No. 749,710. PATENTED JAN. 12, 1904.

L. C. WERNER.

ELECTRIC BLOCK SIGNAL SYSTEM.

APPLICATION FILED DEC. 12, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

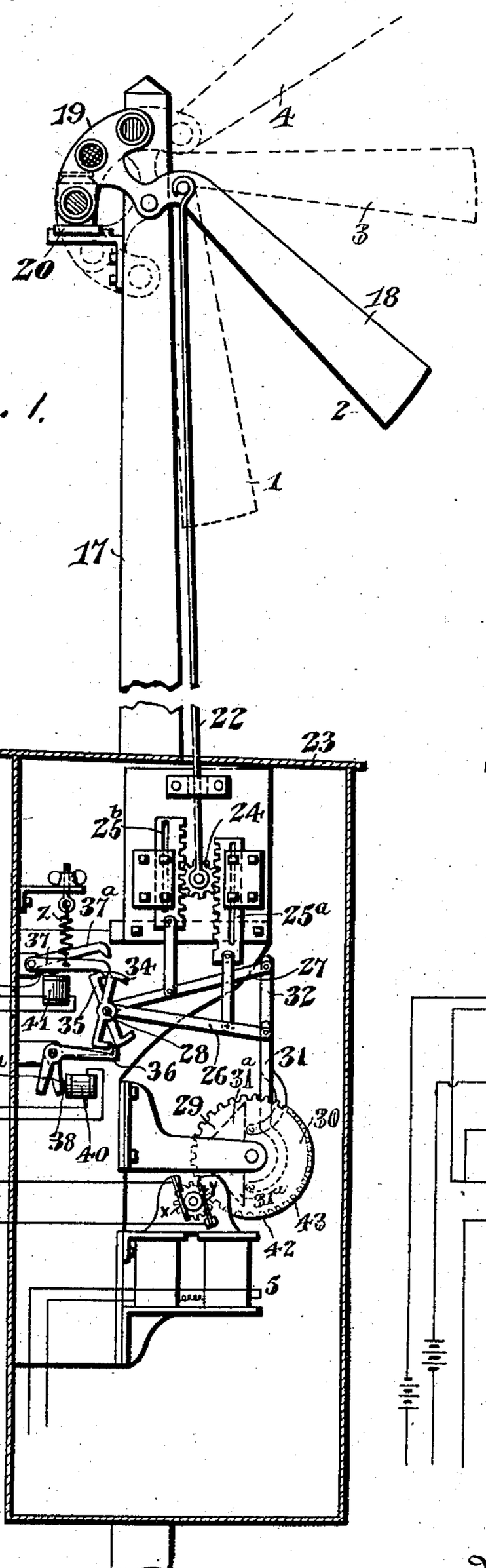
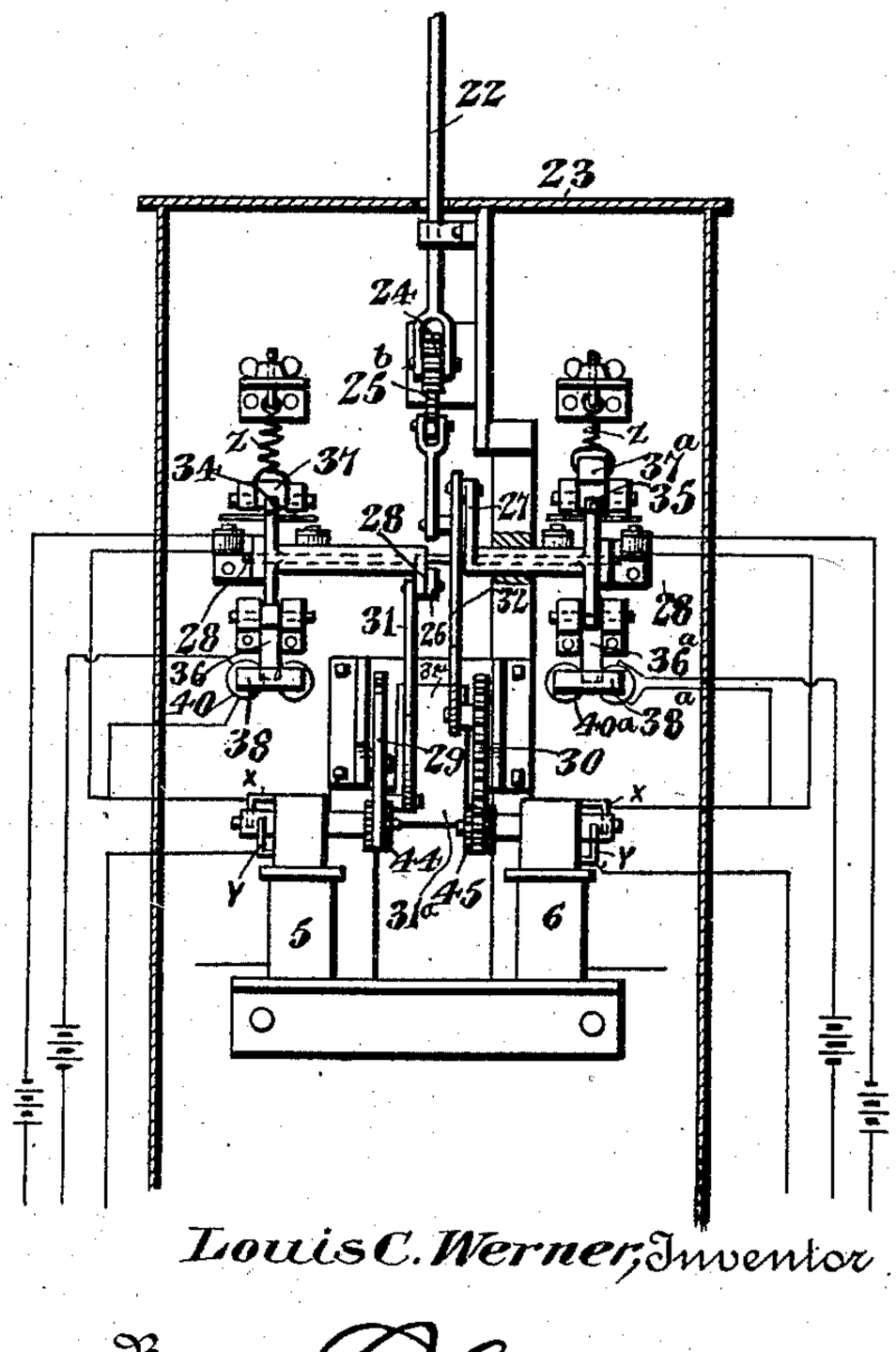


Fig. 2.



Witnesses
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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4

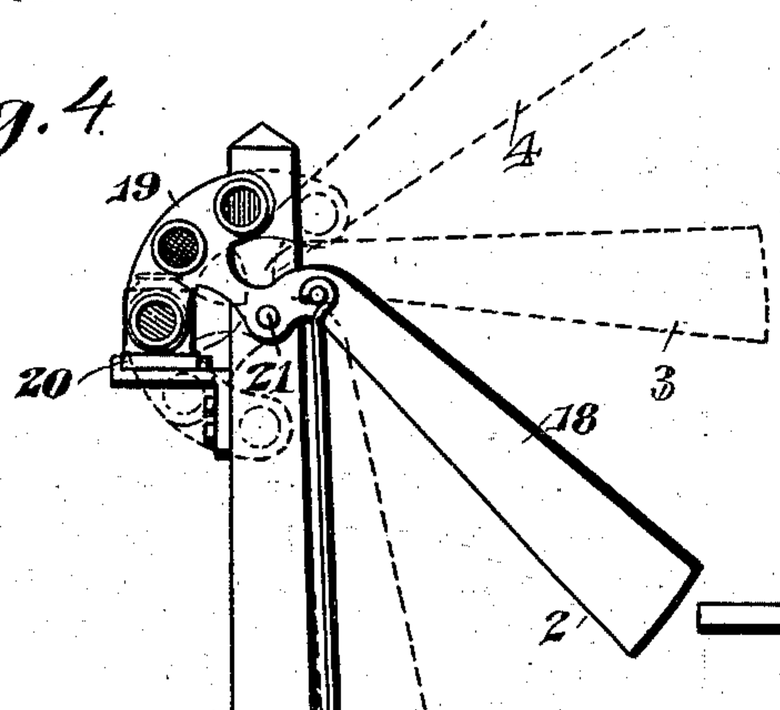


Fig. 3.

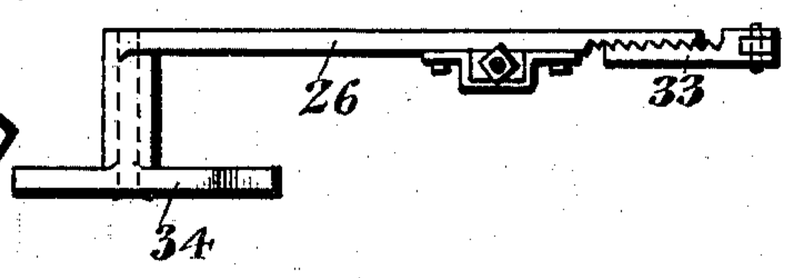
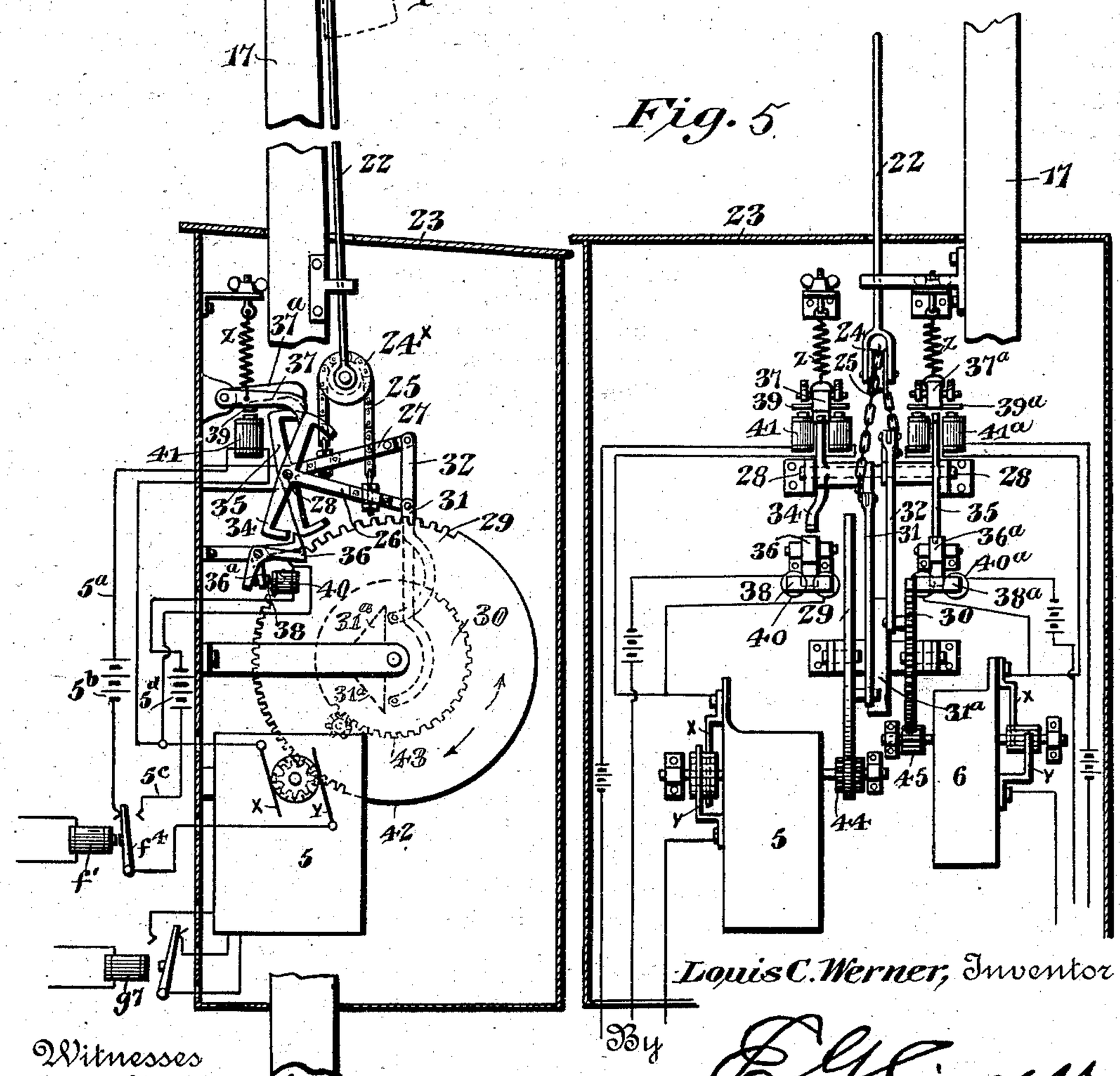


Fig. 5.



Witnesses

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No. 749,710. Patented January 12, 1904.

UNITED STATES PATENT OFFICE.

LOUIS C. WERNER, OF BROADBROOK, CONNECTICUT.

ELECTRIC BLOCK-SIGNAL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 749,710, dated January 12, 1904.

Application filed December 12, 1901. Serial No. 85,595. (No model.)

To all whom it may concern:

Be it known that I, LOUIS C. WERNER, a citizen of the United States, residing at Broadbrook, in the county of Hartford and State of Connecticut, have invented a new and useful Electric Block-Signal System, of which the following is a specification.

This invention relates to a novel semaphore and operating mechanism for moving the signal-arm to the several positions indicative of the signals which serve for the guidance of the engineers.

The object of the invention is to provide operating mechanism of novel character arranged for electrical control and capable of providing for the automatic display of four signals determined by the positions of the arm.

A further object of the invention is to automatically lock the arm in any position to which it is moved and to equip the semaphore with operating-motors so related to the locking mechanism and a suitable controlling device that the locking mechanism will be released immediately prior to the movement of the motor or motors and locked as soon as the motor mechanism has moved the signal-arm to the desired position.

Subordinate to these general objects are many others which will hereinafter more fully appear and to the accomplishment of which the system is arranged and the apparatus constructed in the manner to be fully described, illustrated in the accompanying drawings, and succinctly defined in the appended claims.

In the drawings, Figure 1 is a sectional elevation of one of the signals or semaphores and its operating apparatus, the electrical connections therefor being shown in diagram, Fig. 2 is another view of the semaphore-operating mechanism shown in Fig. 1, but looking in a different direction. Fig. 3 is a detail view of one of the motor-levers. Figs. 4 and 5 are views similar to Figs. 1 and 2, but illustrating a modified construction.

The semaphore is capable of being moved to four different positions. (Best illustrated in Fig. 1 of the drawings.) The completely-depressed position (indicated by the numeral 1) indicates that the track is "clear," the full-line position 2 admonishes "caution," the third position (designated by 3) indicates "danger," and the fourth or completely-elevated position (denoted by the numeral 4) indicates "extreme danger." The fourth position is that which the semaphore will naturally assume, but the normal position thereof is "clear," because each semaphore is operated by a pair of motors 5 and 6, one of which is arranged to move the semaphore the distance of one position and the other of which is of sufficient capacity to move the semaphore two positions, and therefore under normal conditions these motors will retain the semaphore at "clear" against its tendency to move to the position of "extreme danger." Each motor is therefore provided with a motor-circuit 5^a or 6^a, in which is located a battery 5^b or 6^b. These circuits are normally closed by the attraction of the armatures of the paired electromagnets—as, for instance, the magnets f' and g^7—which are designed to control the motor-circuits of the semaphore. The closing of these motor-circuits 5^a and 6^a will render active the batteries 5^b and 6^b, operating the motors in one direction until the semaphore is drawn down to the "clear" position, where, as before stated, it is normally held, and it may be explained that in practice the motor-circuit 5^a of the more powerful motor 5 is controlled by a relay in the track-circuit of an adjacent block, while the motor-circuit 6^a of the less powerful motor 6 may be controlled by a relay in the ground-circuit of the next succeeding block. In such case the short-circuiting of a track-battery by the presence of a train in a block will demagnetize the primary relay of the adjacent semaphore—that is to say, the relay controlling the more powerful motor 5—as, for instance, the relay f'—while the secondary relay (that relay controlling the operation of the weaker motor 6)—as, for instance, the relay g^7—will not be affected. Therefore the semaphore will be permitted to move back two positions—to wit, to the "danger" position—but will be prevented by the secondary motor from moving back to the position of "extreme danger."

In the drawings I have illustrated each of the motor-circuits 5^a and 6^a as having a shunt-terminal 5^c or 6^c, in which is located a reversely-disposed battery 5^d or 6^d, so that when the ar-

matures of the semaphore-relays are released the current will be reversed to effect the positive reverse motion of the semaphores. So far as the broad aspect of the invention is concerned, however, these shunt-terminals and reverse batteries are not essential, as the breaking of the motor-circuits by the release of the armatures of the semaphore-relays would permit the gravitation of the semaphores to their proper positions by reason of counterweights employed in connection therewith and tending when unopposed by a motor to move the semaphore to the position of "extreme danger."

The mechanism for operating and locking each of the several semaphores is illustrated in Figs. 1, 2, and 3, and comprises a support or post 17, adjacent to the upper end of which is pivoted a semaphore-arm 18, formed, as usual, with a counterweight 19 of arcuate form and having openings fitted with disks of glass arranged for presentation before a signal-lantern 20 and colored in a manner to signify the position of the semaphore-arm at night, white signifying "clear." The counterweight 19 is entirely withdrawn from before the lantern when the arm is at "clear," permitting the display of the white light of the signal-lantern. When the semaphore-arm is moved to "caution," the counterweight 19 is swung down to present a green glass before the light, a pink glass being displayed when the arm is at "danger" and a red glass when the arm is moved to the position of "extreme danger." At one side of the pintle 21, upon which the arm is mounted, said arm is connected to the upper end of a connecting-rod 22, having its lower end extended into a casing 23 and provided with a pinion 24 at its lower extremity. At opposite sides of the pinion are suitably guided a pair of vertically-disposed racks 25^a and 25^b, meshing with the pinion and pivotally connected at their lower ends to links 25^c and 25^d, having their lower ends secured to oscillatory arms or levers 26 and 27 at different distances from the common axis of the latter, said arms or levers being mounted upon a common shaft 28, supported within the casing by suitable brackets. It should be noted that the connection of the rack 25^a with the lever 26 is at least twice as far from the shaft 28 as is the connection between the rack 25^b and the lever 27. Therefore a given oscillation of the lever 26 will move the rod 22 twice as far as a similar oscillation of the lever 27. It is by reason of this peculiar arrangement of the connections that the motor 5, heretofore designated the "primary" motor and connected to the lever 26 in a manner to be explained, has twice the capacity of the motor 6, referred to as the "secondary" motor and arranged to oscillate the lever 27. At a point below the levers are mounted a pair of motor-disks 29 and 30, connected to the levers 26 and 27, respectively, by means of intermediate links 31 and 32, pivoted at their upper ends to the outer ends of the levers and eccentrically connected at their lower ends to the disks. The movements of the disks are limited by a stop 31^a. (See Fig. 2.) The throw of the levers is adjustable by means of adjustable extensions 33, which serve to lengthen or shorten the levers, and to thus determine the distances from the fulcrums thereof of their connections with the links 31 and 32. Each of the levers 26 and 27 is of a general T form in order to provide each of them with a locking-head 34 or 35, each arranged to coöperate with a pair of pivoted detents 36 and 37, 36^a and 37^a, disposed to engage the opposite ends of the locking-head in front and rear thereof. These detents, which of course constitute elements of the semaphore-locking mechanism, are connected to and operated by the armatures 38 and 39, 38^a and 39^a of magnets 40 and 41, 40^a and 41^a. It will now be evident that the rotation of either of the disks in the direction of the full-line arrow in Fig. 1, assuming the connecting-rod to be at its highest position, will draw the rod down, and thus effect corresponding movement of the semaphore-arm, the latter being moved down two positions by a complete downward oscillation of the lever 26, one position by a complete downward oscillation of the lever 27, and three positions—that is to say, from "extreme danger" to "clear"—by the downward movement of both levers. In like manner the release of the lever 26 will permit the semaphore-arm to move up two positions, the release of the lever 27 will permit it to move up one position, and the complete upward movement of both levers will restore the semaphore-arm from "clear" to "extreme danger." As stated, the downward movement of the levers is secured by the rotation of the disks in the direction of the full-line arrow in Fig. 2, and the opposite oscillation of the levers is of course effected by the reversal of the disks in the direction of the dotted arrow in Fig. 1. It now remains to be seen how these disks are rotated and how the detents are actuated to lock the levers in their depressed or normal positions. The disks 29 and 30 are provided with peripheral teeth 42 and 43, extending part way around the disks and meshing, respectively, with the pinions 44 and 45, constituting the power-transmitting elements of the motors 5 and 6. The character of these motors is not essential, since any mechanism adapted for either electrical actuation or control and capable of operating the disks may be employed. For purposes of illustration, however, I have shown somewhat diagrammatically a pair of electromotors upon the armature-shafts of which the pinions 44 and 45 are mounted. It has been explained that at each semaphore is grouped a pair of relays, one of which controls the operation of the primary motor 5 and the other the operation of the secondary motor 6. In Fig. 4

these relays are shown and designated by the characters f' and g^7; but I shall only describe in detail the relation of the primary relay f' with respect to the motor 5 and the locking mechanism of the lever 26, as this arrangement is identical with the arrangement of the other relay g^7, the motor 6, and the locking mechanism of the lever 27, the only difference in the two sets of devices being different capacities of the two motors with respect to the movement of the semaphore-arm under the impulse thereof. The armature f^4 of the primary relay f' when attracted by the latter closes a motor-circuit 5^a, including the battery 5^b, the magnet 41, and the brushes x y of the motor 5. When this motor-circuit is closed, the motor will be driven to rotate the disk 29 in the direction of the full-line arrow in Fig. 2 to draw down the lever 26 to its lowermost position, where it is normally held. When such position has been reached, the magnet 41, having been energized to attract its armature 39, will draw down the detent 37 into locking engagement with the upper end of the locking-head 34 of the lever 26. The locking of the lever 26 will serve to retain the latter irrespective of any movement which may be imparted by the other motor to the lever 27. The motor-circuit 5^a is provided with a shunt-terminal 5^c, containing a reversed battery 5^d and including the magnet 40. If now the armature f^4 is released by the demagnetization of the relay f', said armature will open the motor-circuit 5^a and will close the circuit through the shunt-terminal 5^c. The battery 5^b and the magnet 41 will thus be cut out of the motor-circuit, and under the impulse of the reversed battery 5^d the motor will be driven in a reverse direction to rotate the disk 29 in the direction of the dotted arrow for the purpose of raising the lever 26 to permit the upward movement of the semaphore-arm. This movement of the parts will not be interfered with by the movement of the detent 37, because as soon as the motor-circuit 5^a is opened the magnet 41 will be demagnetized and the detent 37 will be drawn out of its locking position by its spring z. Simultaneous with the reversal of the motor the magnet 40 will be energized, attracting its armature 38 and swinging the detent 36 upward. The detent, however, will strike against the end of the locking-head 34 and will not interfere with the movement of the lever. As soon, however, as the lever has reached its uppermost position the detent 36 will move to its locking position behind the lower end of the locking-head and will lock the lever 26 in its elevated position in a manner similar to the locking of said lever in its depressed position by the detent 37. In the position of the parts shown in Fig. 2 the lever 26 is drawn down and the lever 27 is thrown up. As the latter lever is only capable of moving the semaphore-arm 18 one position, the effect of its movement will be to present said arm at "caution." Suppose, however, the lever 27 should be drawn down and the lever 26 thrown up. The result of this position of the parts would be to place the semaphore-arm at "danger"—that is to say, at the second position. If now both levers are thrown up, it is evident that the semaphore-arm will be moved three steps from the normal position—to-wit, to "extreme danger." If both levers 26 and 27 are drawn down, the semaphore-arm will obviously be drawn back three positions to "clear."

In Figs. 4 and 5 of the drawings I have shown a slightly-modified form of semaphore-operating apparatus. In this form the racks 25^a and 25^b and the pinion 24 are substituted by a chain 25, secured at its opposite ends to the levers 26 and 27 and passed around an idle pulley $24^\times$, located at the lower end of the connecting-rod 22. This construction is entirely effective under ordinary conditions, as the semaphore-arm will be moved under the impulse of its counterweight whenever the chain is slacked by the reversal of either or both of the motors. The construction shown in Figs. 2 and 3 is thought to be preferable, however, since it contemplates the positive actuation of the semaphore-arm in both directions, and the power of the motors is therefore exerted to move the arm—as, for instance, in the event of its being blocked by snow and ice in the winter.

It is thought that from the foregoing the construction, arrangement, operation, and advantages of my signal system and apparatus will be clearly comprehended; but while the illustrated embodiments of the invention are thought at this time to be preferable I wish to reserve the right to effect such changes, modifications, and variations thereof as may be suggested by experience and experiment and embraced within the scope of the protection prayed.

What I claim is—

1. In a block-signal system for railways, the combination with a signal device, and a motor for moving the same to its different positions, of a pair of signal-locking devices, a motor-circuit controlling the operation of the motor in one direction and including an electromagnet disposed to operate one of the locking devices, a shunt-terminal for said motor-circuit, said shunt-terminal including an electromagnet controlling the operation of the other locking device, reversed generators in the motor-circuit and in the shunt-terminal thereof, respectively, and a relay disposed to close the circuit through either generator and magnet, whereby the motor may be operated in either direction, and the signal device locked in either of its set positions.

2. In a block-signal system for railways, the combination with a signal device, a pair of motors and differential connections for moving the signal device different distances in the

same direction, of locking mechanism for locking the signal in its set positions, separate circuits controlling the operation of the motors and their associated locking mechanism, and a make-and-break device in each of said circuits.

3. In a block-signal system for railways, the combination with a signal device, and a pair of operating-motors, of a pair of locking devices associated with each motor to lock the signal in its set positions, an independent motor-circuit for each motor, said circuit including a generator and an electromagnet controlling the operation of one of the locking devices of the adjacent motor, and each of said motor-circuits having a shunt-terminal including a reversed generator and an electromagnet controlling the operation of the other locking device of the adjacent motor, and a relay having its armature interposed between the direct and shunt terminal of each motor-circuit, whereby the circuit may be closed through either generator and magnet to operate the motor in either direction, and to lock the signal in either of its set positions.

4. In a block-signal system for railways, the combination with a support, of a movable semaphore-arm, a pair of motor-arms, means for effecting an independent operative connection between the semaphore-arm and each motor-arm, and for imparting a different degree of movement to the semaphore-arm from each motor-arm, and a pair of motors carried by the support to operate the motor-arms independently in both directions.

5. In a block-signal system for railways, the combination with a swinging semaphore-arm, and a connecting-rod extending therefrom and provided with a pinion, of a pair of swinging motor-arms, locking means therefor, an independent motor for operating each arm in both directions independently of the other arm, and racks engaging the pinion and connected to the motor-arms.

6. In a block-signal system for railways, the combination with a swinging semaphore-arm, and a connecting-rod extending therefrom and provided with a pinion, of a pair of swinging motor-arms, an independent motor for operating each arm independently in both directions, racks engaging the pinion and connected to the motor-arms, and means for locking the arms to retain the signal in its set positions.

7. In a block-signal system for railways, the combination with a semaphore-arm, a pair of motor-arms, and means for connecting the motor-arms with the semaphore-arm in a manner to permit one motor-arm to operate the semaphore-arm without operating the other motor-arm, of a pair of rotary disks, links connected to the motor-arms and having eccentric connection with the disks, and means for rotating the disks to operate the motor-arms positively in both directions.

8. In a block-signal system for railways, the combination with a semaphore-arm, and a pair of motor-arms, of a pinion operatively related to the semaphore-arm and bodily movable therewith, racks engaging the pinion and connected to the motor-arms at different distances from the axes thereof, and means for operating the motor-arms positively in both directions to shift the semaphore-arm to different positions.

9. In a block-signal system for railways, the combination with a four-position semaphore-arm, a pair of motor-arms operatively related thereto, and means for operating the motor-arms to move the semaphore to either of its four indicating positions, of a pair of locking devices associated with each motor-arm to lock the same at the opposite limits of its movement, and independent controlling means for said locking devices.

10. In a block-signal system for railways, the combination with a four-position semaphore-arm, and a pair of motor-arms operatively related thereto, of means for operating the motor-arms to move the semaphore-arm to either of its four indicating positions, a pair of locking devices associated with each motor-arm, and electrical controlling mechanism common to each pair of locking devices.

11. In a block-signal system for railways, the combination with a four-position semaphore-arm, and a pair of motor-arms operatively related thereto to move the semaphore-arm to either of its four indicating positions, of a locking-head carried by each motor-arm, pivoted detents disposed to engage the opposite ends of each locking-head, and means for operating the detents.

12. In a block-signal system for railways, the combination with a four-position semaphore-arm, a pair of motor-arms and differential connections between the motor-arms and the semaphore-arm to cause said motor-arms to impart different degrees of movement to the semaphore-arm operatively related thereto, of a pair of rotary disks, links connecting the disks with the motor-arms, and means for adjusting the link connections toward or from the axis of the adjacent motor-arm, whereby the throw of said arm may be regulated.

13. In a block-signal system for railways, the combination with a semaphore-arm, and a pair of independent swinging motor-arms operatively related thereto to move the semaphore-arm positively in both directions, of motors operatively connected with the motor-arms, and means for regulating the relative throw of said arms.

14. In a block-signal system for railways, the combination with a swinging semaphore-arm, a connecting-rod extending therefrom and provided with a pinion, and a pair of motor-arms provided with locking-heads, of racks engaging the pinion and connected to the motor-arms at different distances from the axes thereof, a pair of independent motors, rotary disks geared to

the motors, links eccentrically connected to the disks and terminally connected to the motor-arms, a pair of detents associated with each of the locking-heads, electromagnets for operating the detents, a motor-circuit for each motor and each including a detent-operating magnet, a shunt-terminal for each motor-circuit, each shunt-terminal including a detent-operating magnet, reversed generators in the motor-circuits and the shunt-terminals thereof, and a make-and-break device in each of the motor-circuits.

15. The combination with a signal, of a plurality of independent reversible motors operatively connected to the signal to move the same to different set positions, and means for starting each motor to move the signal positively in either direction independently of any other motor.

16. The combination with a signal device, of a plurality of independent reversible motors each of which is connected to the signal device to operate the same positively in both directions independently of the other motor, and means whereby movement imparted to the signal device by one motor is greater than that imparted by the other.

17. The combination with a signal device, of a plurality of independent reversible motors and means operated thereby for imparting different degrees of movement in the same direction to the signal, and independent controlling devices for said motors.

18. The combination with a signal device, of a plurality of independent motors, differential connections between the motors and signal for imparting different degrees of movement in the same direction to the signal, and separate independent controlling devices for said motors.

19. The combination with a signal device, of a plurality of reversible motors, independent differential connections between the signal device and the motors to move said device in either direction without moving the other motor, whereby the signal device may be moved a given distance in either direction and subsequently moved a different distance in the same direction by the successive operation of the motors in any desired order.

20. The combination with a signal, of a plurality of locking devices therefor, a plurality of motors, differential connections, each operated by a motor to move the signal in both directions independently of the other, and separate electrical controlling devices, each of which is common to a locking device and motor and includes means for starting the motor in either direction.

21. In a block-signal system for railways, the combination with a signal device, and a pair of independent operating-motors for moving the signal device in the same direction to different points, of a pair of locking devices associated with each motor to lock the signal in its set positions, and an independent motor-circuit for each motor, each of said circuits including a generator and an electromagnet controlling the operation of one of the locking devices of the adjacent motor.

22. The combination with a signal device, of a plurality of independent motor-arms, and gearing connecting the device to the arms at different distances from the axes of the latter, so that one motor-arm may operate the semaphore-arm a greater distance than the other, and means for moving the motor-arms positively in both directions.

23. The combination with a four-position signal, of operating mechanism for moving said signal the distance between three positions, and separate independent operating mechanism for moving the signal independently in the same direction the distance of two positions, whereby the signal may be moved from "safety" to "danger," and then to "extreme danger" by the successive action of the operating mechanisms, or from "safety" to "caution" and then to "extreme danger" when said mechanisms are operated in reverse order.

24. The combination with a signal, and two operating means positively operated in each direction, and a connection between the signal and each operating means, whereby the signal may be moved by the independent operation of each means or by the conjoint operation thereof.

25. The combination with a signal, and two operating means positively operated in each direction, of a connection between the signal and each operating means, whereby the signal may be moved by the independent operation of each means, or by the conjoint operation thereof, and locking means for the signal.

26. The combination with a signal, and two operating means positively operated in each direction, of a connection between the signal and each operating means, whereby the signal may be moved by the independent operation of each means, or by the conjoint operation thereof, and separate locking devices associated with the two operating means to retain the signal in its set positions.

27. The combination with a four-position signal, and two operating means positively operated in each direction, and differential connections between the signal and said operating means, whereby the signal may be moved from "safety" to "caution," or from "safety" to "danger" by the independent operation of one or the other of said means, or from "safety" to "extreme danger" by the conjoint operation thereof.

28. The combination with a signal, of a pair of operating devices, means whereby one of said devices will shift the signal twice the distance of the other in either direction, and locking devices for locking the operating devices to retain the signal in its set positions.

29. In a block-signal system for railways, the

combination with a positively-operating signal device, of a pair of motors, motor-arms operated thereby, means whereby one of the arms will shift the signal in either direction twice the distance which said signal is shifted by the other, a locking-head on each arm, a pair of locking devices associated with each head, controlling mechanism for each motor and its associated locking devices, each of said controlling mechanisms including a motor-circuit having a battery therein and also having an electromagnet disposed to operate one of the locking devices, a shunt-terminal for said motor-circuit including a reversed battery and an electromagnet disposed to operate the other locking device, and a relay for closing the circuit through either generator and magnet whereby the motor may be operated in either direction and the signal device locked in either of its set positions.

30. The combination with a signal, of a plurality of motors, differential connections whereby one motor will impart a longer stroke to the signal than the other, and locking devices to lock the signal in position.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

LOUIS C. WERNER.

Witnesses:

K. A. BRENNAN,

J. G. CALHOUN.