n clear of the notch in the quadrant o and permits a staff to be withdrawn from the instrument. When a staff is replaced in the instrument at B it depresses the lever j' and operates the switch k'. This permits a current to flow from the positive pole 26 of the battery 101 through the wires 100, 47, and 48, contacts s^7 s^6, and wire 50 to earth at 50'. The current passes through earth to the instrument at A, entering at 51' and flowing reversely through the wire 51, coils 17 and 16 of magnet k, wire 15, contact 11, switch j, wire 14, contacts c', wire 12 to magnet i, which is energized. From the magnet i the current passes through wires h, 6, and 52, contacts s^3 and s^2, and through wires 54 and 22 to the negative pole 24 of the battery 101. The current also passes into the instrument at B, when a staff is replaced in the instrument at B, from earth at 51', through the wire 51, coils

17′ and 16′ of magnet *k*, wire 15′, contact 11′, switch *j*, wire 14′, contacts *c*′, and wire 12′ to the magnet *i*, which it energizes, and returns to the negative pole 24 of the battery 101 by way of wires 6 and 52, contacts s^3 and s^2, and wires 54 and 22. At A the current flowing through the coils 17 and 16 of the magnet *k*, caused by the replacement of a staff in the instrument at B, as hereinbefore described, causes the needle *m* to deflect to the right and thereby permits a current to flow from the positive pole 26′ of the battery 101′ through the wires 27, 28, 29, and 30, the needle *m*, contact L, and wire 66 to the magnet *g*, which it energizes. From this magnet *g* the current flows through wires 68, 42, and 43 to the negative pole 24′ of the battery 101′. The similar current at B, which flows through the coils 17′ and 16′ of the magnet *k*, causes the magnet *g* at B to be simultaneously energized in a similar manner. The bell *b* at each instrument is operated by a separate battery 69, of low potential. When the signal-man at B wishes to ring the bell at A, he depresses his tapper *c*. A weak current then flows from the battery 69 at B through the wire 70, tapper *c*, contact 10′, switch *j*, wire 14′, contacts *c*′, wire 12′, magnet *i*, line-wire *h*, magnet *i* at A, wire 12, contacts *c*′, wire 14, switch *j*, contact 10, (switch *j* not having been raised,) through right-hand part of tapper *c* and the bell *b* to earth. The current is enabled to pass into and energize the magnet *i* at A when the plunger *d* at B is pushed in, as hereinbefore described, because the switch *j* at A is normally resting on the contact 10, and the circuit through the magnet *i* is completed through the wire 12, contacts *c*′, wire 14, switch *j*, contact 10, and through the bell to earth. When the current passes into the magnet *i* at A, it energizes it, and the switch *j* then leaves the contact 10 and bears against the contact 11 instantaneously and again completes the circuit through the wire 15 and the parts connected to it, as hereinbefore described. The current is enabled to pass from the contact 11 into the switch *j* at A when a staff is replaced in the instrument at B, because the magnet *i* at A is in the circuit of a current, which enters the instrument at A from earth through the bell and passes to the magnet *i* through the contact 10, switch *j*, wire 14, contacts *c*′, and wire 12, causing the switch *j* to pass from the contact 10 to the contact 11 and establish the circuit through the magnet *i*, as hereinbefore described.

The operation of the apparatus is as follows: Take the case of two stations A and B. There is one instrument at each station, both instruments being exactly alike, and they are connected together by means of one line-wire *h*. (See Fig. 10.) Suppose a train is at station A and wishes to proceed to station B. The signal-man at station A rings up station B by depressing the tapper *c*. This rings the bell *b* on B's instrument. B replies by depressing his own tapper *c* and so rings the bell in A's instrument. If B is ready to receive a train from A and the starting-signal at B in the direction of A is at "danger," he presses in his plunger *d* as far as it will go and thereby causes a current to flow in the direction of the arrows from the main battery 101, of greater potential, along the line-wire *h*. This current passes through the magnet *i* in A's instrument and operates it and causes the switch *j* to act, which allows the current to pass to the two-way polarized automatic switch *k*. The needle *m* is deflected to the left and a current passes to magnet *f*, thereby actuating it and drawing out the lock *n* and freeing the staff-releasing gear—viz., quadrant *o*. When the lock *n* is drawn out, the indicator *p* shows this, and at the same time a local current from A's main battery is switched in by means of the switch *q*, which local current holds out *n* till the signal-man is at liberty to take out a staff. A staff can only be placed in an instrument at one end of the slot and can only be taken out at the other end of the slot. (See Fig. 1.) The moment a staff is taken out the quadrant *o* is operated and the current is broken at *r* and the lock *n* drops onto the quadrant *o*. A spring S brings the quadrant *o* back to its normal position, where it is locked by *n*. When the quadrant *o* is operated by the action of taking out a staff, the catch-rod *t* causes the disk 3 to revolve, and by means of the ratchet *v* and spindle *a*′ causes the pointer *b*′ to point to "1" on the dial *e*. (Refer to Fig. 1.) The same operation goes on for every succeeding staff that may be taken out. The plunger *d* at A is locked by the revolution of the disk *u* and remains locked until the dial shows "0" or zero again.

The above description describes what takes place when a staff is taken out of an instrument. Thus it will be seen that when the signal-man at B plunges to A his own dial intimates the fact that one staff has been freed in A's instrument. B's plunger is not locked, so that on receiving intimation from A a second staff at A may be liberated by B again plunging; but it will have been seen that A's plunger is locked and consequently A cannot plunge to B with the object of freeing a staff for a train in the conflicting direction.

The following operation takes place when a staff is replaced in an instrument: The staff being placed in the entrance hole at the right-hand side of the instrument (see Fig. 1) and passing down the slot depresses the lever *j*′. This lever is connected to the switch *k*′, (see Fig. 9,) which sends a reverse current to the switch *k* in both instruments. This causes the needle *m* to deflect to the right, which closes the circuit to the magnet *g*. The magnet *g* by means of the lever L′ and connecting-rod *m*′ (see Fig. 5) operates the escapement *n*′ and also an escapement attached to the disk 1 and allows the disks 3 and 1, respectively, in either instrument to go back one. Thus if only one staff has been taken out the dial-needle *b*′ goes back to zero.

The interlocking with the signals is effected in the following manner: At each instrument the rod p' is normally lowered, so that the rod q' may slide through its notch 110, the rod 112 resting on the lug i', as shown in Fig. 11. The rod s' at each instrument is normally raised, so that its end engages with the notch r^2 of the rod q', thereby locking the signal-lever R, the rod U′ being in the notch in the disk x, as shown at the right hand in Fig. 8. When the signal-man at B pushes in his plunger, he enables the signal-man at A to withdraw a staff from the instrument at A. When the signal-man at A takes a staff from his instrument, the act of withdrawing the staff releases his own starting-signal rod q', because the disk x is revolved by the quadrant o, rod t, and the ratchet-wheel, thereby raising the rod U′ and lowering the locking-rod s' at A until the notch 111 is in line with the rod q', as shown in Fig. 12. This operation does not, however, release the signal-lever at B, and the said signal-lever remains locked until the staffs withdrawn from the instrument at A have been replaced in the instruments, either at B or at A, and until the signal-man at B has withdrawn a staff from his instrument. The movement of the signal-lever R at A by the signal-man in lowering his starting-signal locks the plunger at A through the medium of the rod q', bell-crank lever t', rod Q, and lever u', which move the notch 113 out of line with the projection 114 on the plunger. The signal-man at A must therefore place his signal to "danger" before he can push in his plunger and thereby permit a staff to be removed from the instrument at B. In pushing in the plunger at B the projection f' turns the wheel g', so that when the staff is removed from the instrument at A the indicators b of both instruments correspond. The partial revolution of the wheel g', which is a part of disk 1, removes the projection i' from under the rod 112, and the weighted lever o' raises the rod p', so that its lower end locks the rod q' and the signal-lever R. The act of replacing a staff in the instrument at B unlocks the rod q', because the disk 1 is caused to revolve backward when the lever j' is depressed, the magnet g being energized and the escapement n' operated to permit the counterweight to turn back the disk. The projection i' is beveled on one side, and thereby raises the rod 112 to its original position and lowers the notch 110 of the rod p' into line with the rod q'.

What I claim is—

1. In a staff system for controlling traffic on a single line railroad, the combination, of two similar staff instruments, and a single line wire connecting the said instruments, each said instrument being provided with batteries of different potential, a bell, a plunger, an electrically-controlled switch j, and mechanism for locking the staffs, all operatively connected with the line wire, the weak current when switched on at the one instrument operating to ring the bell of the other instrument without moving the switch j, and the strong current operating to move the said switch and release the staff-locking mechanism of the other instrument when the said plunger of the one instrument is operated, substantially as set forth.

2. In a staff system for controlling traffic on a single line railroad, the combination, of two similar staff instruments, and a line wire connecting the said instruments, each instrument being provided with a plunger, electrically-controlled staff-locking mechanism, and electrically-controlled plunger-locking mechanism, operatively connected with the said line wire, the staff-locking mechanism of the one instrument being only releasable by operating the plunger of the other instrument, and the subsequent actuation of the said staff-locking mechanism upon the removal of a staff from the one instrument operating to effect the locking of the plunger of the same instrument, substantially as set forth.

3. In a staff system for controlling traffic on a single line railroad, the combination, of two similar staff instruments, and a line wire connecting the said instruments, each instrument being provided with a plunger, electrically-controlled plunger-locking mechanism, and a switch actuated upon inserting a staff into either instrument, and operating thereupon to release the plunger of one instrument from its said locking-mechanism, substantially as set forth.

4. In a staff system for controlling traffic on a single line railroad, the combination, of two similar staff instruments, signal-operating devices at each instrument, and a line wire connecting the said instruments, each instrument being provided with a plunger, electrically-controlled staff-locking mechanism, and mechanism normally locking its signal-operating devices, the staff-locking mechanism of the one instrument being only releasable by operating the plunger of the other instrument, and the subsequent actuation of the said staff-locking mechanism upon the removal of a staff from the one instrument operating to release the signal-operating mechanism of the same instrument, substantially as set forth.

5. In a staff system for controlling traffic on a single line railroad, the combination, with a staff instrument provided with a plunger, and an auxiliary plunger-locking device, of signal-operating mechanism, and intermediate operating devices connecting the said signal-operating mechanism with the said plunger-locking device, whereby the plunger is locked when the signal is lowered and cannot be operated again until the signal is raised by its said operating mechanism, substantially as set forth.

6. In a staff system for controlling traffic on a single line railroad, the combination, of two similar staff instruments, and a line wire connecting the said instruments, each instrument being provided with a plunger, electrically-

controlled staff-locking mechanism, electrically-controlled plunger-locking mechanism, and electrically-controlled plunger-releasing mechanism, all operatively connected with the said line wire, the removal of a staff from the one instrument operating to lock the plunger of the same instrument and thereby preventing the removal of a staff from the other instrument, and the re-insertion of a staff into the one or the other instrument operating to unlock the plunger of one instrument, substantially as set forth.

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