No. 801,394. PATENTED OCT. 10, 1905.

F. L. O'BRYAN.

SIGNALING.

APPLICATION FILED JUNE 29, 1905.

3 SHEETS—SHEET 1.

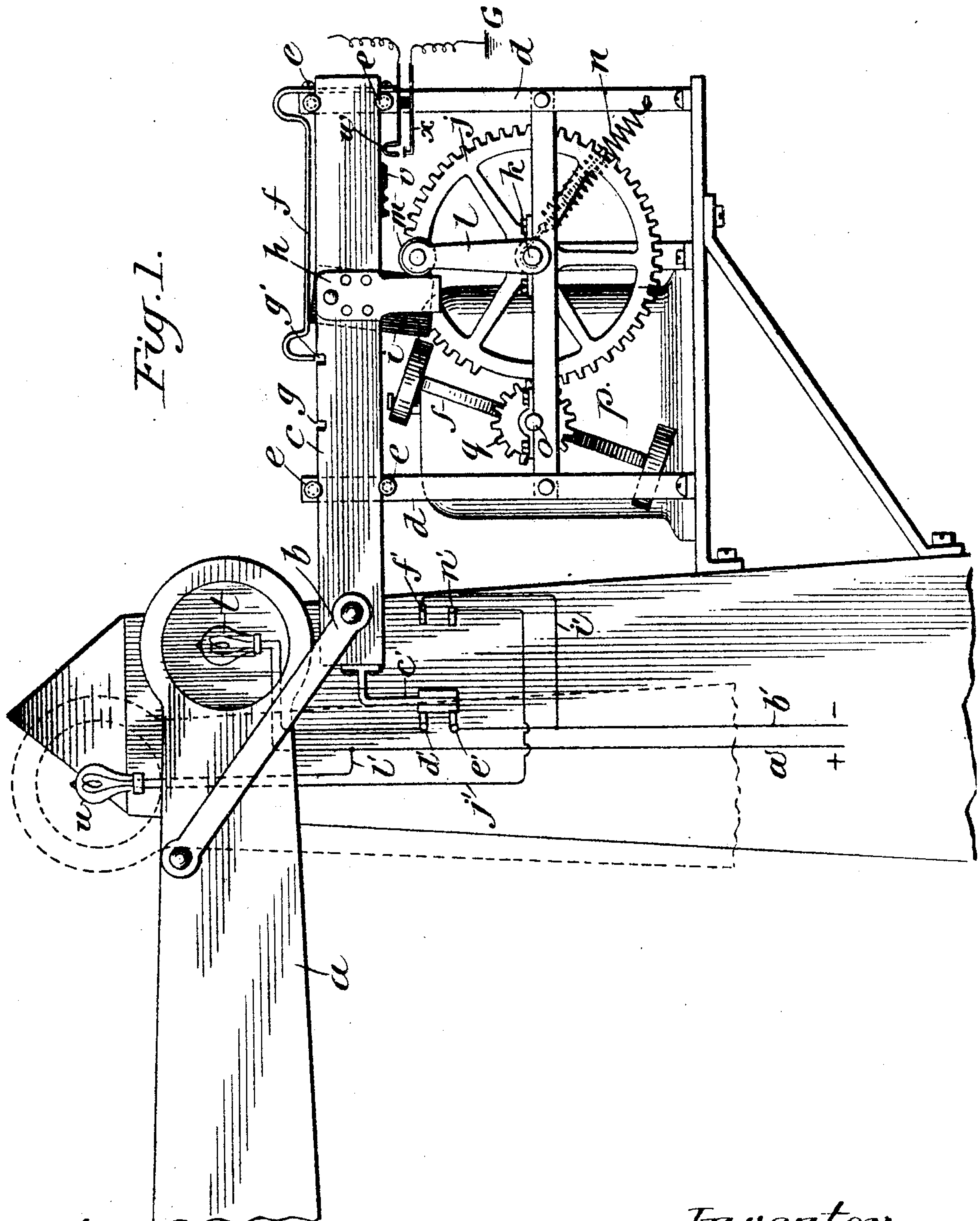

Fig. 1.

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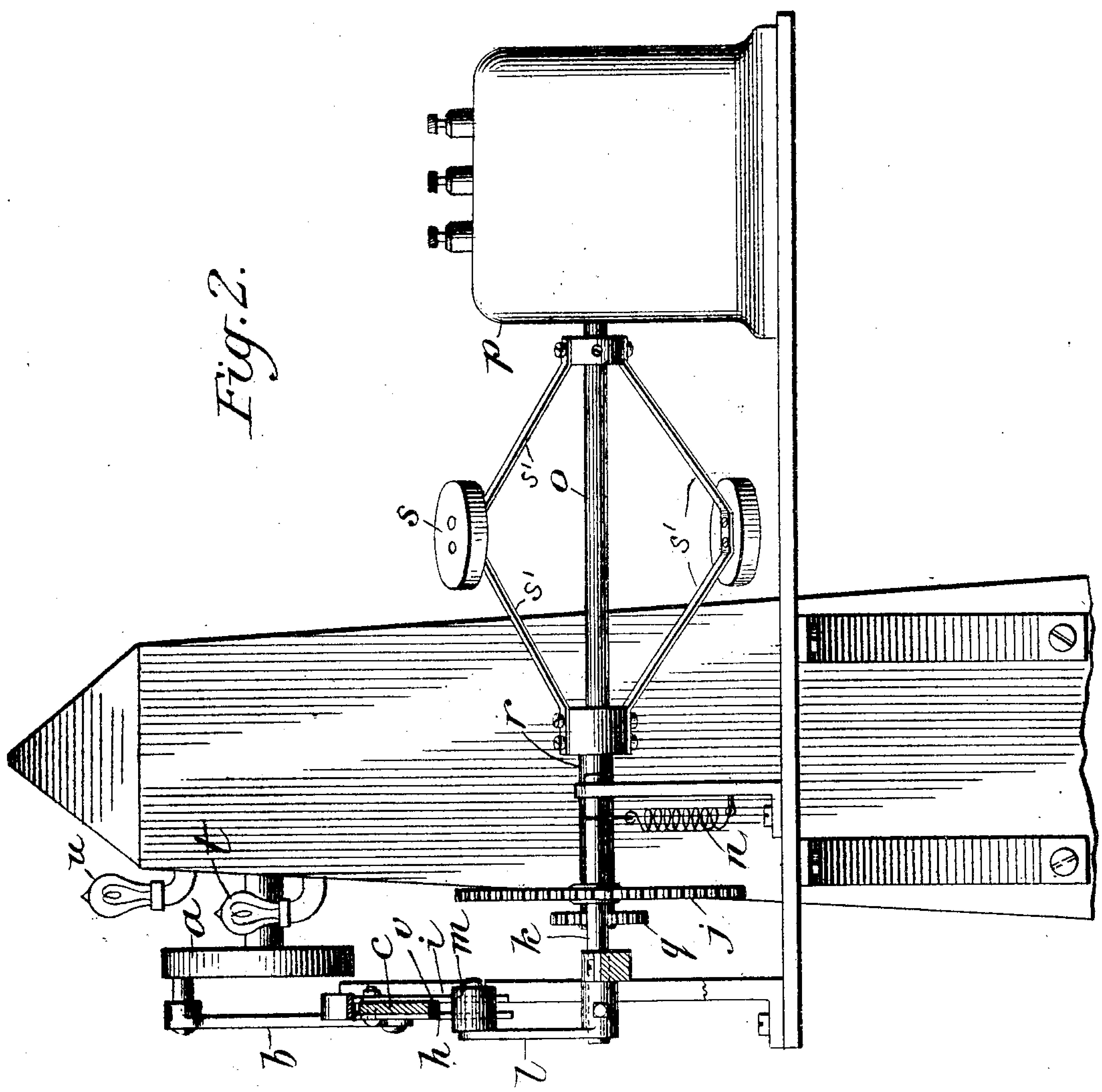
3 SHEETS—SHEET 2.

Fig. 2.



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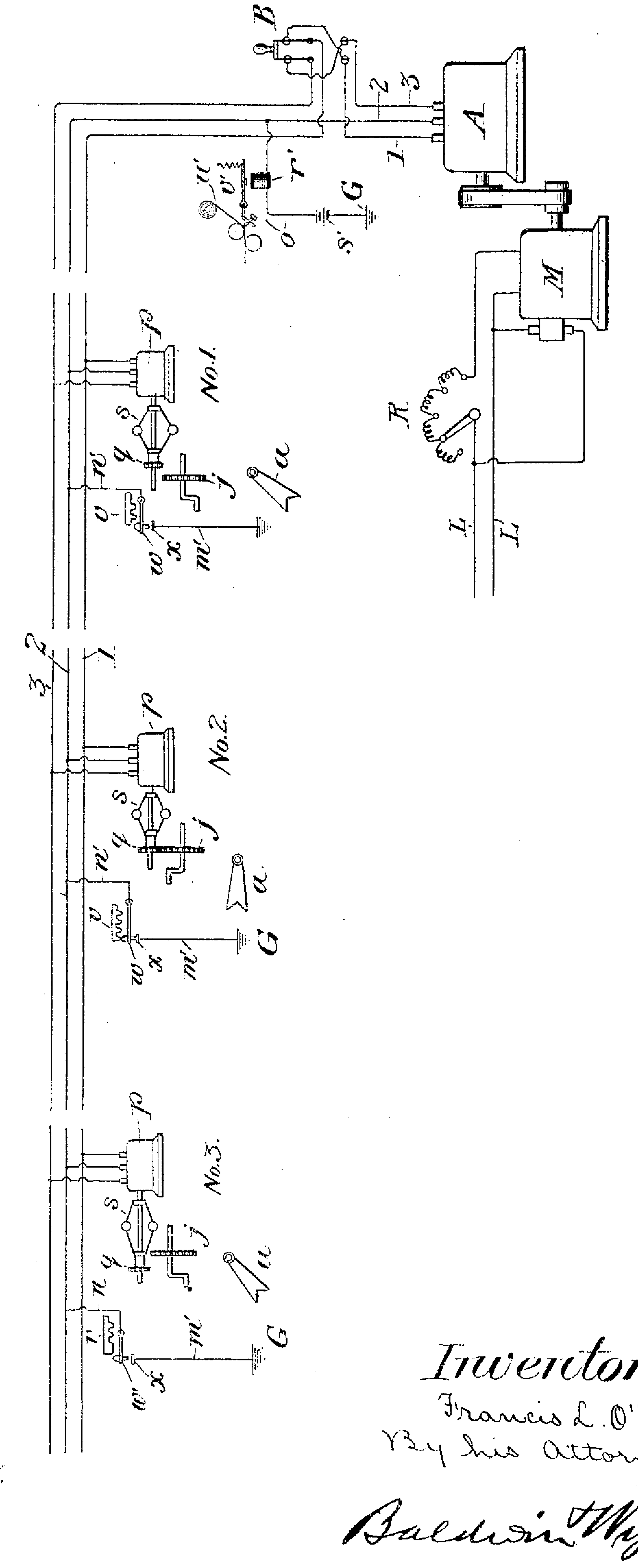
3 SHEETS—SHEET 3.

Fig. 3.



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SIGNALING.

No. 801,394. Specification of Letters Patent. Patented Oct. 10, 1905.

Application filed June 29, 1905. Serial No. 267,491.

To all whom it may concern:

Be it known that I, FRANCIS L. O'BRYAN, a citizen of the United States, residing in South Framingham, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Signaling, of which the following is a specification.

My invention relates to certain new and useful improvements in signals and in the means for operating the same selectively.

To this end the invention comprises a series of signals, motors for operating the several signals, and means controlled by the speed of the individual motors for operatively connecting the same with the corresponding signals.

One practical embodiment of the invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a semaphore-signal and the operating mechanism therefor. Fig. 2 is an end elevation thereof. Fig. 3 is a diagrammatic representation of a system involving the application of a three-phase electric transmission circuit for operating a series of semaphores of the type illustrated in Figs. 1 and 2 selectively.

Referring to Figs. 1 and 2, *a* indicates a pivoted semaphore-arm, such as is usually employed in railway signaling systems, which is adapted to be moved to a horizontal position to indicate "danger" and to a substantially vertical or inclined position to indicate "safety," as will be well understood by those versed in the art. Mounted in a suitable framework attached to the semaphore-support is a reciprocating slide *c*, connected to the semaphore by a link *b*, so that as said slide is moved to one or the other of its extreme positions the semaphore is moved to "danger" or to "safety," as the case may be. The slide *c* is guided in suitable bearings *e*, mounted upon the standards of the framework, which bearings cause the movement of the slide to be confined in a rectilinear path. The upper edge of said slide *c* is provided with two recesses *g g'*, which are adapted to be alternately engaged by a spring-detent *f*, attached to the framework and overlying said slide *c*, said detent serving to lock the semaphore in its extreme positions.

Journaled in suitable bearings on the framework is a short shaft *k*, having on its outer end a crank *l*, provided at its end with a roller *m*, adapted to engage a depending arm *h*, rigidly secured to the side of slide *c*, and also adapted to engage a trip *i*, pivoted to the opposite side of the slide *c*, and said trip adapted as it is swung in either direction by the engaging crank to strike the forward end of spring-detent *f* and free the slide *c* preparatory to the movement of said arm in one direction or the other by the coöperation of crank *l* with arm *h*. Upon shaft *k* is fixed a gear *j*, havinga portion of its teeth cut away for a purpose to be hereinafter more particularly described. Connected by a strap or cord to the shaft *k* is a spring *n*, which tends to rotate the shaft to carry the crank out of engagement with the arm *i*.

Located at one side of the slide *c* and gear *j* is a motor *p*, upon the shaft *o* of which is slidably mounted a gear *q*, the shafts *o* and *k* being substantially parallel, so that at one point in the sliding movement of gear *q* said gear will engage and rotate gear *j* and its shaft *k*. The sliding movement of the gear *q* is regulated by a centrifugal governor, formed of the usual weights *s*, mounted upon spring-arms *s'*, the latter being connected at one end to a stationary collar on the motor-shaft *o* and at the other end to a corresponding collar secured to the sleeve *r* of gear *q*. The weights *s* or the springs *s'*, or both of them, are so adjusted that the governor will move the gear *q* into position on shaft *o* to mesh with gear *j* on shaft *k* only when the motor attains a certain predetermined speed, and when the speed of the motor exceeds or falls below the predetermined limit by any material amount the gear *q* either slides past gear *j* without operating the same or fails to move far enough along its shaft to mesh with said gear *j*. It will be seen, therefore, that the operative engagement of gears *q* and *j* is directly dependent upon and in accordance with the predetermined speed of the motor *p*. For example, if the centrifugal governor is set to bring the gears into mesh when the motor attains a speed of five hundred revolutions per minute, if said motor is so controlled as to decrease its speed to four hundred and fifty revolutions per minute the gear *q* will not be moved sufficiently to mesh with gear *j*, and if the speed of the motor be increased by appropriate means to five hundred and fifty revolutions per minute gear *q* will be quickly slid past gear *j* without operating the same.

When the motor has attained the speed required, gear *q* is moved directly opposite gear *j* and drives the latter and with it shaft *k* and crank *l*, which in the upper arc of its revolution engages trip *i*, which knocks spring-detent *f* out of the coöperating recess *g* or *g'* in slide *c* and frees the latter. The continued movement of said crank *l* engages the roller *m* on the end thereof with depending arm *h* and moves the slide *c* to one or the other of its extreme positions to set the semaphore *a* to danger or safety position, accordingly as the motor *p* is driven in one direction or the other. As the slide *c* and the semaphore *a* reach the limit of their movements the mutilated portion of gear *j* comes opposite the teeth of gear *q*, and the rotation of said gear *j* is arrested; but said gear is still held in the position to which it has been moved until the motor *p* is deprived of its energy or its speed is changed when gear *q* moves away from gear *j* under the influence of the centrifugal governor, whereupon spring *n* immediately reverses the shaft *k* and crank *l*, moving the latter out of engagement with trip *i* and permitting detent *f* to engage the particular recess *g* or *g'*, which is immediately below the end thereof, and lock the semaphore in the position in which it has been set. A clockwise rotation of the motor as illustrated in Figs. 1 and 2 drives gear *j* to set the semaphore at "safety," and an anticlockwise movement of said motor adjusts the signal to "danger," so that the conditions to be observed to properly operate the semaphore are two, first, to drive the motor in the appropriate direction, and, second, to speed the motor at the predetermined number of revolutions per minute required to cause the speed-governor to move gear *q* into mesh with gear *j* and hold said gear in that position.

In order that the semaphore may also serve effectively as a night-signal, it is provided with the usual spectacle at its rear end which is adapted to be brought into registry with a red light *t* when the signal is set at "danger" and with a white or green light *u* when the semaphore is thrown to the opposite positions. The lights *t* and *u* are preferably incandescent electric lamps adapted to be connected into and cut out of a power-circuit *a'* *b'* by a switch *c'* on the end of slide *c*. For example, when the semaphore is at "danger" current passes through lamp *t* from lead *a'*, thence to contact *d'*, switch *c'*, contact *e'* to return-lead *b'*. Under these conditions the circuit to lamp *u* is broken at contacts *f'* *n'*. When the semaphore is moved to "safety," as indicated in dotted lines in Fig. 1, slide *c* has moved to its other extreme position and switch *c'* closes the circuit of lamp *u* as follows: lead *a'*, wire *l'*, lamp *u*, wire *j'*, contact *n'*, switch *c'*, contact *f'*, wire *i'*, to return-lead *b'*.

Means for indicating the position and operation of the signal at a central controlling-station may be supplied, and a simple and efficient apparatus for accomplishing this object comprises a circuit-closer consisting of a spring member *w* and a stationary contact *x*, connected to the two leads of an electric circuit containing a suitable indicating or recording instrument, said spring member lying in the path of and being adapted to be operated to close the circuit by a projection on the under side of slide *c*, said projection being provided with a series of breaks preferably corresponding to the dots and dashes of the Morse code, each slide having a distinctive arrangement of such dots and dashes to properly identify the operation of the corresponding signal at the central station.

To apply a series of separate signals of the type hereinbefore described to a system of control in which the signals may be operated selectively, the several signals with their operating-motors are located at the desired positions and the motors connected to a source of power which may be so controlled as to vary and regulate the speed of the several motors. The centrifugal governors of the several motors are regulated to cause the corresponding gears *q* and *j* to engage only when the speed of the motor reaches and remains at a predetermined limit. For example, the gears of the first signal are engaged by the corresponding governor to operate said signal when the speed of the signal-motor is one hundred revolutions per minute and none of the other signal-gears will mesh, as the other motors have a speed of only one hundred revolutions per minute. At two hundred revolutions per minute of the several motors governor No. 1 will pull its gear *q* quickly past gear *j* without operating signal No. 1; but governor No. 2 will cause its gear to mesh with corresponding gear *j* and operate signal No. 2; but the other signals are still unoperated, because their respective governors are set to cause their corresponding gears to mesh only at higher speeds of the motors, such as three hundred revolutions per minute, four hundred revolutions per minute, &c., respectively.

The motor system may be of any desired type, provided it is sufficiently elastic to permit of ready adjustment of the power source to vary and regulate the speed of the motors by the different amounts necessary to bring the respective signal-operating gears into mesh through the agency of the corresponding governors, and thereby operate the signals selectively in either direction. Such system may, for example, be a direct-current electric-transmission circuit, an alternating-current circuit, or, as illustrated in Fig. 3, a three-phase electric-transmission circuit comprising a three-phase generator A, to whose leads 1, 2, and 3 synchronous motors *p* at signal-stations Nos. 1, 2, and 3, respectively, are connected. A reversing-switch B of any approved type is located in the power-circuit to change the direction of the current and reverse the motors p at will from the central station. The speed of the motors is also controlled and regulated from the central station by varying the current conditions in the circuit as, for example, varying and regulating the speed of generator A or interposing resistances or a suitable compensating device in the circuit-leads, thereby changing and regulating the frequency of current in the line. For example, if the generator develops a frequency sufficient to turn all of the motors at one hundred revolutions per minute signal No. 1 will be operated, as hereinbefore described, but signals Nos. 2 and 3 will not be affected. If the frequency be changed to cause all the motors p to turn at the rate of two hundred revolutions per minute, signal No. 2 only will be operated, and at a still further change in the frequency to speed all the motors at three hundred revolutions per minute signal No. 3 will be operated to the exclusion of all of the others, and so on, each predetermined change in the frequency causing one particular one of any number of motors to be operatively connected with its signal to operate the latter alone and in either direction, according to the position of switch B. In practical operation generator A is driven light or with switch B open until the desired frequency is attained to produce the necessary speed in the motors to operate the signal corresponding to that speed. Then switch B is closed and the current sent to line to drive all of the motors and to operate but a single selected signal, which may be thus be set to "danger" or "safety" at the will of the central operator. By increasing or diminishing the frequency developed by generator A the speed of all of the motors may be changed accordingly and any other signal of the series set in accordance with this speed without in any way interfering with the other signals of the system. For instance, signals Nos. 1, 2, and 3 may be set successively to "danger" and subsequently cleared in the same or reverse order, or each signal may be set to "danger" and cleared before the next succeeding one is operated, and so on, the operation of any signal being effected in strict accordance with the current conditions in the line or the speed of the several motors.

A simple and effective means for changing the frequency of the signal-operating circuit is illustrated in Fig. 3, in which M indicates a direct-current shunt-motor belted to the generator A, with a rheostat R in the field-circuit of said motor to accurately regulate the current from the leads L L′, flowing through the field of said motor M, and thereby regulate the speed of said motor and the generator A, driven thereby. As the frequency of the current generated by A is a direct function of the speed of the generator A, it will be seen that any desired frequency may be produced and maintained by regulating the speed of the driving-motor M by the means shown.

As heretofore referred to, the position and operation of each signal may be indicated or recorded at the central operating-station. In the present plan this is accomplished by providing each signal-station with a distinctive code-signal make-and-break device v, w, and x, which closes a circuit from a grounded battery s' at the central station through a recording instrument r' v' u', lead 2 of the power-circuit, wire u, circuit-breaker w x of the operating-semaphore, wire m, to ground, thereby recording on strip u' the distinctive indication in dots and dashes controlled by the corresponding member v.

While I have thus particularly described one embodiment of my improved signals and the method of systematizing and operating them, it is to be understood that the invention is not limited to the particular mechanism referred to, as the latter may be varied within wide limits without departing from the spirit and scope of the invention.

Having thus described my invention, what I claim is—

1. A signal system, comprising a series of signals, motors for operating the several signals, means controlled by the speed of the individual motors for operatively coupling the same with the corresponding signals, and means for varying the speed of the motors, whereby the signals may be operated selectively.

2. A signal system, comprising a series of signals, motors for operating the several signals, normally disconnected gearing between each motor and the corresponding signal, means controlled by the speed of the individual motors for operatively engaging said gearing, and means for varying the speed of the motors, whereby the signals may be operated selectively.

3. A signal system, comprising a series of signals, motors for operating the several signals, normally disconnected gearing between each motor and the corresponding signal, a centrifugal governor connected to each motor and controlling the gearing to cause the latter to engage when the corresponding motor attains a predetermined speed, and means for varying the speed of the motors, whereby the signals may be operated selectively

4. A signal system, comprising a series of signals, motors for operating the several signals, means controlled by the speed of the individual motors for operatively coupling the same with the corresponding signals, and means controlled from a central station for varying the speed of the motors to operate the signals selectively.

5. A signal system, comprising a series of signals, motors for operating the several signals, normally disconnected gearing be-

tween each motor and the corresponding signal, means controlled by the speed of the individual motors for operatively engaging said gearing, and means controlled from a central station for varying the speed of the motors to operate the signals selectively.

6. A signal system, comprising a series of signals, motors for operating the several signals, normally disconnected gearing between each motor and the corresponding signal, a centrifugal governor connected to each motor and controlling the gearing to cause the latter to engage when the corresponding motor attains a predetermined speed, and means controlled from a central station for varying the speed of the motors to operate the signals selectively.

7. A signal system, comprising a series of signals, an electric power-circuit, motors in said circuit for operating the several signals, means controlled by the speed of the individual motors for operatively connecting the same with the corresponding signals, and means at a central station for changing the current conditions in said power-circuit to vary the speed of the motors, whereby said signals may be operated selectively.

8. A signal system, comprising a series of signals, an electric power-circuit, motors in said circuit for operating the several signals, means at a central station for changing the current conditions in said power-circuit, and means for reversing the direction of the current therein; whereby the speed of direction of the motors may be controlled to operate the signals selectively in both directions.

9. A signal system, comprising a series of signals, an electric power-circuit, motors in said circuit for operating the several signals, normally disconnected gearing between each motor and the corresponding signal, means controlled by the speed of the individual motors for operatively engaging said gearing, and means at a central station for changing the current conditions in said power-circuit to vary the speed of the motors; whereby said signals may be operated selectively.

10. A signal system, comprising a series of signals, an electric power-circuit, motors in said circuit for operating the several signals, normally disconnected gearing between each motor and the corresponding signal, means controlled by the speed of the individual motors for operatively engaging said gearing, means at a central station for changing the current conditions in said power-circuit, and means for reversing the current therein; whereby the speed and direction of the motors may be controlled to operate the signals selectively in both directions.

11. A signal system, comprising a series of signals, a multiphase electric power-circuit, induction-motors in said circuit for operating the several signals, means for varying the phases in said circuit to regulate the speed of the motors, and means controlled by the speed of the individual motors for operatively connecting the motors with the corresponding signals.

12. A signal system, comprising a series of signals, a multiphase electric power-circuit, induction-motors in said circuit for operating the several signals, means for varying the phases in said circuit to regulate the speed of the motors, means controlled by the speed of the individual motors for operatively connecting the motors with the corresponding signals, and a switch for reversing the direction of current-flow in said circuit to change the direction of the several motors.

13. A signal, comprising a semaphore, a reciprocating slide connected thereto for swinging the same, a geared crank-shaft for actuating said slide, a motor normally disconnected from said crank-shaft, and means controlled by the speed of the motor for connecting the latter to the crank-shaft to operate the signal.

14. A signal, comprising a semaphore, a reciprocating slide connected thereto for swinging the same, a detent for locking the signal, a geared crank-shaft for tripping said detent and actuating said slide, a motor normally disconnected from said crank-shaft, and means controlled by the speed of the motor for connecting the latter to the crank-shaft to operate the signal.

15. A signal, comprising a semaphore, a reciprocating slide connected thereto for swinging the same, a detent for locking the signal, a geared crank-shaft for tripping said detent and actuating the slide, a motor normally disconnected from said crank-shaft, means controlled by the speed of the motor for connecting the latter to the crank-shaft, and means for disconnecting the same when the signal has been set.

16. A signal, comprising a semaphore, a reciprocating slide connected thereto for swinging the same, a detent for locking the signal in both positions, a crank-shaft for tripping the detent and moving said slide in both directions, a gear on the crank-shaft, an electric motor, a movable gear on the shaft thereof, a governor operating to connect said gears when the motor attains a predetermined speed, and means for disengaging said gears when the signal has been set.

17. A signal, comprising a semaphore, a reciprocating slide connected thereto for swinging the same, a detent for locking the signal in both positions, a crank-shaft for tripping the detent and moving said slide in both directions, a gear on the crank-shaft, a spring for returning said shaft to inoperative position, an electric motor, a movable gear on the shaft thereof, a governor operating to connect said gears when the motor attains a predetermined speed, and means for disen-

gaging said gears when the signal has been set.

18. A signal, comprising a semaphore, a reciprocating slide connected thereto for swinging the same, a detent for locking the signal in both positions, a crank-shaft for tripping the detent and moving said slide in both directions, a gear on the crank-shaft, a spring for returning said shaft to inoperative positions, an electric motor, a movable gear on the shaft thereof, a governor operating to connect said gears when the motor attains a predetermined speed, means for disengaging said gears when the signal has been set, and an electric indicator-circuit operated by a moving part of the apparatus to show the position of the signal at the operator's station.

In testimony whereof I have hereunto subscribed my name.

FRANCIS L. O'BRYAN.

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