

No. 694,847.

Patented Mar. 4, 1902.

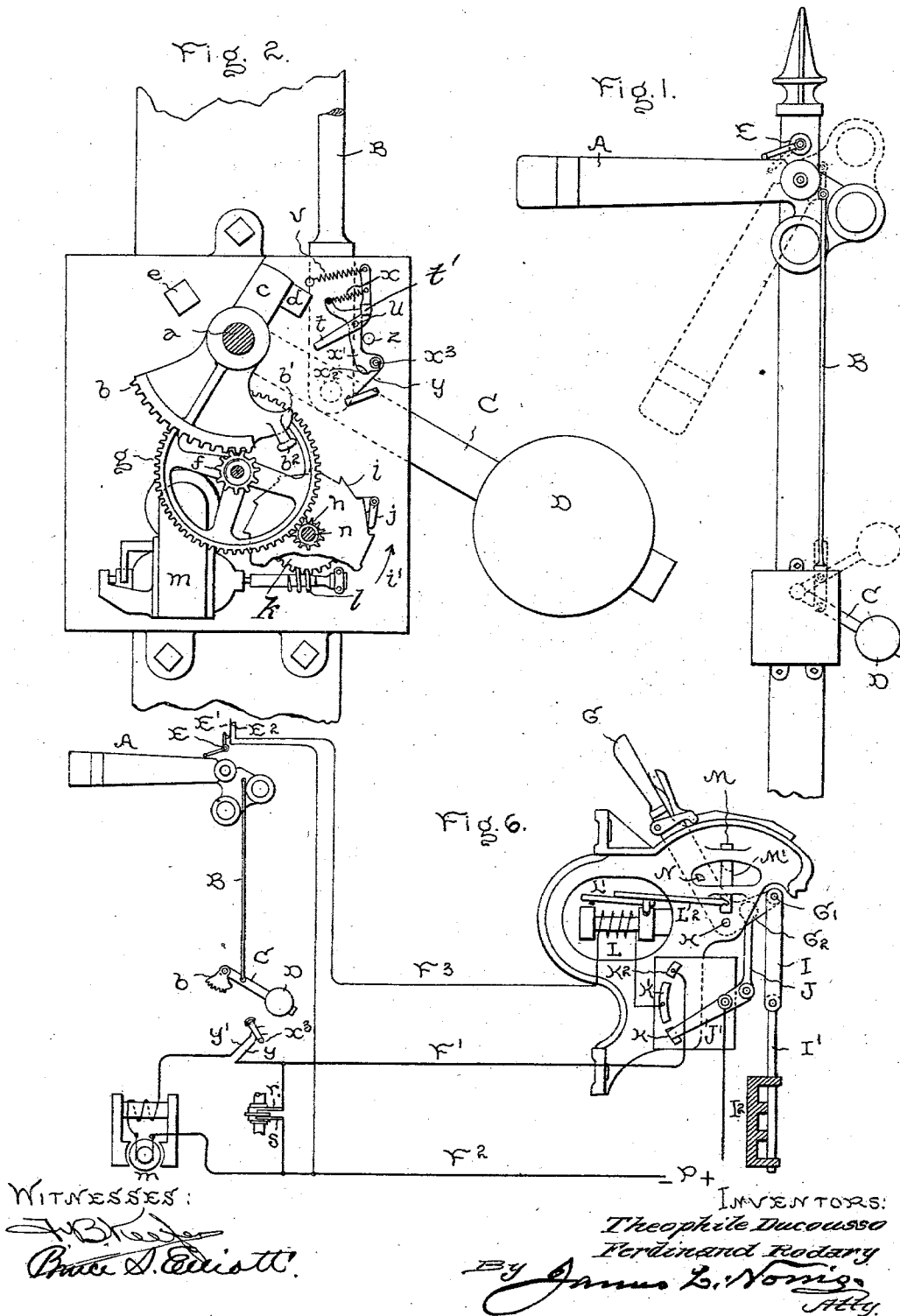
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(Application filed Apr. 1, 1901.)

(No Model.)

2 Sheets—Sheet 1.



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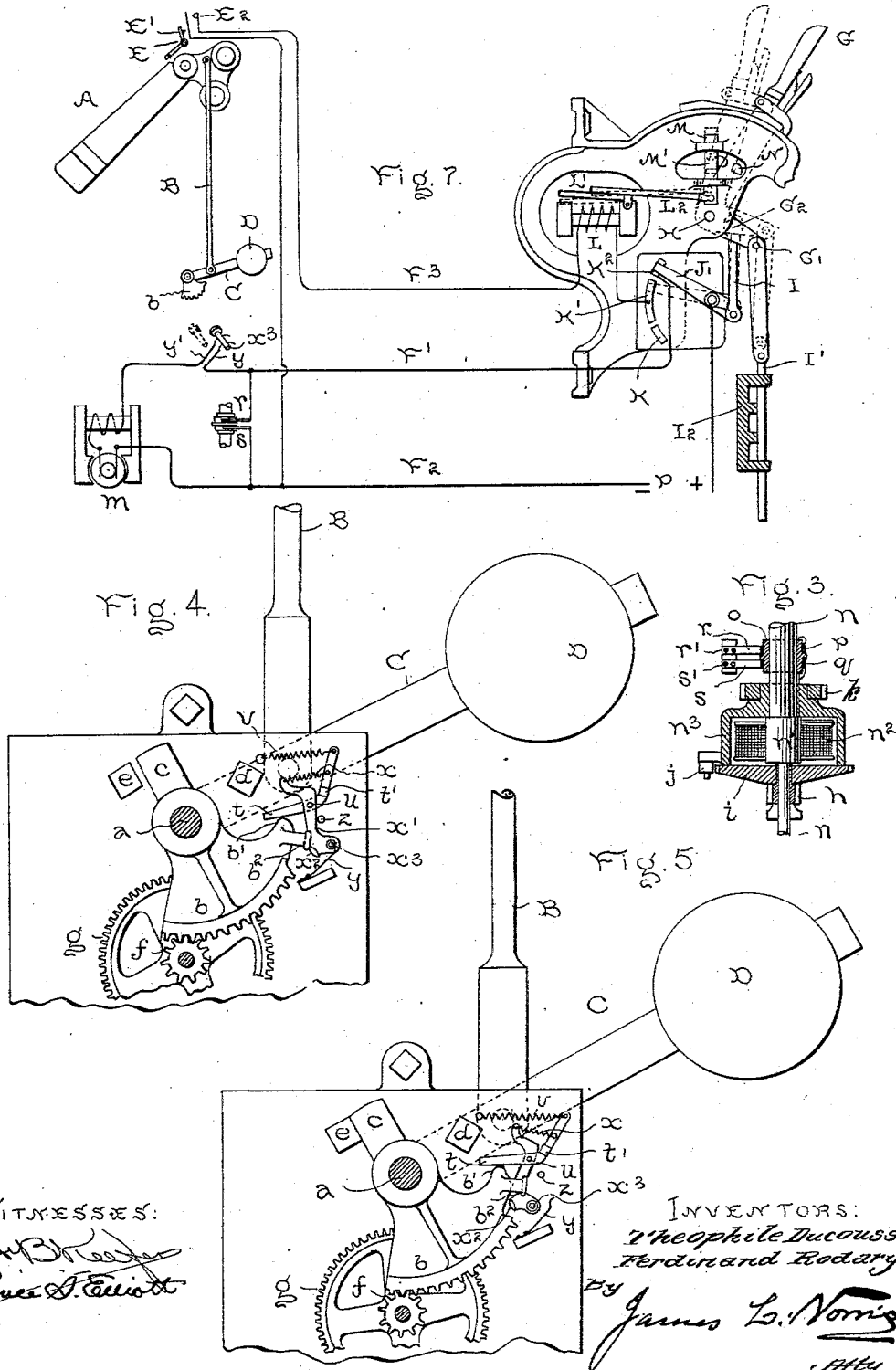
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2 Sheets—Sheet 2.



UNITED STATES PATENT OFFICE.

THÉOPHILE DUCOUSSO AND FERDINAND RODARY, OF PARIS, FRANCE.

ELECTRICAL OPERATION AND CONTROL OF RAILWAY-SWITCHES.

SPECIFICATION forming part of Letters Patent No. 694,847, dated March 4, 1902.

Application filed April 1, 1901. Serial No. 53,920. (No model.)

To all whom it may concern:

Be it known that we, THÉOPHILE DUCOUSSO, a resident of 219 Rue de Vaugirard, and FERDINAND RODARY, a resident of 53 Rue de Vaugirard, Paris, in the Republic of France, citizens of the Republic of France, have invented certain new and useful Improvements in the Electric Operation and Control of Railway-Signals, of which the following is a specification.

Our invention has reference to the electric operation and control of railway-signals, and has for its object to provide means of effecting the movement of the signals, of locking them at "danger," and of controlling the said position of "danger" in accordance with the conditions required for securing safety.

The system constituting our invention comprises a source of electricity and a transmitting or operating lever in the signal-box or central station, mechanism for moving the signal situated in the immediate neighborhood of the signal, and an electric conducting system between the two apparatus, composed of two wires for the transmission-circuit, properly speaking, and a supplementary wire to control the "danger" position in combination with one of the transmitting-wires.

To simplify the description, we have in the accompanying drawings allotted the same letters of reference to the same parts in all the figures.

Figure 1 is a general view showing the application of the motor to a semaphore. Fig. 2 is a face view in detail of the motor mechanism. Fig. 3 is a longitudinal section of the driving-shaft of the motor mechanism. Fig. 4 represents a portion of the motor mechanism during the passage from the position of "danger" to the "line clear" position. Fig. 5 represents the same motor mechanism in the "line clear" position of the signal. Figs. 6 and 7 represent the operating-lever and also the connections between same and the motor apparatus, respectively, in the case when the signal is at "danger" and during its passage to "line clear" in order to clearly show the stages or phases of the action.

In our improved system the signal is maintained at "line clear" by electrical action. It passes from "line clear" to "danger" by

the action of gravity. Finally, it is kept rigidly locked in the "danger" position by a purely mechanical action.

Referring now to the drawings, the signal A is connected by the rod B to the lever C, provided with a counterweight D, which by the action of gravity tends to put the signal into the "danger" position. The lever C is keyed upon the shaft *a*, as are also the toothed sector *b* and the arm *c*. This latter moves between two fixed stops *d e* on the framing, which limits its travel in concordance with the angular displacement of the signal. The sector *b* gears with a pinion *f*, rigidly connected to the wheel *g*, which itself gears with a pinion *h*, loose on its shaft *n*, but rigidly connected to a plate *i*, of iron or other magnetic metal. This plate forms part of a magnetic clutch, the arrangement of which is shown in Fig. 3. The iron shaft *n* presents a portion *n'* of larger diameter, upon which is an exciting-bobbin *n''*. A cup or casing *n'''*, of iron or other magnetic metal, is keyed upon the shaft *n*, and the rim of this bell or casing is capable of being applied against the plate *i*. A toothed wheel *k*, gearing with the worm *l*, is keyed upon the cup or casing *n'''*. Further, the cup or casing *n'''* carries a pawl *j*, which engages and drives the teeth of the plate *i*. The two extremities of the wire of bobbin *n''* pass into a groove in the hub of the cup or casing *n'''* and terminate in two collecting-rings *p q*, mounted upon an insulating-collar *o*, fixed on the shaft *n*. Two rubbing-springs *r s* serve to secure the electrical communication of the said rings with the corresponding wires *r' s'*.

Returning to Fig. 2, the worm *l* will be seen mounted as a sleeve upon the end of the shaft of the electric motor *m*. The thread of the worm *l* has such an inclination that the motion shall not be reversible—that is to say, that a force exerted by the wheel *k* cannot cause the worm *l* to turn; also, the mechanism being in the position represented in Fig. 2—that is to say, the signal being at "danger"—an external force which would tend to raise the counterweight D or to lower the signal A to "line clear" would not have any appreciable effect, because the movement would be at once locked by the action of the pawl

j upon the toothed plate *i*. The motor mechanism comprises likewise a rapidly-operating interrupter composed of a metal contact x^3 , mounted upon a lever x' , but electrically insulated therefrom and capable of putting a set of contact springs $y y'$ into communication. The lever x' carries a projection x^2 and is movable about the center *u*, which is also the center of rotation of a second lever *t*, capable of moving the first by a projection t' . The lever *t* is pulled by the spring *v* and, on the other hand, a spring *x* connects the two levers *t* and x' . In the position Fig. 2 it is the spring *v* which, pulling the lever *t*, maintains the contact of x^3 with the set of springs $y y'$, the lever x' bearing against the stop *z*. To move this interrupter, the sector *b* carries a tooth b' and a concentric tappet b^2 . The operation of the interrupter is as follows: When the motor mechanism arrives near the end of its travel to put the signal to "line clear," the tooth b' pushes the lever *t*, Fig. 4, and the spring *x* tends in its turn to communicate motion to the lever x' ; but the projection x^2 of this latter remains locked by the tappet b^2 until the precise moment when this tappet has escaped from the said projection. At this moment, Fig. 5, the lever x' moves suddenly in obedience to the action of the spring *x* and insulates the springs $y y'$. The escape of the lever x' is regulated to act at the precise moment when the arm *c* has nearly come against the stop *e*—that is to say, when the signal is at "line-clear." In the opposite movement—that is to say, when the counterweight *D*, falling from the position Fig. 5 to that of Fig. 2, the projection x^2 is held by the interior face of the tappet b^2 until the moment when the said tappet has entirely passed. Then only can the spring *v* actuate the two levers *t* and x' and suddenly reestablish the contact $y y'$. We will explain later that this set of contacts controls the stoppage of the motor.

The signal comprises a controlling-interrupter *E* or lever actuated directly by the signal-arm and operating a set of contacts $E' E^2$ in such manner that this contact is closed only when the signal is in the "danger" position. The transmitting or operating lever, Figs. 6 and 7, comprises the lever *G G'*, movable about the center *H* and jointed at *G'* to the connecting-rod *I* of the bar *I'* of the locking-table *I^2*. The part played by this table is described in our prior application for patent relating to the control of the points. We will not repeat it here. The lever *G* is also jointed at G^2 to the connecting-rod *J* of the switch *J'*, which switch *J'* is connected to the positive pole of a source of electricity *P* and is adapted to come upon the bearing-blocks or contact-surfaces *K, K',* or K^2 , according to the position of the lever *G*. The lever *G* carries a lug *N* in combination with a bolt *M*, having a slot M' , this bolt sliding in the framing of the apparatus and being controlled

by the lever L^2 of the armature *L'* of the electromagnet *L*. This bolt is kept by its own weight in the position Fig. 6 when the electromagnet *L* is not excited. It does not oppose the passage of the lever *G* from the position Fig. 6 to that of Fig. 7, because the lug *N* and the slot M' of the bolt are cut to slope in the direction of this movement in such manner that the lug *N* lifts the bolt *M* in passing; but in the movement in the reverse direction—that is to say, from the position Fig. 7 to that of Fig. 6—the lever *G* is arrested by the bolt *M* until this latter is lifted in consequence of the excitation of the electromagnet *L*.

The electrical connections between the operating-lever and the signal are indicated in Figs. 6 and 7, in which we have shown in heavy lines the operating-circuit for the signal-actuating mechanism (see line-wires F' and F^2) and in ordinary lines the circuit employed for controlling the position of the signal, (see line-wire F^3 .) The bearing block or surface *K* of the switch is insulated. The contact-surface K' is connected to the electromagnet *L* and through this by F^3 and E^2 to the controlling-interrupter. The second contact E' of this latter is connected to the wire F^2 . The contact block or surface K^2 is connected through F' and y to the interrupter of the motor mechanism, the other contact y' of which is connected to the series motor *m*, which is connected by the wire F^2 to the negative pole of the source of electricity *P*. In Figs. 6 and 7 the clutch mechanism is shown only by the collecting-rings and their contact-springs *r s*, which are connected, respectively, with the wires F' and F^2 —that is to say, the clutch mechanism is always electrically connected between these two wires.

The operation is as follows: Fig. 6 the signal is kept at "danger" by the action of the counterweight *D* and locked in this position by the pawl *j*, as we have shown in describing the mechanism. The lever *G* also occupies the "danger" position. To put the signal to "line clear," the lever *G* is brought to the position indicated in full lines, Fig. 7, and corresponding to "line clear." In this movement the switch *J'* is brought upon the contact block or surface K^2 , and the current coming from +*P* passes by $J' K^2$, the wire F' , partly by *r s*, through the clutch, and returns to −*P* by F^2 ; but another portion passes by the contact $y x^3 y'$ through the motor *m* and returns by F^2 , as above. This current simultaneously operates the clutch and the motor. Now the direction of rotation of the motor is such that the worm *l* drives the wheel *k*, and consequently the clutch cup or casing n^3 , in the direction of the arrow *i'*, Fig. 2. The result of the excitation of the clutch is to cause the plate *i* to adhere to the cup or casing n^3 , and consequently to put the pinion *h* in driving connection with the wheel *k*. This movement is transmitted by the wheel *g* and the

pinion *f* to the sector *b*, by this latter to the shaft *a* and to the lever *C*, which rises with its counterweight *D*, while the connecting-rod *B* causes the signal to descend toward the "line clear" position. In Fig. 4 will be seen the state of the mechanism a little before the end of the complete movement before the interrupter x^3 has operated, and Fig. 5 after the completion of the movement—that is to say, after the operation of the interrupter x^3 . At this moment, reference being had to Fig. 7, where the interrupter x^3 is shown in dotted lines after its operation, it will be seen that the current no longer passes into the motor *m* and this stops; but the current continues to pass through the clutch and maintains the mechanism, and consequently the signal, in the "line clear" position. If, the lever *G* being in the "line clear" position indicated in full lines, Fig. 7, it is desired to put the signal to "danger," the said lever *G* is placed in the position shown in dotted lines, beyond which position it cannot immediately pass by reason of the obstruction by the bolt *M*. In this position the switch *J'* has quitted the contact-surface *K^2*, thus interrupting the transmission-circuit. From this point the clutch is no longer excited, the weight *D* brings the signal to "danger," imparting motion to the gear *b f g h* and the plate *z*, which no longer adheres to the cup or casing *n^3*, Figs. 2, 3, and 5, but the switch *J'* is upon the contact-surface *K'*. Consequently as soon as the signal is at "danger" the current from +*P* passes by *J' K'* through the electromagnet *L* by *F^3* and the contact *E^2 E'* to the wire *F^2* and to the pole —*P*. The electromagnet *L* is excited, raising the bolt *M* to allow the lug *N* to pass. Then only can the lever *G* be put over to the full extent of its throw, as in Fig. 6, in which position there is no longer any current, the switch *J'* being upon the insulated bearing-surface *K*.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In the electrical operation and control of railway-signals, the combination of a signal-actuating mechanism comprising a signal and signal-operating rods counterweighted to return to "danger" position, a switch opened by the said signal when in "line clear" position, a reversible train of wheels connected to the signals, a motor for actuating the signals, an intermediate cut-out switch for the motor actuated by the reversible train of wheels, a non-reversible train of wheels connected to said motor, a magnetic clutch disposed between the reversible and non-reversible train of wheels a one-direction mechanical clutch between the magnetic clutch and the reversible train of wheels, mechanism for controlling the actuating mechanism comprising a hand-operated lever, a locking-bolt for said lever, an electromagnet for operating said bolt, a controlling switch-arm

and three contacts actuated by said hand operating-lever, electric transmission-circuits between the controlling and the actuating mechanism comprising a circuit from one contact of said controlling-switch through the bolt-actuating magnet to the switch opened by the signal when in "line clear" position, a circuit from said controlling-switch to the motor through the intermediate switch, a shunt-circuit across the motor-circuit for the magnetic clutch in the signal-actuating mechanism all adapted for use and operation substantially as and for the purposes herein set forth.

2. In the electric operation and control of railway-signals, the signal-actuating mechanism comprising a reversible train of wheels connected to the signals, a motor for actuating said train of wheels to set the signals to "line clear" position, a non-reversible train of wheels connected to said motor, a magnetic clutch disposed between the reversible and non-reversible train of wheels, a one-direction mechanical clutch between the magnetic clutch and the reversible train of wheels and arranged to prevent the backward movement of the reversible train of wheels to set the signals to "line clear" position when the magnetic clutch is out of action, said mechanical clutch allowing the signal to return to "danger" position but preventing the same being moved to "line clear" except by the motor, all substantially as and for the purposes set forth.

3. In the electric operation and control of railway-signals the actuating mechanism comprising an electric motor, a worm-gear so constructed as to only transmit power from the motor, an electromagnetic part of a magnetic clutch rotated by said worm-gear, an armature for said clutch, a ratchet-and-pawl gear between the clutch and its armature, a reversible train of wheels connected to the armature of the magnetic clutch a sector driven by said reversible train of wheels, and connected with the signal-stops *c d* for said sector, a pair of spring-pressed levers *t x'* pivoted to the frame and to one another and forming with contacts *y y'* a switch controlling the electric circuit for operating the motor, a stop x^2 on the lever *x'* and a stop b^2 and nose *b'* on the said quadrant all adapted to operate substantially as and for the purposes set forth.

4. In an electrically operated and controlled railway-signal, the combination with the motor-driven actuating mechanism, of a controlling mechanism comprising a hand-lever controlled by an interlocking frame, a locking-bolt for said lever, an electric switch actuated by the hand-lever, an electromagnet for operating the hand-lever-locking bolt and arranged in a circuit controlled by the hand-lever switch and a switch actuated by the signal, and means carried by the hand-lever arranged to be engaged by the bolt when the

hand-lever is shifted to set the signal to "danger" position and prevent the hand-lever from breaking the circuit at the hand-lever switch until the signal has been completely
5 set to "danger" position, substantially as described.

In witness whereof we have hereunto signed

our names in the presence of two subscribing witnesses.

THÉOPHILE DUCOUSO.
FERDINAND RODARY.

Witnesses:

LÉO LORENTZ,
GEORGES MINSSART.