No. 837,396. PATENTED DEC. 4, 1906.

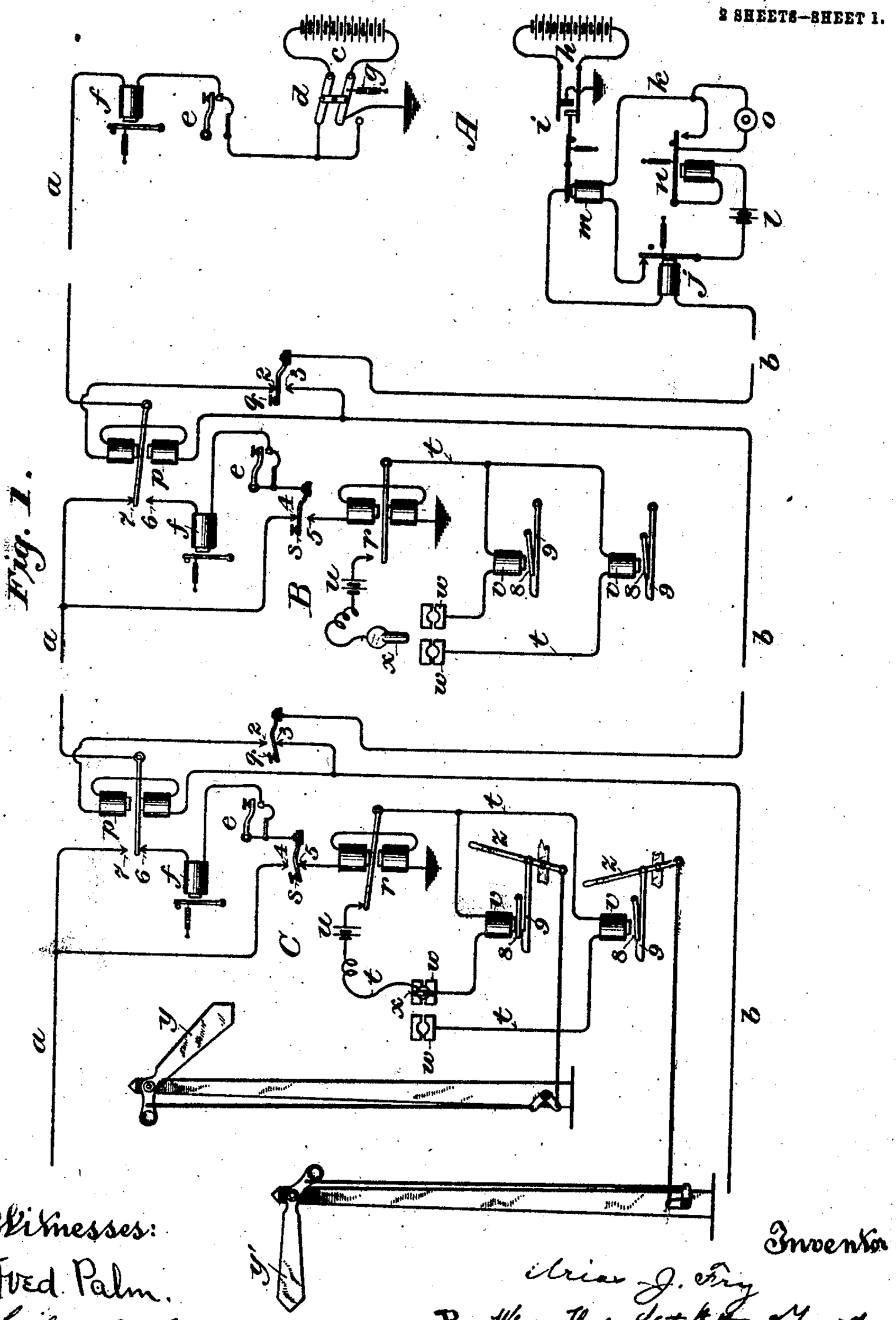
U. J. FRY.

ELECTRIC CONTROLLING SYSTEM.

APPLICATION FILED APR. 9, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

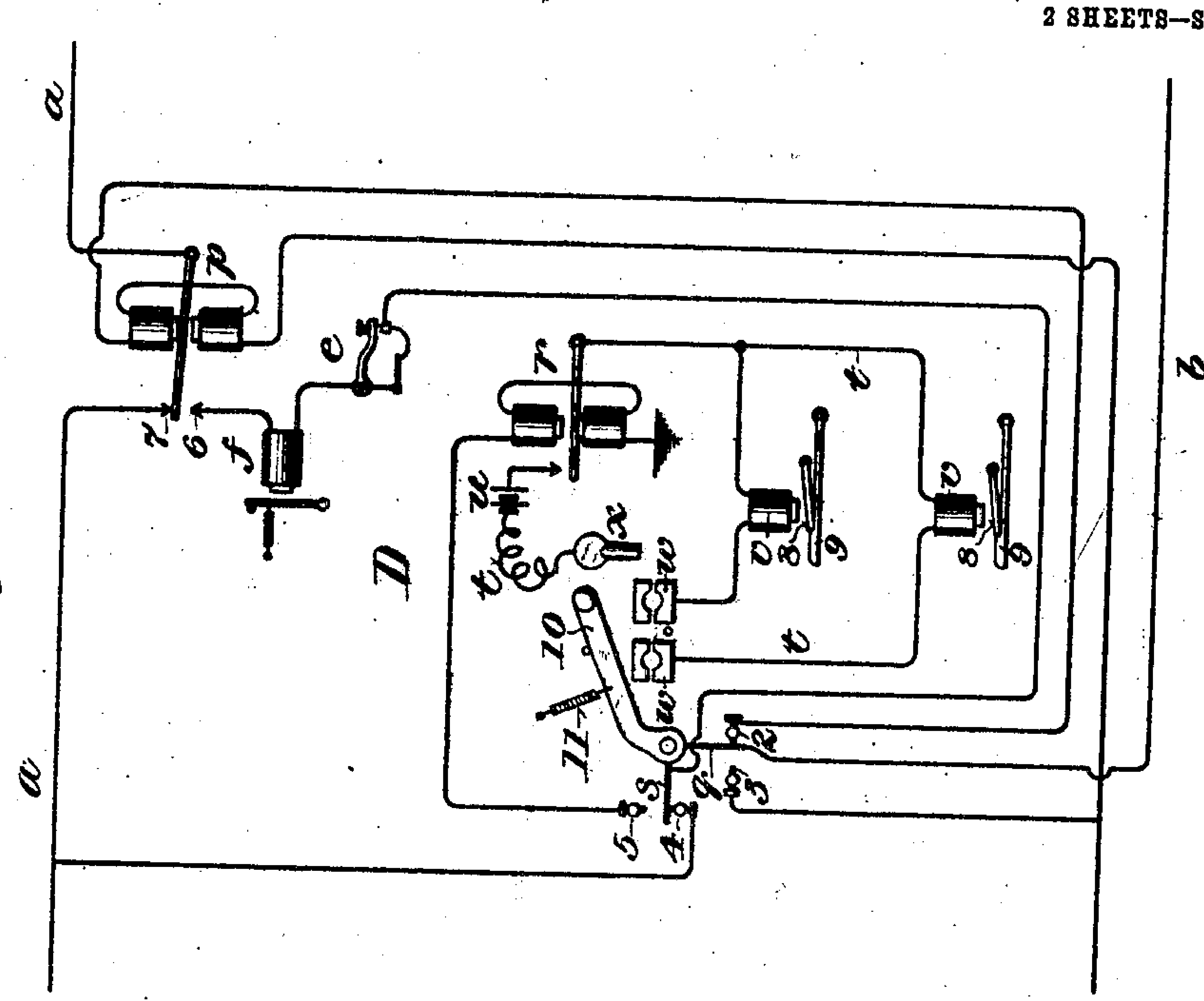
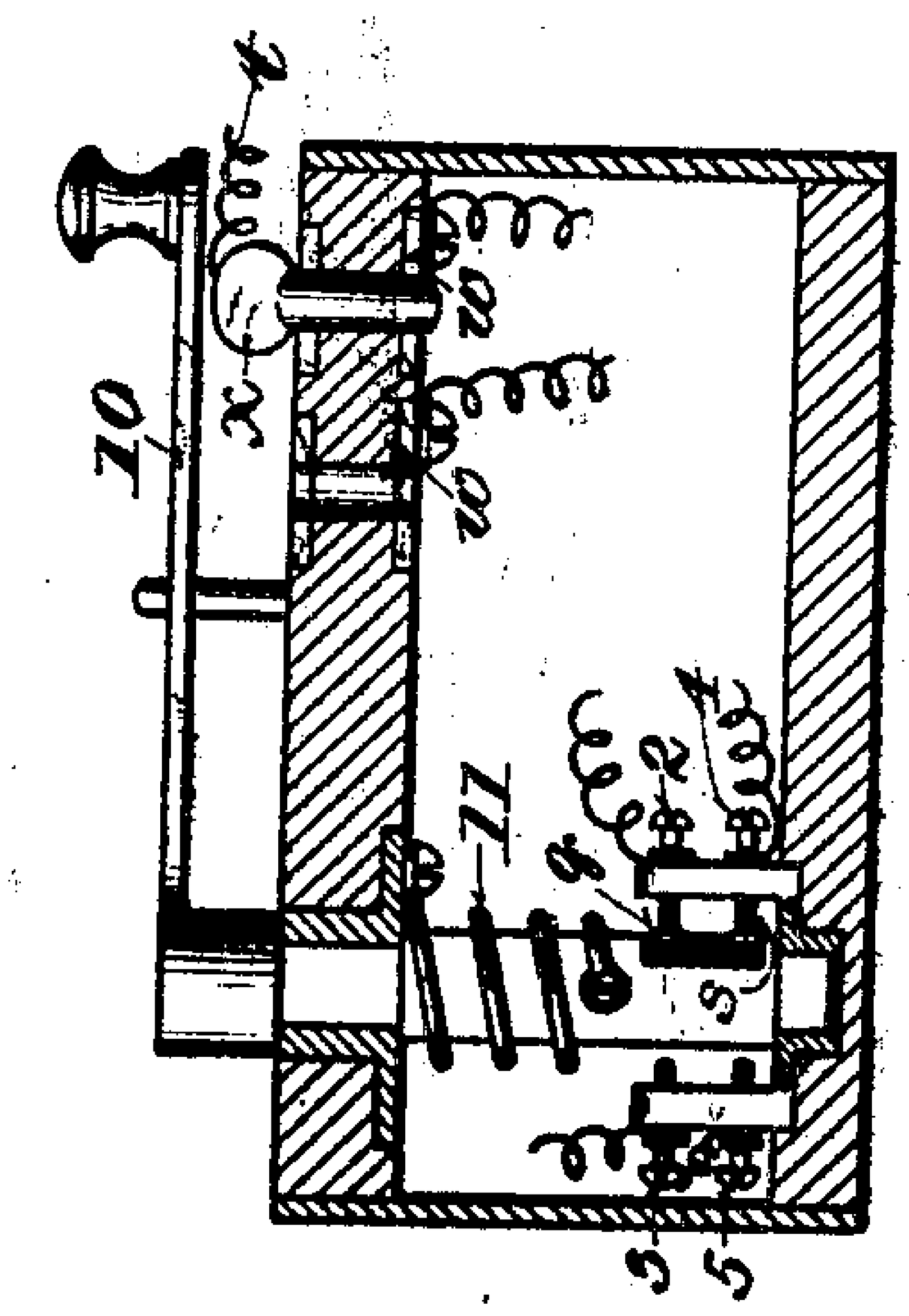


Fig. 3.



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ELECTRIC CONTROLLING SYSTEM.

No. 837,396. Specification of Letters Patent. Patented Dec. 4, 1906.

Application filed April 9, 1906. Serial No. 310,626.

To all whom it may concern:

Be it known that I, URIAS J. FRY, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Electric Controlling Systems, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The main objects of this invention are to control the application of electric current to various kinds of work, such as the operation or release of railway-signals at different points from a central point or main station, to place responsibility on a single operator, to avoid mistakes and accidents, and generally to improve the construction and operation of apparatus of this class.

It consists in certain novel features of construction and in the peculiar arrangement and combinations of parts, as hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings like characters designate like or similar parts in the several figures.

Figure 1 is a diagram of apparatus embodying the invention as installed at and connecting two substations with a main station. Fig. 2 is a diagram showing an extension and modification of the apparatus; and Fig. 3 is a sectional view, on an enlarged scale, of a part of the apparatus shown in Fig. 2.

For the purpose of illustration and explanation the apparatus is shown and described in connection with block-signals for railways; but with little or no change it may be used for other purposes, such as the distribution or control from a central or main station of current for lighting, power, and other uses.

The system as shown comprises a central or main station A and substations B, C, and D, which are connected by two electric circuits—a "working" circuit *a* and a "cut-out" circuit *b*.

At the main station A the working circuit includes a battery or generator *c*, a pole-changing switch *d*, and Morse or other transmitting and receiving instruments *e* and *f*. The switch *d*, which is shown in abnormal position, is held in normal position when released by a spring *g*.

The cut-out circuit includes at the main station a battery or generator *h*, an automatic pole-changing switch *i*, and the magnet of a relay *j*.

A normally closed local circuit *k* at the main station includes a battery or generator *l*, a magnet *m* for operating or reversing the switch *i*, the armature of the relay *j*, the magnet and armature of a repeating-relay *n*, and a device, such as an ordinary push-button *o*, for manually closing said circuit around the break made by the relay *n*. The armatures of the relays *j* and *n* and the armature or armature-lever of the magnet *m*, which constitute a part of the pole-changing switch *i*, are provided with retracting-springs and back stops.

At each substation the cut-out circuit includes the magnets of a polarized relay *p* and is provided with a switch *q*, having back and front stops and contact-pieces 2 and 3 for momentarily opening said circuit and diverting the cut-out current from said relay to the main line beyond. A branch of the working circuit at each substation includes a Morse key *e* and receiver *f* or other instruments for transmitting and receiving signals or messages. Each substation is also provided with a polarized relay *r*, connected on one side with the ground and on the other with the front stop 5 of a switch *s*, which, in its normal position against its back stop 4, closes the working circuit through the receiving and transmitting instruments *e* and *f* at each station to the line beyond. The armature of each relay *p*, working between opposing stops and contact-pieces 6 and 7, forms a part of the working circuit, and when said armature in its normal position engages its front stop 6 said circuit passes through the associated transmitting and receiving instruments *e* and *f*; but when in abnormal position it engages its back stop 7 the working current is diverted from said instruments and the associated relay *r* and switch *s* to the main line.

At each substation there is a local circuit *t*, including a battery or generator *u* and the armature or movable part of the relay *r*, which controls said circuit. For railway-signal service and some other purposes this circuit may have a number of branches each provided with a magnet *v*, which may be called the "working" magnet, and an inaccessible contact-piece *w*, arranged to be en-

gaged by a plug *x* or other shiftable part for closing the circuit through either branch.

For railway-signal service each substation is supplied with semaphores or signals *y y'*, which are connected and arranged in the usual or in a suitable manner to be operated by levers *z* for governing the running of trains in opposite directions. These signals are locked and normally held in danger or stop position by the pivoted armatures 8 or detents operated by the magnets *v* and normally engaging locking-bars 9, connected with the levers *z*, as shown in Fig. 1 at C. To prevent an operator at a substation from lowering both his signals by shifting the plug *x* from one contact-piece *w* to the other without permission from the operator at A, the arms or movable members of the switches *q* and *s* may be attached or connected with a crank-arm 10, as shown at D in Fig. 2, said crank being constructed and arranged to extend over the plug *x* and prevent its withdrawal from the contact-piece with which it is engaged as long as said switch-arms are held against their front stops 3 and 5. A retracting-spring 11 tends to hold said crank in normal position with the switch-arms against their back stops 2 and 4.

In the application of the system to other purposes than the control of railway-signals the working magnets *v* will be arranged to operate other devices or mechanism. When applied to the control of railway-signals as herein shown and described, the apparatus operates as follows: Assuming that signals *y* control east-bound traffic and an east-bound train wishes permission to pass station C, the operator at that station obtains such permission from the operator at the main station A, communicating with him by means of the transmitting and receiving instruments *e* and *f* in the working circuit. When the operator at C has received permission to lower his signal, he depresses the key of his switch *q*, thereby cutting out all other substations in both directions from connection with the main station A. In the normal condition of the system, with all the switches *q* standing against their back stops 2, as shown at B, Fig. 1, the armature of the repeating-relay *n* is held by its magnet in opposition to the pull of its retracting-spring against its front stop and forms a part of the local circuit *k*. The magnet *m*, being thus energized, holds its armature against the pull of its retracting-spring in its normal position, the reverse from that in which it is shown in Fig. 1. Under these conditions when the key or arm of switch *q* is depressed at C the cut-out circuit *b* is momentarily broken at that point. The magnet of the relay *j*, being thus deënergized, drops its armature, breaking the local circuit *k* at that point and deënergizing magnet *m* and relay-magnet *n*, which release their armatures. The pole-changing switch *i* is thereupon shifted by its retracting-spring to the position in which it is shown in Fig. 1, reversing the current of the battery *h* through the cut-out circuit. Immediately upon the engagement of the key or arm of the switch *q* with its front stop 3 at C the cut-out circuit *b* is closed and the magnet of relay *j* is again energized, thereby closing the local circuit at that point; but the local circuit remains open on account of the break therein at the repeating-relay *n*, and consequently the pole-changing switch *i* will retain the position to which it has just been shifted for reversing the cut-out current. This reversed current through the cut-out circuit *b* shifts the armatures of the relays *p* at all the substations except C from their front stops 6 to their back stops 7, as shown at B and D, Figs. 1 and 2, thereby diverting the working current in circuit *a* from the signal transmitting and receiving instruments *e* and *f* and preventing the operators at those stations from making use of the working current if they attempted to do so by depressing the keys of their switches *s*. By the depression of the key of the switch *q* at C the relay *p* at that station was cut out of circuit *b*, and the armature of said relay was thus allowed to remain against its front stop 6 in position to direct the working current through the magnets of the associated relay *r* upon the depression of the key or arm of the associated switch *s*. The operator at C having inserted his plug *x* between the pair of contact-pieces *w* in that branch of the local circuit *t* controlling the signal *y*, then depresses the key of switch *s* against its front stop 5, thereby connecting the relay *r* at that station with the working circuit *a* through the associated signal transmitting and receiving instruments *e* and *f* and the armature of the relay *p*. The operator at A having shifted his switch *d* into the position in which it is shown in Fig. 1 sends through the circuit *a* a reversed current which shifts the armature of the polarized relay *r* at C against its back stop and closes the local circuit *t*, thereby energizing the magnet *v* in that branch through which the circuit is closed, drawing the armature of detent 8 out of engagement with the associated locking-bar 9, and releasing the signal *y*, which the operator then lowers, as shown in Fig. 1, by means of the lever *z*.

With the arrangement shown at D in Fig. 2 if the operator should attempt to secure a second unlocking or to release his signal *y'* with current intended for his signal *y* after the latter had been released it would be necessary for him to allow the crank 10 to return to its normal position, so that the plug *x* could be shifted from one contact-piece *w* to the other; but in this operation the switch-arm *q* engages its back-stop 2, closing the cut-out circuit *b* through the associated relay

p, and the reversed current thereby supplied to said relay shifts its armature against its back stop 7, cutting off the working current from that substation.

After receiving word from the operator at the substation that the signal for which permission has been obtained has been lowered the operator at A releases his switch *d* and pushes the button *o*, thereby restoring the system to its normal condition. The spring *g* shifting the switch *d* when released back to its original position, current from battery *c* flows through the working circuit *a* in its normal direction. The depression of the button *o* momentarily closing the local circuit *k* around the break between the armature of relay *n* and its front stop energizes the magnet of said relay and the magnet *m*, which thereupon attract their armatures, closing the break in the local circuit at *n* and restoring the pole-changing switch *i* to its original position, so that current from the battery *h* will again flow through the cut-out circuit in its normal direction, and thereby shift the armatures of all the relays *p* back against their front stops 6.

If the operators at two or more stations should attempt simultaneously to secure the use of the working circuit, the substation nearest to the main or central station A would prevail, because the depression of the switch *s* at that substation disconnects the more distant stations from the working circuit *a*, while the depression of the switch *q* reverses the cut-out current, thereby shifting the armatures of the relays *p* at all other stations against their back stops 7 and cutting the working current off from those stations.

The batteries or generators *c* and *h* of the working and cut-out circuits each have at the main station A, as shown in Fig. 1, a ground connection with which either pole may be connected through the associated pole-changing switches *d* and *i*; but in place of ground connections either or both circuits may obviously have a wire instead of a ground return.

In place of the telegraph instruments *e* and *f* the working circuit may be provided with telephones for communicating between any substation and the main station, or such instruments may be entirely omitted from the working circuit and a separate circuit employed for transmitting messages.

Various changes in details of construction and arrangement of parts may be made without materially affecting the operation of the system and without departing from the principle and intended scope of the invention.

I claim—

1. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station, a polarized relay at each substation controlling the working circuit and having its magnet in the cut-out circuit, a pole-changing switch in the cut-out circuit, means for reversing said switch when said cut-out circuit is opened, and a switch at each substation arranged to open the cut-out circuit and to disconnect the associated polarized relay therefrom, substantially as described.

2. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station, a polarized relay at each substation controlling the working circuit and having its magnet in the cut-out circuit, a pole-changing switch in the cut-out circuit, a local circuit including a magnet for operating said switch, a relay-magnet included in the cut-out circuit and controlling said local circuit, and a switch at each substation arranged to open the cut-out circuit and disconnect the associated polarized relay, substantially as described.

3. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station, a polarized relay at each substation controlling the working circuit and having its magnet in the cut-out circuit, a pole-changing switch in the cut-out circuit at the main station, a normally closed local circuit including a repeating-relay and a magnet for holding said switch in normal position, means for closing said local circuit around the break therein caused by said repeating-relay, a relay in the cut-out circuit controlling said local circuit and a switch at each substation arranged to open the cut-out circuit and to disconnect the associated polarized relay, substantially as described.

4. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station; a polarized relay included in the cut-out circuit and controlling the working circuit at each substation; a local circuit including a working magnet at each substation, a polarized relay for closing said local circuit, a switch for connecting said relay with the working circuit, a pole-changing switch in the working circuit at the main station, a pole-changing switch in the cut-out circuit, means for reversing said last-mentioned switch when the cut-out circuit is opened, and a switch at each substation arranged to open the cut-out circuit and to disconnect the associated polarized relay which is normally included therein, substantially as described.

5. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station, and each including a generator and a pole-changing switch, a local circuit at each substation, including a generator and

having branches each including a working magnet, means for closing said local circuit through either branch, a polarized relay for closing said local c rcuit, a switch for connecting said relay with the working circuit, a polarized relay in the cut-out circuit at each substation for diverting the working current from that station, means for reversing the pole-changing switch of the cut-out circuit when that circuit is opened, and a switch at each substation arranged to open the cut-out circuit and to disconnect the associated relay therefrom, substantially as described.

6. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station, and each including a generator and a pole-changing switch, a local circuit at each substation including a generator and having branches each provided with a working magnet, means for closing said local circuit through either branch comprising a contact-piece for each branch and a shiftable part adapted to be engaged with either contact-piece, a polarized relay for closing said local circuit, a switch for connecting said relay with the working circuit, a polarized relay in the cut-out circuit at each substation for diverting the working current from that station, means for reversing the pole-changing switch of the cut-out circuit when that circuit is opened, a switch arranged to open the cut-out circuit and to disconnect the associated relay therefrom, and an operating-arm connected with the switches in the working and cut-out circuits at each substation and adapted when in position for connecting the working circuit with the local relay to prevent the removal of said shiftable part from the contact-piece engaged thereby, substantially as described.

7. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station and each including a generator and pole-changing switch, message transmitting and receiving instruments in the working circuit at each station, a local circuit including a working magnet at each substation, a polarized relay for closing said local circuit, a switch for connecting said relay with the working circuit, a polarized relay included in the cut-out circuit at each substation for diverting the working current from that station when it is being utilized at another and the cut-out current is reversed, means for reversing the pole-changing switch of the cut-out circuit when said circuit is opened, and a switch at each substation arranged to open the cut-out circuit and to disconnect the associated relay therefrom, substantially as described.

8. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station, a polarized relay included in the cut-out circuit and controlling the working circuit at each substation, a local circuit including a working magnet at each substation, a polarized relay for closing said local circuit, a pole-changing switch in the working circuit at the main station, a pole-changing switch in the cut-out circuit, means for reversing said last-mentioned switch when the cut-out circuit is opened, and a switch at each substation arranged to open the cut-out circuit and to disconnect the associated polarized relay which is normally included therein, substantially as described.

9. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station and each including a generator and a pole-changing switch, a local circuit at each substation including a generator and having branches each including a working magnet, means for closing said local circuit through either branch, a polarized relay for closing said local circuit, a polarized relay in the cut-out circuit at each substation for diverting the working current from that station, means for reversing the pole-changing switch of the cut-out circuit when that circuit is opened, and a switch at each substation arranged to open the cut-out circuit and to disconnect the associated relay therefrom, substantially as described.

10. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station and each including a generator and a pole-changing switch, a local circuit at each substation including a generator and having branches each provided with a working magnet, means for closing said local circuit through either branch comprising a contact-piece for each branch and a shiftable part for engaging either contact-piece, a polarized relay for closing said local circuit, a polarized relay in the cut-out circuit at each substation for diverting the working current from that station, means for reversing the pole-changing switch of the cut-out circuit when that circuit is opened, a switch arranged to open the cut-out circuit and to disconnect the associated relay therefrom, and an operating-arm connected with the switch in the cut-out circuit at each substation and adapted when in abnormal position for disconnecting the associated relay from the cut-out circuit to prevent the removal of said shiftable part from the contact-piece engaged thereby, substantially as described.

11. In an electric controlling system the combination of working and cut-out circuits connecting a number of substations with a main station and each including a generator and pole-changing switch, message transmitting and receiving instruments in the working circuit at each station, a local circuit in-

cluding a working magnet at each substation, a polarized relay for closing said local circuit, a polarized relay included in the cut-out circuit at each substation for diverting the working current from that station when it is being utilized at another and the cut-out current is reversed, means for reversing the pole-changing switch of the cut-out circuit when said circuit is opened, and a switch at each substation arranged to open the cut-out circuit and to disconnect the associated relay therefrom, substantially as described.

In witness whereof I hereto affix my signature in presence of two witnesses:

URIAS J. FRY.

Witnesses:

CHAS. L. GOSS,

BERNARD C. ROLOFF.