No. 795,322. PATENTED JULY 25, 1905.

L. S. WALLE.

RAILWAY BLOCK SIGNAL SYSTEM.

APPLICATION FILED DEC. 29, 1903.

4 SHEETS—SHEET 1.

Fig. 2

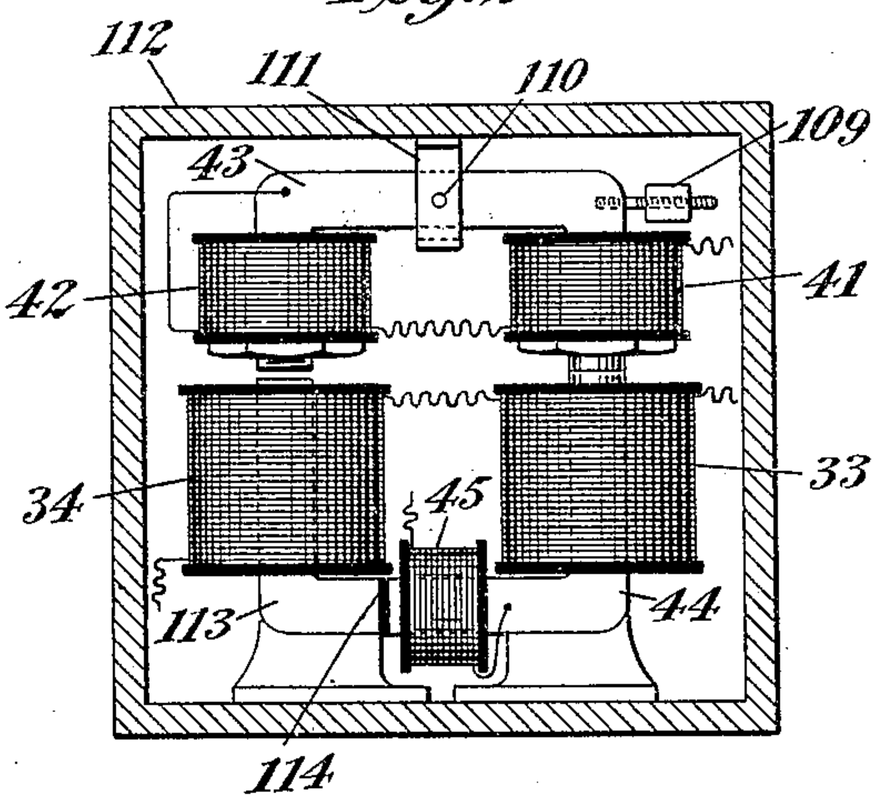


Fig. 1

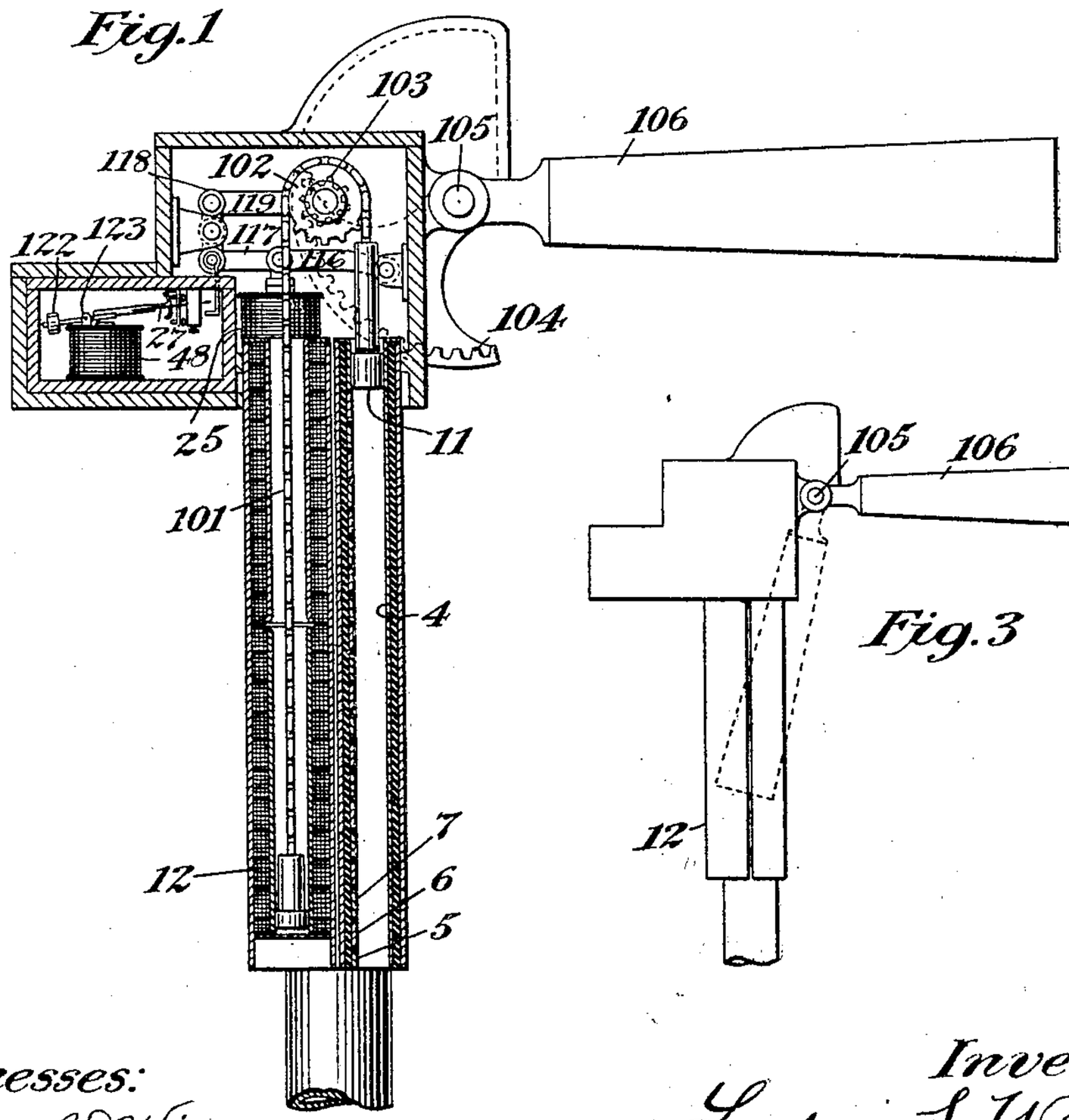


Fig. 3

Witnesses:
Chas. D. King.
Fridtjof Jelsen

Inventor:
Ludwig S. Walle
By his Attorney
Lewis J. Doolittle

No. 795,322. PATENTED JULY 25, 1905.

L. S. WALLE.

RAILWAY BLOCK SIGNAL SYSTEM.

APPLICATION FILED DEC. 29, 1903.

4 SHEETS—SHEET 2.

Fig. 4

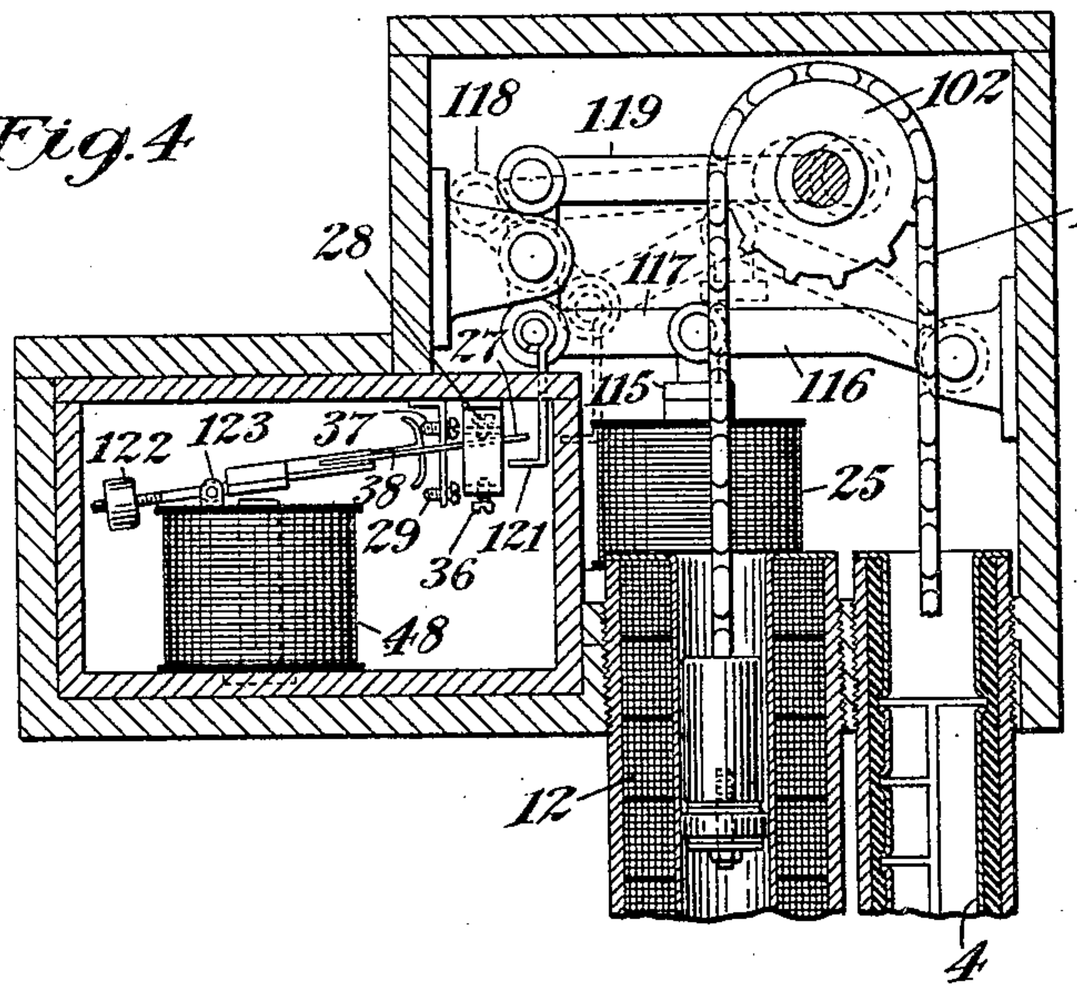
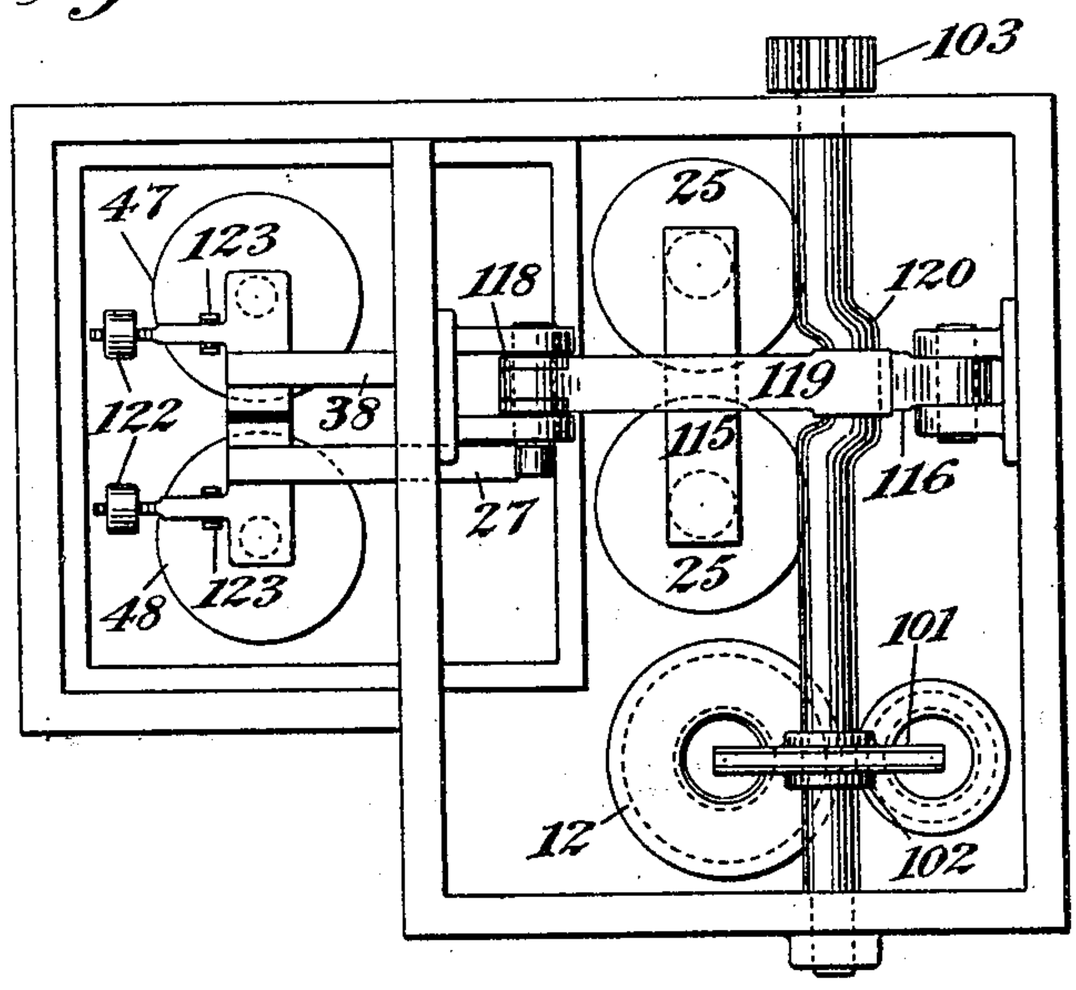


Fig. 5



Witnesses:
Chas. D. King.
Fridtjof Jebsen

Inventor:
Ludwig S. Walle
By his Attorney
Lewis J. Doolittle

No. 795,322. PATENTED JULY 25, 1905.

L. S. WALLE.

RAILWAY BLOCK SIGNAL SYSTEM.

APPLICATION FILED DEC. 29, 1903.

4 SHEETS—SHEET 3.

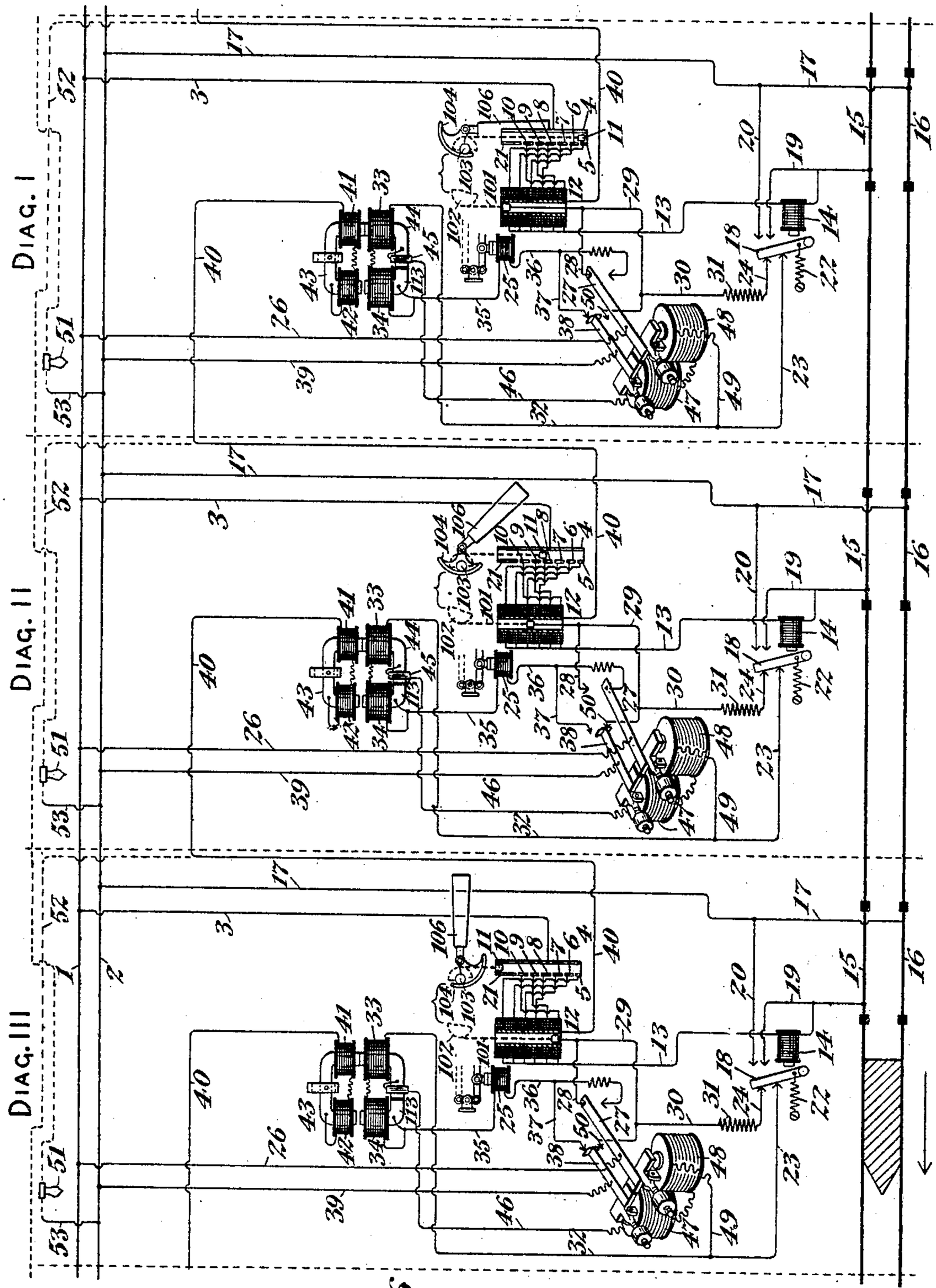


Fig. 6

Witnesses:
Chas. D. King.
Fridtjof Jebsen

Inventor:
Ludwig S. Walle
By his Attorney
Lewis J. Doolittle

No. 795,322. PATENTED JULY 25, 1905.

L. S. WALLE.

RAILWAY BLOCK SIGNAL SYSTEM.

APPLICATION FILED DEC. 29, 1903.

4 SHEETS—SHEET 4.

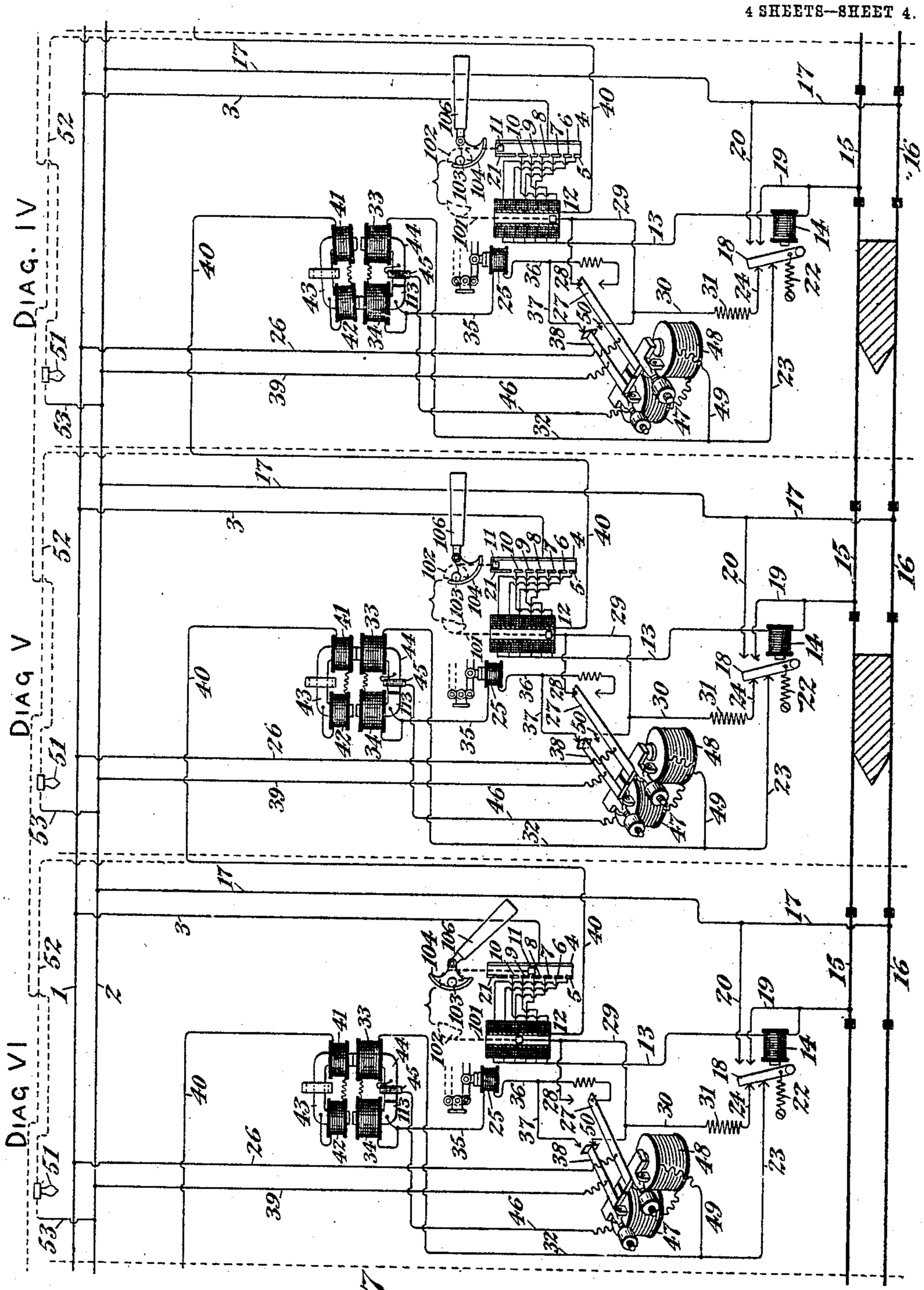


Fig. 7.

Witnesses:
Chas. D. King.
Fridtjof Jelsen.

Inventor:
Ludwig S. Walle
By his Attorney
Lewis J. Doolittle

UNITED STATES PATENT OFFICE.

LUDWIG S. WALLE, OF BROOKLYN, NEW YORK, ASSIGNOR TO FRIDTJOF JEBSEN, OF BERGEN, NORWAY.

RAILWAY BLOCK-SIGNAL SYSTEM.

No. 795,322. Specification of Letters Patent. Patented July 25, 1905.

Application filed December 29, 1903. Serial No. 187,076.

To all whom it may concern:

Be it known that I, LUDWIG S. WALLE, a subject of the King of Norway and Sweden, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Railway Block-Signal Systems, of which the following is a specification.

This invention relates to a railway signaling device known as a "block-signal," and is of the type described as a "three-position" signal. In systems of this type the semaphore-arm stands horizontal for the stop position and drops to forty-five degrees for the caution position and to the vertical for the free position.

The object of this invention is to provide a device which shall be simple in its construction and positive in its action to operate a semaphore-signal, as above stated. This semaphore is placed on a post at the side of the track in the usual manner. To accomplish this result, I have provided a solenoid operated by means of a series of coils which are connected into circuit automatically as the core is drawn down. This core is attached to a chain or other suitable means passing over a sprocket or pulley, having a counterweight attached to the other end thereof. This counterweight also carries a switching device for controlling the current in the solenoid-coil. Attached to the shaft carrying the sprocket is a holding device for controlling the rotation thereof, which is in the nature of a toggle-joint held by an electromagnet which when the current flows through the coil holds the toggle and prevents the shaft from rotating. This shaft is connected to the semaphore-shaft, and consequently controls the position of the semaphore.

Referring to the drawings, Figure 1 represents a sectional view of the solenoid and counterweight, showing the semaphore-arm and connecting part in the horizontal or stop position. Fig. 2 represents a sectional view of the reversing-current device, which is used to control the direction of the flow of the current in the system, as will be seen and described in connection with the diagram. Fig. 3 represents an outline view of the mechanism, showing the semaphore in the stop position and also illustrating the position to which the semaphore will drop when the line is out of order by reason of broken connections, &c., by the dotted position. Fig. 4 represents an enlarged sectional view of the upper part of the solenoid mechanism shown in Fig. 1 and illustrates the operation of the toggle-joint holding device, which is shown in full lines as held by the electromagnet and in the dotted position when the current is broken in the holding-magnet, allowing the shaft carrying the sprocket-wheel to rotate. Fig. 5 is a plan view of Fig. 4. Fig. 6 illustrates in diagrammatic form the connections between the different parts of this system as they stand when the train has just passed the signal-post shown under diagram at the left. For convenience these diagrams are numbered I, II, and III, representing the connections of the apparatus on three consecutive signal-posts, which it is understood may be placed at any distance apart. In the connection shown the train has just passed post No. III. Fig. 7 is a diagram of the connections similar to Fig. 6, with the exception that the connections are shown as two trains are following one block apart, one having just passed signal-post No. V and the second train having just passed post No. IV.

The same reference-numbers refer to corresponding parts in all views.

The operation of the different parts of this system is as follows:

Referring to Fig. 1, a solenoid is shown at 12 and a counterweight at 11, connected by a chain 101, passing over a sprocket-wheel 102, which is mounted on a shaft carrying a small gear 103 and a gear meshing 104, which is in turn connected to the semaphore-shaft 105, which carries the semaphore 106. The counterweight 11 forms a connection between the contact-strip 4 on the one side and contact connections, such as 5, &c., on the other for connecting the current successively into the solenoid-coils as the counterweight is drawn up and the solenoid-core 12 drawn down. This will be seen more clearly by referring to the diagram in Fig. 6.

Referring to Fig. 2, which is the reversing-current device, I have shown at 41 and 42 coils of the ordinary form, which are connected in series and are in turn connected to a U-shaped core 43. This core is pivoted at 110 to a suitable bracket 111, attached to the outer case 112, which allows the core to oscillate according to the change of polarity. At 33 and 34 are shown similar coils, also connected in series, which act in a similar manner upon a U-shaped core 44 and 113, with the exception

that this core is electrically insulated at 114 one side from the other and is fixed in position. At 45 is shown a small auxiliary coil which acts upon core 113 to counteract any residual magnetism in the same. It is seen that this coil is connected in series with coils 41 and 42 when the upper core 43 stands in the position as shown, which is the normal position either with no current flowing, when it is held as shown by counterweight 109, or when only one train passes two consecutive blocks, as will be explained more fully hereinafter.

In Fig. 3 is shown in dotted position the semaphore as it stands when the circuit is broken, thus allowing the counterweight 11 to fall to its lowest position.

Referring to Figs. 4 and 5, I have illustrated a holding-magnet 25, which when current flows holds the connecting-piece 115, which in turn is connected to the toggle-joint arms 116 and 117, preventing the same from rising to the dotted position shown, and so holding the connecting-lever 118 and link 119, which is connected to an offset in the shaft, forming a crank, (better shown in Fig. 5 at 120,) which prevents the same from turning. It is seen that as soon as the current in a holding-magnet 25 is broken the weight of the semaphore-arm will cause this shaft to rotate, not being held by the toggle formed by 116 and 117. To insure a more certain action, I have shown two holding-magnets 25. In the operation of the device the current is broken only for an instant, and so to insure the breaking of the toggle, allowing the semaphore-arm to drop, I have provided a stop at 121, which is attached to lever 118, which prevents the connecting-blade 27 from being drawn to its lowest position and making the circuit again through the holding-magnet 25 until the shaft has completed one revolution, which corresponds to a movement of the semaphore-arm of forty-five degrees. The counterweight 122 keeps the contact-blades 27 and 38 in their upper position unless the current flows in magnets 47 and 48, when they are drawn temporarily to the lower position and held as long as current flows in these coils. These contact-blades are pivoted at 123 and are independent in their action, blade 27 being held from being drawn to its lower position by stop 121, while blade 38 is immediately drawn to its lowest position when current flows in the coils. The construction of blade 27 is such that the circuit is at once broken between it and contact 28 and is not made again until it reaches its lowest position in connection with contact 36, while blade 38 is of such construction that the circuit between it and contacts 37 and 29 is never broken completely, but is open between 38 and 29 when the blade stands in its upper position and is open between 38 and 37 when the blade stands in its lower position. The operation of this part of the mechanism and the function of these different parts are more clearly seen in connection with the diagram in Figs. 6 and 7.

The operation of the system is as follows: A train passing over the insulated portions of track 15 and 16, as shown under diagram No. III in Fig. 6, closes the solenoid-circuit, and current flows from the positive line-wire 1 to wire 3, to contact 4, through the sliding contact 11, which starts at the lower position, and successively through contacts 5, 6, 7, 8, 9, and 10 to the corresponding solenoid-coils, thus drawing the solenoid 12 down to its lowest position and raising the semaphore to the stop position, as shown in diagram No. III. From the solenoid-coil the current flows through wire 13 to coil 14, to rail 15, through the wheels of the train to rail 16, to wire 17, to the negative line-wire 2. By means of coil 14 the contact-lever 18 is drawn over when the current flows in the coil, thus opening the circuit through the hold-magnet 25 and closing the circuit between wires 19 and 20. This results in a continuous flow of current in the solenoid-circuit after the train has passed until the solenoid 12 reaches its lowest position and the sliding contact 11 reaches its upper position, cutting out the solenoid-circuit. Contact 21 is not connected in circuit and serves merely as a guide for the contact 11 in its upper position. When the solenoid-circuit is open, as described, and the semaphore stands in the stop position, the contact-lever 18 is returned to its normal position by means of a spring 22, thus closing the circuit between wires 23 and 24 and allowing the current to flow in the hold-magnet circuit from the positive line-wire 1 through 26 to lever 27, to wire 28, to 29, to 30, through resistance 31 to 24, to contact-lever 18, to wire 23, to 32, to coils 33 and 34, to wire 35, through the hold-magnet 25, wires 36 and 37, to contact-lever 38 and wire 39 to the negative line. This holds the semaphore in the stop position until the train passes the next signal ahead. At the same time contact being made by the solenoid-core 12 allows the current to flow through line 40 to coils 41 and 42 under diagram No. II, through 43 and 44 to coil 45, to wire 46, to cut-out coils 47 and 48, to wire 49, to wire 32, through coils 33 and 34, to wire 35, through hold-magnet 25, to 36 and 37, to contact-blade 38, which stands in its upper position at first, and through wire 39 to the negative line 2, opening the hold-circuit and allowing the semaphore to drop to the forty-five-degree or caution position. When the cut-out blades 38 and 27 are brought to the lowest position in diagram No. II, as just described, the connection between 27 and 28 is broken and wire 40 is connected to the negative side of the line through the blade 38 and wire 39. This reverses the direction of the current in wire 40 and also allows the cut-out blades 27 and

38 in diagram No. I to return to the upper position by means of their counterweight, thus opening the hold-magnet circuit through 25 and allows the semaphore to drop to the free position, as shown in diagram No. I, where it is held by the current in the circuit through the hold-magnet 25 when the cut-out blade 27 reaches its upper position in the same manner as described for diagram No. III. The resistance 31 is large enough to prevent the flow of current in coils 47 and 48 sufficient to draw the blades 27 and 38 down again. Should the wires become broken or the circuits fail to work, the counterweight 11 will bring the semaphore past the free position, as the hold-magnet 25 will no longer prevent the rotation of the shaft, and will at once indicate that the system is out of order. This is shown in dotted position of the semaphore in Fig. 3.

In the foregoing description I have assumed that only one train is passing any two consecutive signal-posts. Referring now to Fig. 7, I have illustrated in diagrams No. IV, V, and VI the connections as they stand when two trains follow one another one block apart, one train having just passed the post under diagram No. IV, while the train ahead has just passed No. V. The signal and connections under No. VI are shown in the caution position to illustrate the connections in IV after a train has passed post V and just before the second train passes IV. It is in this instance that the function of the reversing-current device, which was described under Fig. 2, is especially evident. It is seen by referring to the description and diagram under Fig. 6 that when the current is reversed in coils 41 and 42 when the signal drops from caution to free position, as shown under II and I, respectively, that it is also reversed in coils 33 and 34, and consequently the upper pivoted core 43 does not change its position.

Referring now to Fig. 7, it is seen that when the first train passes signal V and brings that signal to stop position and signal IV to "caution" the passing of a second train by signal IV will open switch 18, and consequently open the circuit through coils 47 and 48, which hold 38 and 27 in the down position, allowing 38 and 27 to go to the upper position by means of their counterweights, and thus reversing the circuit through coils 33 and 34 on account of the negative connection from wire 32 being changed to positive from blade 27 through wire 28, to 29, to 30, to resistance 31, to 24, to blade 18, to wire 23, to 32, to coils 33 and 34, to wire 35, to coil 25, to 36 and 37, to blade 38, to 39, to the negative line. As the current remains in the same direction in coils 41 and 42, the polarity of core 44 being changed causes core 43 to move on its pivot, breaking the connection between 43 and 44 and making a new condition between 43 and 113 to the negative side of the line.

At 51 in Figs. 6 and 7 is shown a lamp which may be mounted so as to illuminate the post which the train is approaching. The connection 53 is always on the negative line, while the connection 52 is connected through 40 to the positive line when the signal is at stop position, and as the lamp is on the next post ahead it will light up and enable the engines to see the position of the signal which the train is approaching. As the signal drops to caution position the wire 40 is connected to the negative sides of the line and no current will flow in the lamp.

It is understood that this system is operative without the lamp-circuits; but it may be found a desirable addition thereto.

I have used the term "semaphore" to designate the signal used to illustrate my invention; but it is evident that any form adapted to this use may be substituted. This is also the case with the solenoid shown in the drawings, which may be of various other forms and design adapted to operate by means of an electric coil in which the flow of current is controlled by the train passing a predetermined point. I do not limit myself to the details of construction of the several devices used, as they are only intended as illustrations of preferred forms of devices adapted to perform their several functions in the signal system and from which it will be evident that many changes in detail of construction and design may be made without departing from the scope of this invention.

What I claim is—

1. In a block-signal system, the combination with an electrically-operated semaphore-signal, of a power-circuit, an electric solenoid acting intermittently with a counterweight to operate said signal successively and intermittently through intermediate positions, and means for closing the solenoid-circuit when a train passes a predetermined point.

2. In a block-signal system, the combination with a semaphore-signal, of a power-circuit, an electric solenoid comprising a series of coils connected successively in a circuit as the solenoid-core is advanced, means for closing the solenoid-circuit when a train passes a predetermined point, and means for holding the semaphore-signal in the position indicating the location of the train.

3. In a block-signal system, the combination with a semaphore-signal, of a power-circuit, an electric solenoid comprising a series of coils connected successively into circuit and automatically cut out of circuit as the core advances, means for closing the solenoid-circuit when a train passes a predetermined point, and means for holding the semaphore-signal in the position indicating the location of the train.

4. In a block-signal system, the combina-

tion with a semaphore-signal, of a power-circuit, an electric-solenoid for operating said signal, a counterweight which tends to bring the solenoid-core to its initial position and the semaphore-signal to its corresponding position when current does not flow in the solenoid-coils, means for closing the solenoid-circuit when a train passes a predetermined point, and means for holding the semaphore-signal in the position indicating the location of the train.

5. In a block-signal system, the combination with a semaphore-signal, of a power-circuit, an electric solenoid for operating said signal, means for closing the solenoid-circuit when a train passes a predetermined point, and a toggle-joint device having a coexistent movement for holding the semaphore-signal in the position indicating the location of the train.

6. In a block-signal system, the combination with a semaphore-signal, of a power-circuit, an electric solenoid for operating said signal, means for closing the solenoid-circuit when a train passes a predetermined point, and a toggle-joint device having a coexistent movement in which the toggle is held and locked by an electromagnet thus holding the semaphore-signal in the position indicating the location of the train.

7. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, and a toggle-joint device having a coexistent movement for holding the signal in the position indicating the location of the train.

8. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, and a toggle-joint device having a coexistent movement in which the toggle is held and locked by an electromagnet thus holding the signal in the position indicating the location of the train.

9. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, a toggle-joint device having a coexistent movement in which the toggle is held and locked by an electromagnet, and means for breaking the current in said electromagnet when the train passes a predetermined point allowing the signal to drop to its next position indicating the location of the train.

10. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, a toggle-joint device having a coexistent movement in which the toggle is held and locked by an electromagnet, means for breaking the current in said electromagnet when the train passes a predetermined point, and means to prevent the circuit being made in the said electromagnet until the signal has dropped to its next position indicating the location of the train.

11. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, a toggle-joint device having a coexistent movement in which the toggle is held and locked by an electromagnet, an electric-operated switch controlled by the succeeding signal operating to open the circuit in said electromagnet allowing the signal to drop to its next position indicating the location of the train.

12. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, a toggle-joint device in which the toggle is held and locked by an electromagnet, an electric-operated switch controlled by the succeeding signal operating to open the circuit in said electromagnet, and a stop operated by said toggle-joint device preventing said switch from closing until the signal has dropped to its next position indicating the location of the train.

13. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, and a toggle-joint device in which the toggle is held and locked by an electromagnet, a third wire forming a circuit between said electromagnet and the succeeding signal, and means for reversing the current in said third wire and releasing the toggle allowing the signal to drop to its next position indicating the location of the train.

14. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, and a toggle-joint device in which the toggle is held and locked by an electromagnet, a third wire forming a circuit between said electromagnet and the succeeding signal, and an electric-operated switch controlled by the succeeding signal and operating to reverse the current in said third wire and releasing the toggle allowing the signal to drop to its next position indicating the location of the train.

15. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, and a toggle-joint device in which the toggle is held and locked by an electromagnet, a third wire forming a circuit between said electromagnet and the succeeding signal, means for reversing the current in said third wire when one train passes two consecutive signals and releasing the toggle allowing the signal to drop to its next position, and means for preventing the reversal of said current when two trains follow each other in consecutive blocks thus holding the signals in positions indicating the location of the trains.

16. In a block-signal system, the combination with a semaphore-signal, means for operating said signal, a toggle-joint device in which the toggle is held and locked by an electromagnet, a third wire forming a circuit between said electromagnet and the succeeding signal, means for reversing the current in said third

wire when one train passes two consecutive signals, and a reverse-current device comprising a pivoted core and a fixed core through which the current in the holding-circuit passes and in which the polarity is reversed by the relative reversal of the direction of the current in the coils surrounding said cores resulting in the pivoted core being attracted to the opposite side thus reversing the connection in said holding-circuit and preventing the reversal of said current when two trains follow each other in consecutive blocks thus holding the signals in positions indicating the location of the trains.

17. In a block-signal system, the combination with a track-signal, of a power-circuit, an electric solenoid for operating said signal, insulated track-sections connected to said power-circuit and through which the solenoid-circuit is closed by the passage of a train, means for maintaining the solenoid-circuit after the train has passed the insulated track-sections, and means for opening said circuit when the signal has reached the position indicating the location of the train.

18. In a block-signal system, the combination with a track-signal, of a power-circuit, an electric solenoid for operating said signal, insulated track-sections connected to said power-circuit and through which the solenoid-circuit is closed by the passage of a train, a switch operated by a coil in said solenoid-circuit for maintaining the solenoid-circuit after the train has passed the insulated track-sections, and a switch operated by the solenoid for opening said circuit when the signal has reached the position indicating the location of the train.

19. In a block-signal system, the combination with an electrically-operated semaphore-signal, of a power-circuit, an electric solenoid, means for closing the circuit through the solenoid to set said signal in a predetermined position, and means for opening the solenoid-circuit when a train passes a predetermined point and allowing a counterweight to operate the signal successively and intermittently through intermediate positions to its original position.

20. In a block-signal system, the combination with an electrically-operated semaphore-signal, of a power-circuit, an electric solenoid, means for closing the circuit through the solenoid to set said signal in a predetermined position, and means for opening the solenoid-circuit when a train or trains pass a predetermined point and allowing gravity to operate the signal successively and intermittently through intermediate positions to its original position.

21. In a block-signal system, the combination with an electrically-operated semaphore-signal, of a power-circuit, an electric solenoid, means for closing the circuit through the solenoid whenever a train passes a predetermined point to set said signal in a predetermined position, and means for opening the solenoid-circuit when a train has passed a predetermined point and allowing a counterweight to operate the signal successively and intermittently through intermediate positions to a position indicating the location of the train and from which position said signal may be operated by said solenoid, substantially as described.

Signed at New York, in the county of New York and State of New York, this 10th day of December, A. D. 1903.

LUDWIG S. WALLE.

Witnesses:

LEWIS J. DOOLITTLE,

FRIDTJOF JEBSEN.