No. 619,406. Patented Feb. 14, 1899.

C. HANSEL & P. FREEMAN.

RAILWAY SIGNAL SYSTEM.

(Application filed Oct. 19, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1

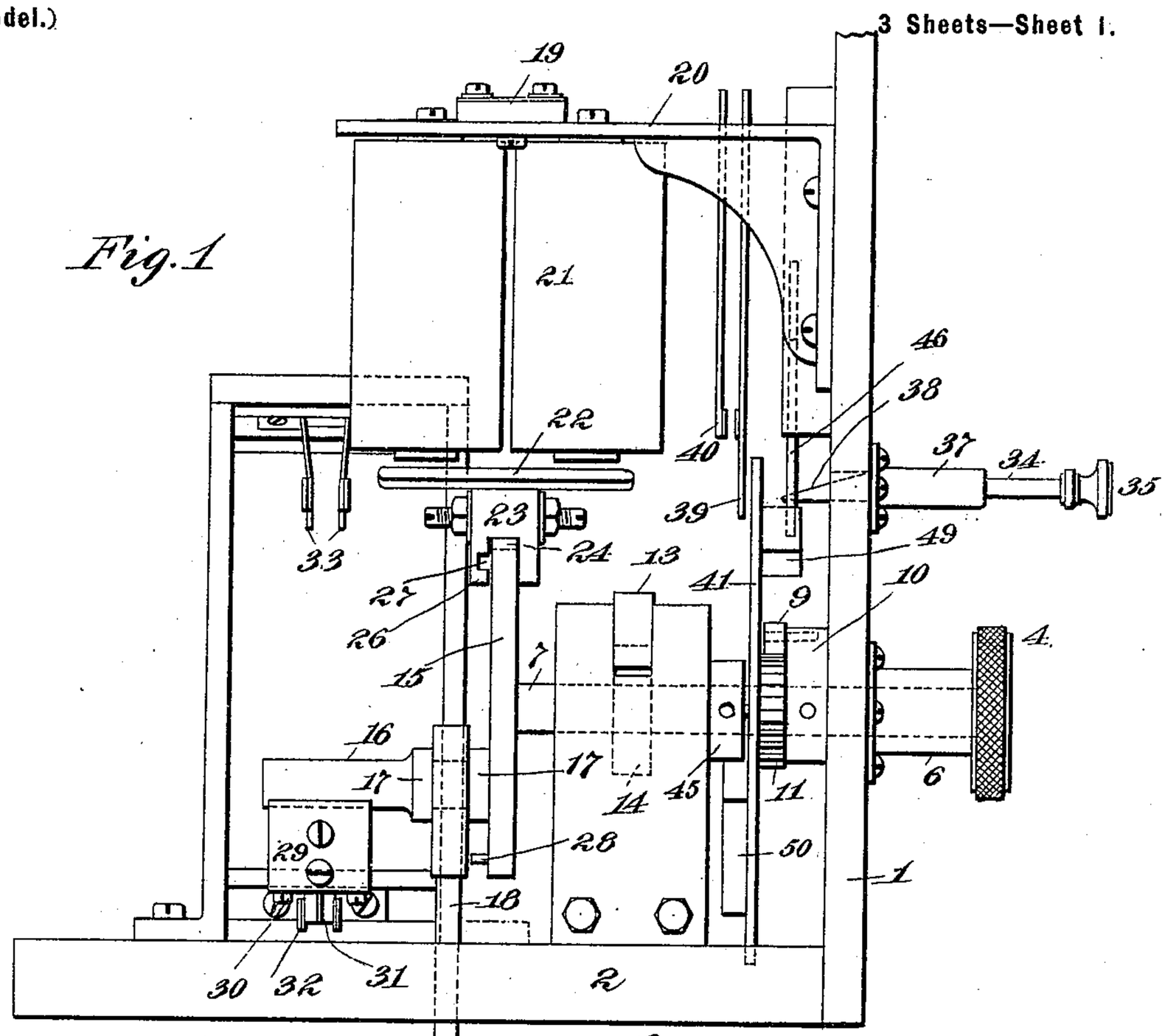

Fig. 2

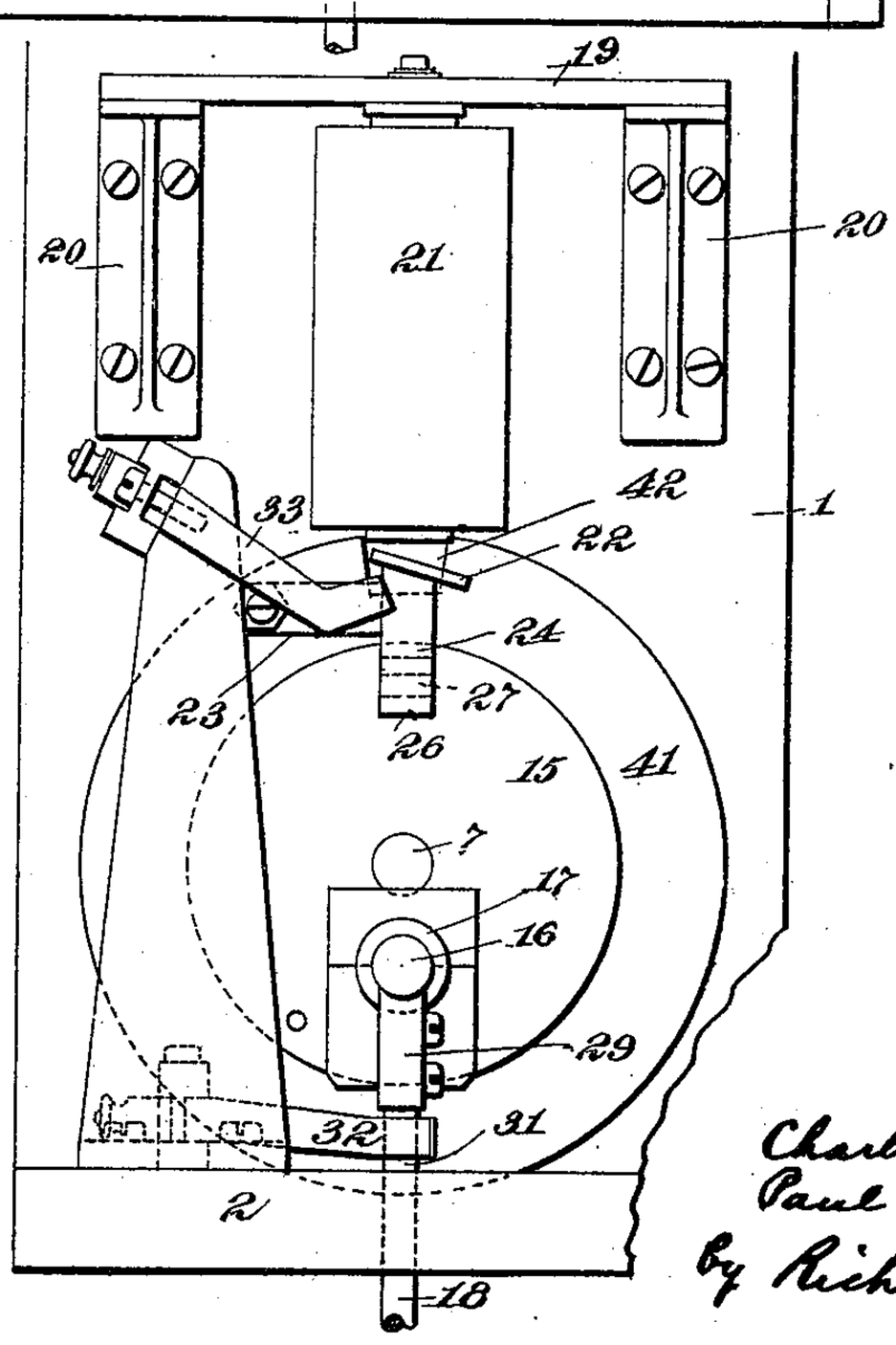

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Fig. 4

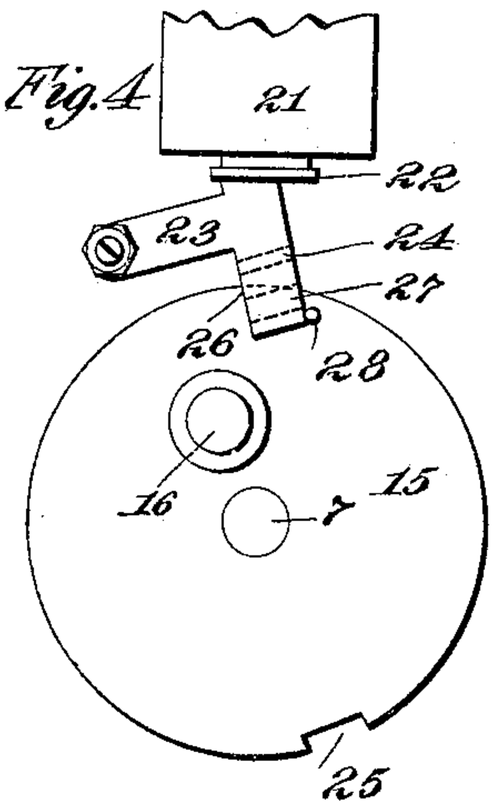


Fig. 6

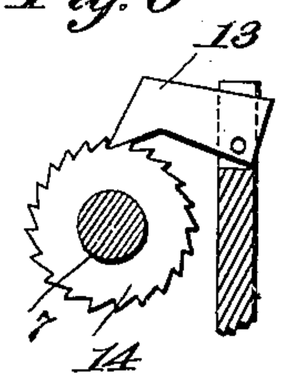


Fig. 5

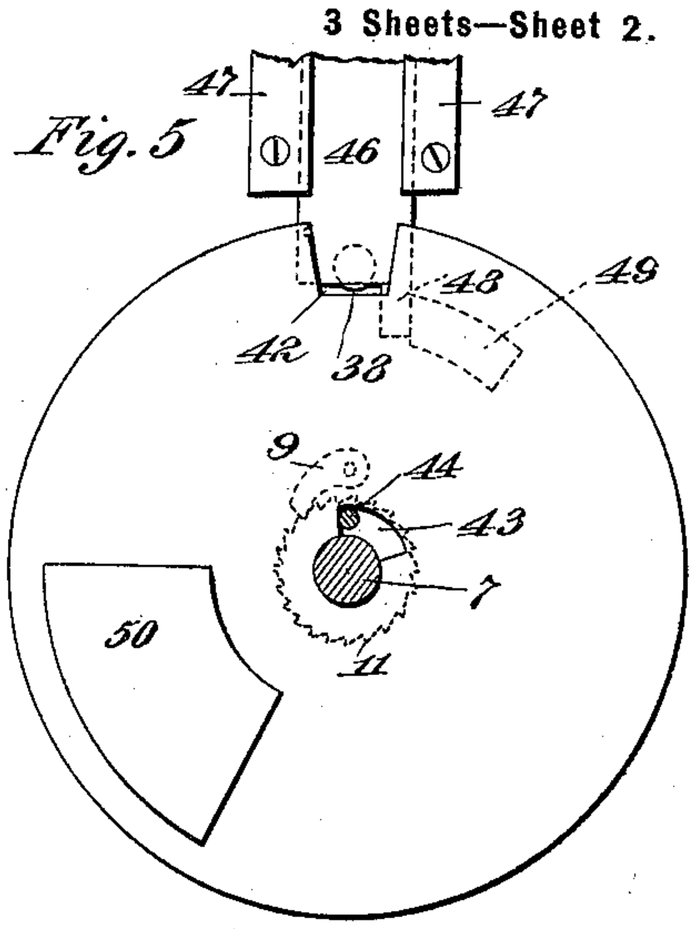
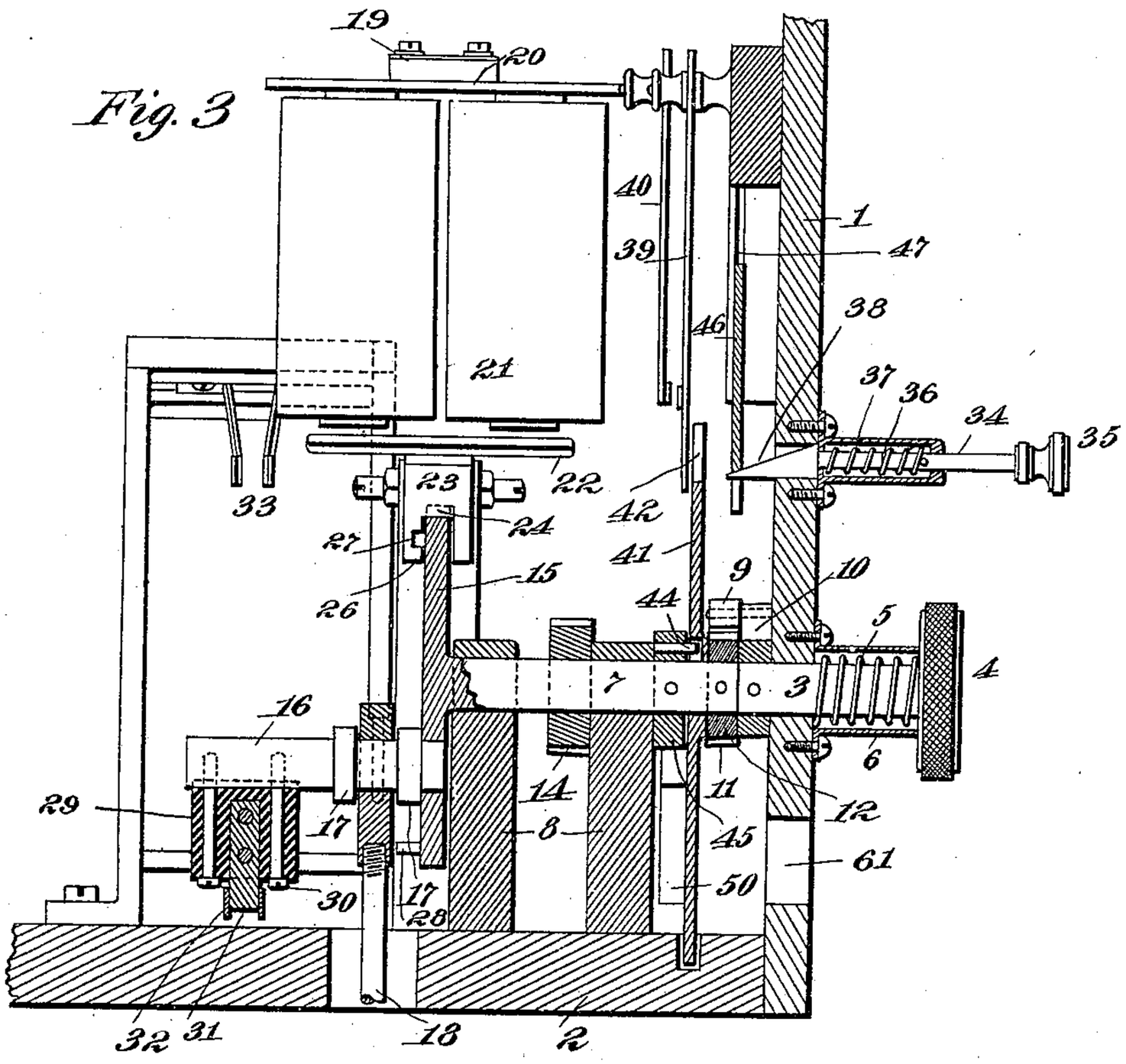


Fig. 3



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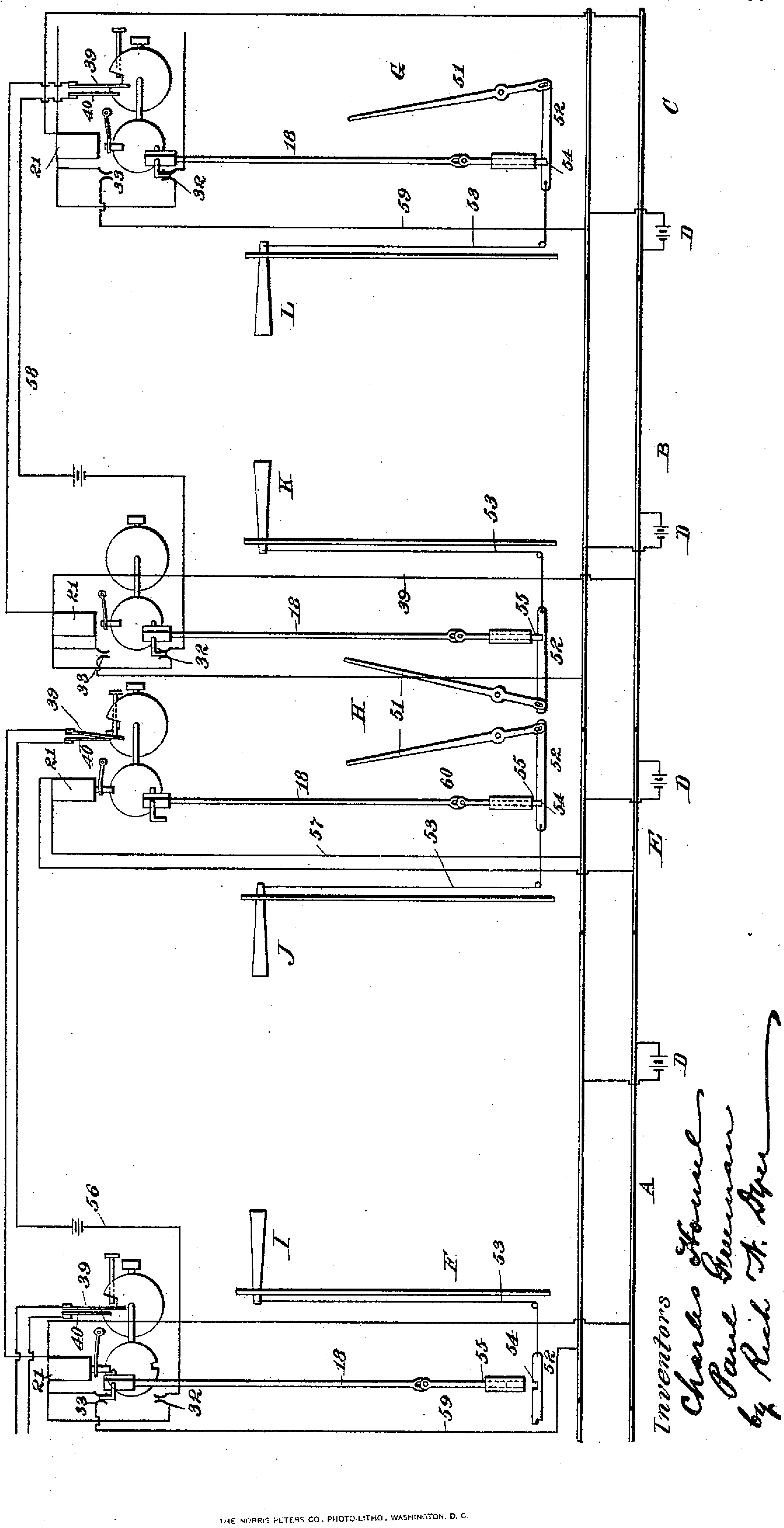

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UNITED STATES PATENT OFFICE.

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RAILWAY SIGNAL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 619,406, dated February 14, 1899.

Application filed October 19, 1898. Serial No. 693,972. (No model.)

To all whom it may concern:

Be it known that we, CHARLES HANSEL and PAUL FREEMAN, citizens of the United States, and residents of the borough of Manhattan, in the city, county, and State of New York, have invented certain new and useful Improvements in Railway Signal Systems, of which the following is a specification.

Our invention relates to various improvements in railway signal systems.

Our systems are adapted for use in an auxiliary relation to block-signals at present employed.

The objects of our invention are to provide a supplementary or auxiliary system for use in connection with block-signals and by which absolute safety of operation may be obtained.

In carrying out our invention we provide an improved locking device for each signal, the lock preferably coöperating mechanically, either directly or indirectly, with the hand-lever by which the signal is set to the desired position. The lock for each signal is controlled by the operator at the succeeding block or station and not by the operator of the signal which is locked. Each locking device is also provided with circuit-closing mechanism, by means of which the locking device of the preceding signal may be released when called for, which circuit-closing mechanism is so constructed that after it has been operated to release the lock at the preceding station it cannot be again actuated until a train has passed the station at which it is located.

The various details of construction and arrangement are illustrated in the accompanying drawings, to which attention is directed.

In the drawings, Figure 1 is a side elevation of an apparatus embodying our present improvements, the inclosing casing of the apparatus being removed; Fig. 2, a rear view of the same; Fig. 3, a vertical sectional view taken on the line of the main operating-shaft; Fig. 4, a separate detailed view of the locking-disk; Fig. 5, a similar view of the disk which coöperates with the circuit-closing mechanism; Fig. 6, a detailed view of the main operating-shaft, ratchet, and pawl; and Fig. 7, a diagrammatic view illustrating a single line of track with four blocks and three stations, the central station controlling two signals, as will be presently explained.

In all of the above views corresponding parts are represented by the same numerals and letters of reference.

1 is a suitable front plate of a casing, which incloses the mechanism of the locking device, the casing being removed for purposes of illustration, but in use snugly inclosing the operating parts, so that they cannot be reached or tampered with.

2 is a base-bed.

Mounted in the plate 1 is a stub-shaft 3, having a suitably knurled or roughened finger-piece 4 at its outer end, by which the said shaft may be turned. The shaft 3 is normally returned, after being operated, by a spring 5, which surrounds it and is concealed in a sleeve 6.

7 is a main operating-shaft, which is mounted in bearings 8 8, secured to the base-bed 2. Forward rotary movement of the shaft 7 is derived from the stub-shaft 3 through a pawl 9, carried on a collar 10, pinned to said stub-shaft and coöperating with ratchet-teeth 11 on a collar 12, pinned to the shaft 7. Backward movement of the shaft 7 is prevented by the engagement of a gravity-pawl 13 with ratchet-teeth 14 on a disk keyed to said shaft and mounted between the two bearings 8 8. On the end of the shaft 7 is a locking-disk 15. This locking-disk carries a wrist-pin 16, having two rings 17 17 thereon, and mounted between said rings is the upper end of a locking-rod 18. This locking-rod is arranged when at its lower position to engage and lock the signal and when in its elevated position to unlock the signal. This may be accomplished in any way—as, for example, by causing the locking-rod 18 to operate a latch, which engages a slot in the signal-lever or in an element moved directly by the signal-lever, as we will presently describe. Mounted above the locking-disk 15 on a cross-piece 19, carried on brackets 20, are the magnets 21, which lock and unlock the disk. The armature 22 of these magnets is mounted on a pivoted lever 23 and is provided with a locking-finger 24, which is adapted to engage in a slot or recess 25 in the disk 15 to lock the same when desired. The lever 23 is also extended down-

ward at 26, which extension is located adjacent to the disk 15 and is provided with a recess 27 therein, through which may pass at the proper time a pin 28, carried on the disk 15. When the armature 22 is attracted, the pin 28 will engage the extension 26 to arrest the movement of the disk; but when the armature 52 is allowed to drop the slot 27 will be brought in alinement with said pin and the latter may pass through the same, allowing the disk to turn.

Carried by the wrist-pin 16 is an insulated block 29, secured in place by screws 30 and carrying a contact-piece 31. This contact-piece 31 is wedge-shaped at its front edge and is adapted to enter and close the circuit between the contact-fingers 32 32 and 33 33, suitably supported from the base 2. We illustrate only two pairs of these contact-fingers, because this is all that is necessary to enable the essential characteristics of our invention to be comprehended; but it will be understood that the said wrist-pin may carry duplicates of the contact-piece 31 to close the contact between other contact-springs for the accomplishment of other results which are desirable in practical signaling work, but which do not require to be specifically explained.

Mounted in the front of the apparatus is a plunger 34, having a thumb-piece 35 at its end and normally held outward by a spiral spring 36, mounted in a sleeve 37. The inner end of the plunger is provided with a wedge 38 thereon, which is adapted to engage a contact-spring 39 to move the latter into engagement with a contact 40. This engagement between the two contact-springs 39 and 40 closes a circuit to a distant station and energizes the magnets 21 thereat to attract the armature 22 and release the disk 15 when desired. In order, however, after the plunger 34 has been pressed to thus unlock the preceding signal and allow the train to enter the block immediately in front of that which is controlled by the apparatus at which the operated plunger is located to prevent a repetition of this operation, we employ a disk 41, mounted on the shaft 7 and having an opening 42 therein, through which the plunger may enter in order to engage the contact-spring 39. This disk is provided with a slot 43, in which works a pin 44, carried by a collar 45 on the shaft 7, so that the disk is allowed a small play with respect to the shaft. The disk is normally locked to maintain the opening 42 in line with the plunger by means of a shutter 46, mounted in ways 47 and having a finger 48, which engages a lug 49 on the disk, as shown in Fig. 5. A counterweight 50 is carried by the disk, so that when the shutter is elevated to release the finger 48 from the lug 49 the disk will be turned, moving relatively to the shaft 47, this relative movement being allowed by the slot 43 working over the pin 44. The wedged inner end 38 of the plunger 34 works underneath the shutter 46 and elevates the same to release the finger 48 from the lug 49, so that when the plunger is retracted by the spring 36 the counterweight 50 will move the disk and carry the opening 42 out of line with the plunger, whereby the plunger cannot again be moved to close the circuit between the contact-springs 39 and 40.

In order that the operation of our improved device may be understood, we illustrate in Fig. 7 a diagrammatic representation of a track having four insulated block-sections, four signals, three stations, and our improved auxiliary apparatus.

A, B, and C represent three block-sections of the usual type, each section being closed on a battery D, as is common. We also illustrate a short section E immediately in advance of the section B. Ordinarily one of these short sections is arranged in advance of each of the ordinary block-sections and is of a very much shorter length than said sections, whereby a train may be brought down to any block-section and be kept stationary in the immediately-preceding short section, as is common. The sections A and C are controlled by stations F and G, respectively, while the sections E and B are controlled by a station H. The signals for the sections A, E, B, and C are designated, respectively, I, J, K, and L. These are ordinary semaphore-arms or any other kind of signals. They operate in any suitable way—as, for example, by means of levers 51, the lower ends of which connect with slide-bars 52, which latter operate the semaphore-signals by wires 53. We illustrate each slide-bar as being provided with a notch 54, with which coöperates a bolt 55, the position of which is determined by that of the locking-rod 18. The magnet 21 of the apparatus at the station F is normally included in a circuit 56, extending through the lower contact-fingers 32 and through the contact-springs 39 and 40 of the apparatus which controls the signal J. The magnet 21 of the apparatus which controls the signal J is included in a track-circuit 57, closed through the block E. Since the signal J is controlled by the same operator as the signal K, the contact-fingers 32 32 and 33 33 are dispensed with, as no distant unlocking of that apparatus is desired. The magnet 21 of the apparatus which controls the signal K is included in a circuit 58, which includes the contact-springs 39 and 40 of the apparatus at the station G and also the contact-springs 32 at its own station. In a similar manner the magnet 21 of the locking device controlling the signal L is adapted to be actuated by the closing of the circuit at the succeeding station. The magnets 21 of the locking devices for the signals I, K, and L are adapted to be energized by a circuit 59, closed on the track-sections A, B, and C, respectively, and adapted to be closed at the contact-fingers 33 33.

In the position of the devices illustrated in Fig. 7 the signals for the several block-sec-

tions are all set to "danger;" but the operating-arm upon the signal I has been unlocked by the release of the bolt 55 from the notch 54. In order that this might be done, the operator at the station F when he observed the train approaching the block A and in order that he might be able to display that signal to "safety" telegraphed or in any other way communicated to the operator at the station H to unlock the signal I. The operator at the station H therefore pressed the plunger 34 to close the circuit 56, that circuit being also closed at the contact-fingers 32 at station F, since the disk 15 was at its normal position, with the locking-rod 18 lowered. The closing of the circuit 56, energizing the magnet 21 for the signal I, attracted the armature thereof to elevate the locking-finger 24 from the notch 25. The operator at the station F could, therefore, then rotate the finger-piece 4 to turn the shaft 3, and through the pawl 9 the shaft 7 was given a partial turn until the pin 28 came into contact with the finger 26, as shown in Fig. 4. In this position the wrist-pin 16 will have passed the vertical center of the disk 15, so that when the disk is again released the weight of the locking-rod will return it to its original position. As soon as the operator at the station F has thus elevated the locking-rod 18 to release his lever and the pin 28 engages the finger 26 to stop further movement of the finger-piece 4 the latter is released and is returned to its normal position by the spring 5, the pawl 9 riding over on the teeth 11. The turning of the shaft 7 by the operator removes the contact-piece 31 from between the fingers 32 to break the circuit 56, and the magnet 21 is momentarily deënergized; but this deënergization takes place after the disk 15 has turned slightly, so that the finger 24 cannot again fall into the slot 25. Before the pin 28 can engage the finger 26 the contact-piece 31 will make contact with the fingers 33 to close the track-circuit of the block A through the magnet 21, which will be again energized, and its armature will be elevated and remain in the position shown in Fig. 4. The signal I being thus unlocked, it can be set to "safety," and the train can enter the block. As soon, however, as the train enters the block A the battery D thereof will be short-circuited, so as to deënergize the magnet 21 and allow its armature to fall away. This brings the slot 27 in line with the pin 28, and the said pin therefore passes through the slot, owing to the return of the disk to its original position by the weight of the locking-bar 18 and the parts carried thereby. By interposing a slotted connection 60 between the locking-bar 18 and the bolt 55 this return movement of the locking-bar is provided for. When, now, the signal I is again set to "danger," indicating the presence of the train in the block-section A, the latch 55 will automatically enter the recess 54 to lock the signal in the "danger" position. When the operator at the station H pressed the plunger 34, the wedge 38 thereof elevated the shutter 46 to release the finger 48 from the lug 49. The weight 50, however, could not turn the disk, because of the presence of the wedge 38 in the opening 42. Immediately, however, as soon as the wedge is withdrawn from the said opening the weight 50 will move the disk by reason of the slot-and-pin connection with the shaft 7, and the opening 42 will therefore be removed from out of line with the wedge. It will therefore be impossible for the operator at the station H to again close the circuit 56 by the depression of the plunger 34. Hence it will be impossible for him to unlock the signal I at the station F while a train is in the block A.

The locking device for the signal J is located in the same tower or cabin as the locking device for the signal K. The former signal is, however, as stated, arranged some distance down the track, depending upon the length of the section E, which is generally from one thousand to fifteen hundred feet. When the block-section E is clear, the battery of that section will be closed through the magnet 21 to keep its armature normally elevated and to normally unlock the disk 15. When, therefore, there is no train in the section E, the operator at H can set the signal J to any desired position, since the disk 15 will not be locked. The operator therefore sets the signal J to "safety," indicating to the engineer that the block E is clear, this being accomplished by turning the handle 4, as before, carrying the pin 28 up into contact with the finger 26. As soon, however, as the train enters the section E the battery thereof is short-circuited, so as to deënergize the magnet and allowing the pin 28 to pass the slot 27, whereby the latch 55 will again descend. When, therefore, the lever 51 for the signal J is moved to set that signal to "danger," it will be automatically locked and will be kept locked while the train is in the section E, since obviously the battery of that section will be short-circuited by wheels, the magnet 21 will be deënergized, and the disk 15 cannot be turned. When the train leaves the section E, the signal J will be again unlocked and can be set to "safety" when desired. In order that the train may enter the section B, it is necessary for the operator at H to signal to the operator at the station G, whereupon the last-mentioned operator closes the circuit 58 at his station to energize the magnet 21 for the locking device of the signal K in the same way that the locking device of the signal I was unlocked by the operator at H. When the operator at H rotates the shaft 7 for the purpose of unlocking the signal J, it will be observed that the pin 44 will engage the end of the slot 43 to carry the disk 41 to its former position, with the lug 49 in engagement with the finger 48, whereby the opening 42 will be again brought in line with the plunger

34. It will therefore be seen that the operator at a station cannot set his advance signal to "safety" without the consent of an operator at a different station; that when the train is on a block a signal set to "danger" cannot be set to "safety;" and that when an operator closes a circuit to unlock a distant signal that operation cannot be repeated until the train has passed his own station and is entirely clear from the distant station. If, for example, it would be possible for the operator at H to unlock the signal I at the station F to allow a train to enter the block A and after the signal I had been set to "danger" to again unlock the said signal while the first train was still in the block A, the apparatus would be objectionable. By providing devices by which the operator at a station is able to unlock a distant signal only once and is not able to repeat that operation until the train has passed his station we remove every possibility of danger from our system.

If desired, the disk 41 may be provided with proper designating numbers or words thereon, which may be observed through an opening 61 in the front of the casing and by which the operator may be positively assured of the correct position of the parts. It will be understood that since the locking devices for controlling the signals J and K are both located at the station H the contact-fingers 39 and 40 of the circuit 56 may be located in connection with either locking device at that station. We illustrate the contact-fingers 39 and 40 for this circuit in connection with the locking device for the signal J simply for the purpose of illustration. While it is convenient that short block-sections, such as E, should be used in connection with each of the main block-sections, it will be understood that such sections may be dispensed with, in which case all of the locking devices will be of the character employed at the stations F and G and will have the same circuit connections.

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

1. In an apparatus of the character described, the combination with a signal and a lock therefor, of a locking-disk for holding said lock in both a locked and an unlocked position, a magnet, an armature therefor which engages and holds the disk both in a locked and unlocked position, and a circuit or circuits for said magnet, by which when energized the disk will be held in an unlocked position and when deënergized the disk will be held in a locked position, substantially as set forth.

2. In an apparatus of the character described, the combination with a signal and a lock which by its weight normally descends to a locked position, of a locking-disk for holding said lock in both a locked and an unlocked position, a magnet, an armature therefor which engages and holds the disk both in a locked and unlocked position, and a circuit or circuits for said magnet by which when energized the disk will be held in an unlocked position and when deënergized the disk will be released to allow the lock to automatically descend to a locked position, whereby the disk will be then held in a locked position, substantially as set forth.

3. In an apparatus of the character described, the combination with a signal and a lock therefor, of a locking-disk controlling said lock, an electromagnet the armature of which engages with said disk to lock the same, and a pin on said disk coöperating with the armature of said magnet to hold the disk in an inactive position, substantially as set forth.

4. In an apparatus of the character described, the combination with a signal and a lock therefor, of a locking-disk connected to said lock, an electromagnet the armature of which engages said disk, a shaft on which the disk is mounted, a handle for turning said shaft in one direction, and a ratchet connection between said handle and shaft, substantially as set forth.

5. In an apparatus of the character described, the combination with a signal and a lock therefor, of a locking-disk connected to said lock, an electromagnet the armature of which engages said disk, a shaft on which the disk is mounted, a handle for turning said shaft in one direction, a pawl-and-ratchet connection between the handle and said shaft, and a spring for returning the handle to its normal position, substantially as set forth.

6. In an apparatus of the character described, the combination with a signal and a lock therefor, of a locking-disk connected with said lock, a magnet for unlocking and locking said disk, a circuit-maker controlling the magnet of a distant station, a plunger for actuating said circuit-maker, and a disk rotatable with the locking-disk and having an opening normally in line with said plunger and circuit-maker, substantially as set forth.

7. In an apparatus of the character described, the combination with a signal and a lock therefor, of a locking-disk connected with said lock, a magnet for unlocking and locking said disk, a circuit-maker controlling the magnet of a distant station, a plunger for actuating said circuit-maker, a disk rotatable with the locking-disk and having an opening normally in line with said plunger and circuit-maker, means for releasing said disk by the movement of the plunger, and a weight for moving said opening out of line with said plunger, substantially as set forth.

8. In an apparatus of the character described, the combination with a signal and a lock therefor, of a locking-disk connected with said lock, a magnet for unlocking and locking said disk, a circuit-maker controlling the magnet of a distant station, a plunger for actuating said circuit-maker, a disk rotatable

with the locking-disk and having an opening normally in line with said plunger and circuit-maker, a weight for moving said opening out of line with said plunger, a shutter engaging a lug on said disk, and a wedge on said plunger for actuating said shutter, substantially as set forth.

This specification signed and witnessed this 15th day of October, 1898.

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