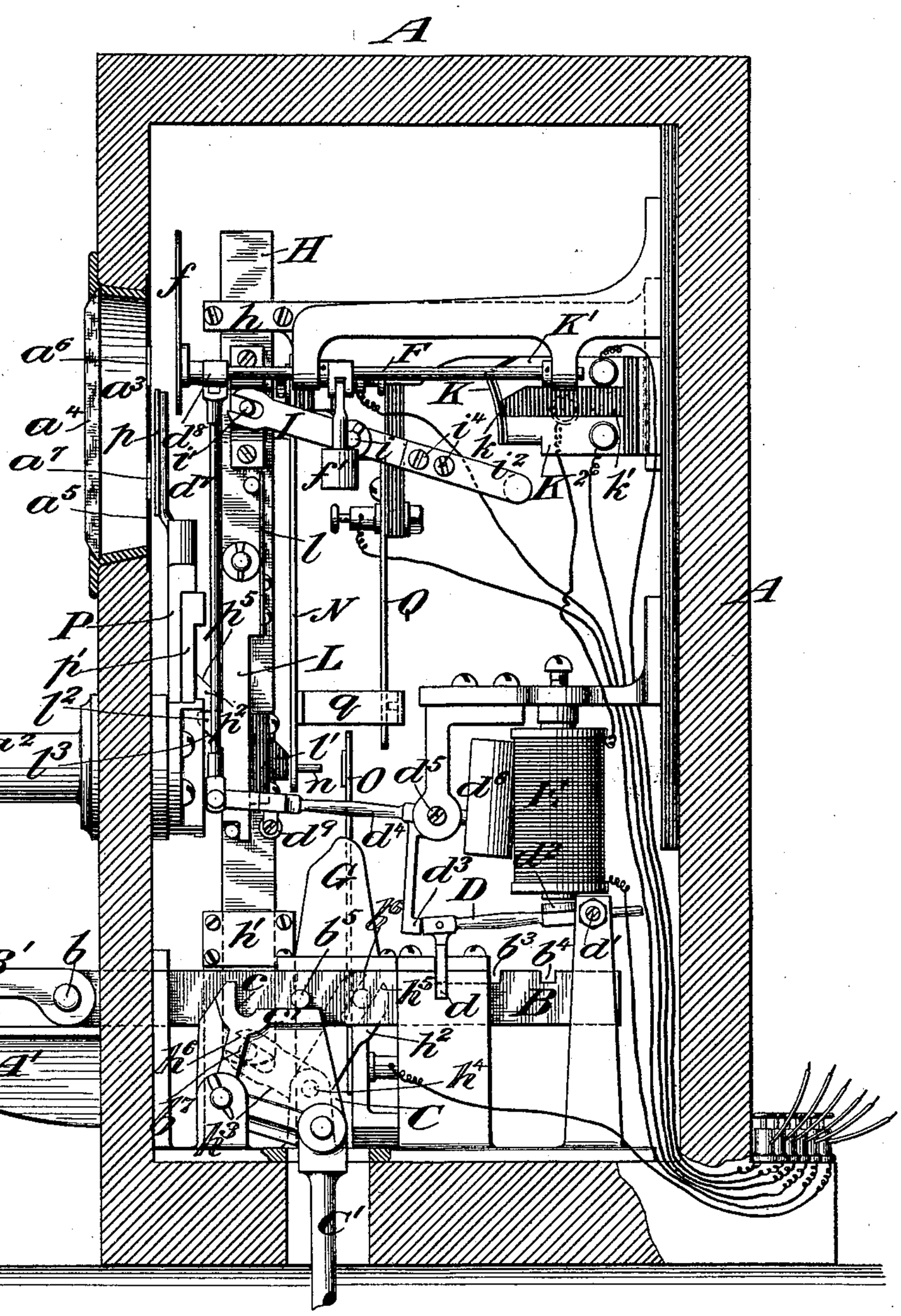
(No Model.) 4 Sheets—Sheet 1.

T. H. PATENALL.

BLOCK SIGNAL APPARATUS.

No. 480,411. Patented Aug. 9, 1892.

Fig. 1.



Witnesses:—
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Inventor:
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(No Model.) 4 Sheets—Sheet 2.

T. H. PATENALL.

BLOCK SIGNAL APPARATUS.

No. 480,411. Patented Aug. 9, 1892.

Fig. 2.

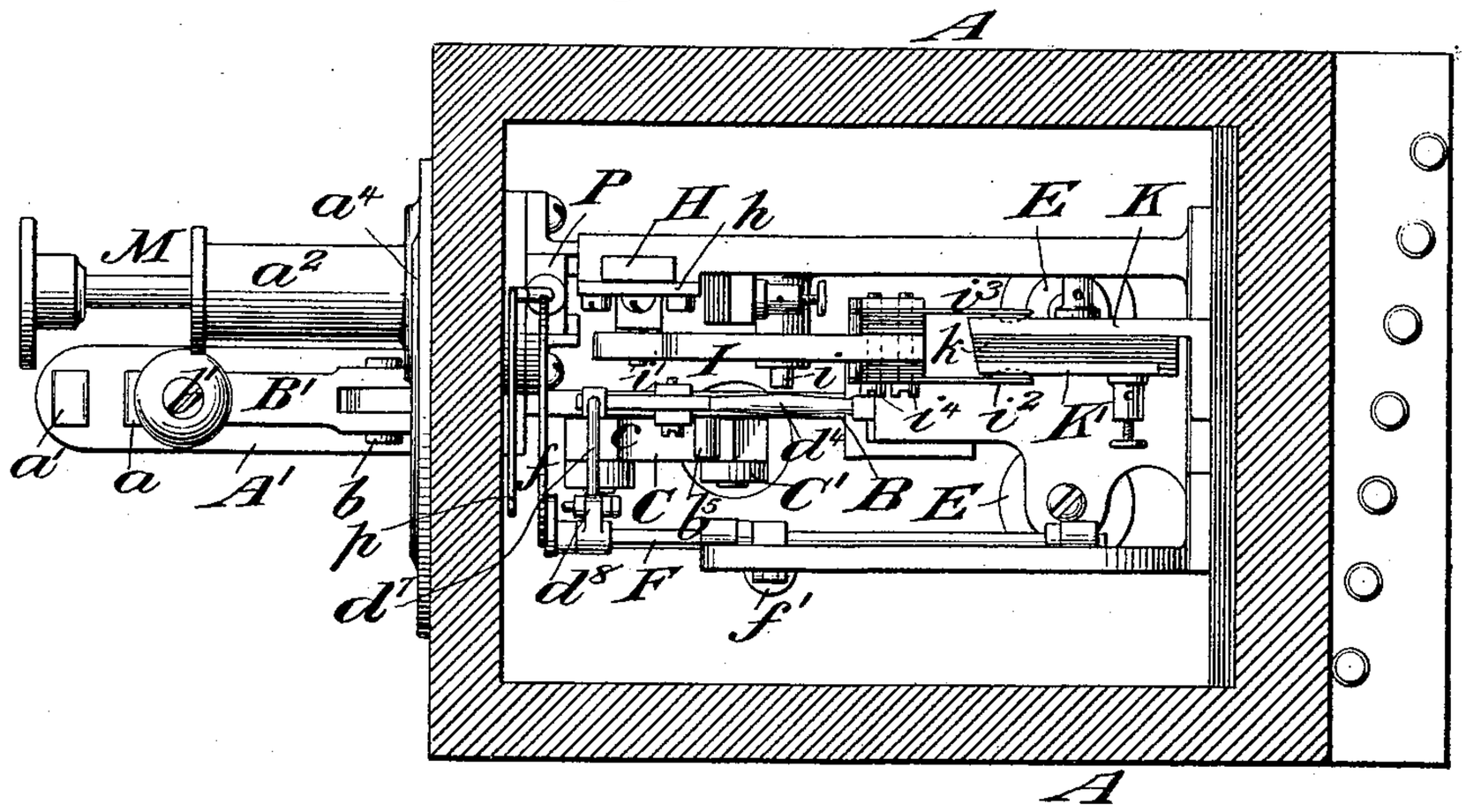
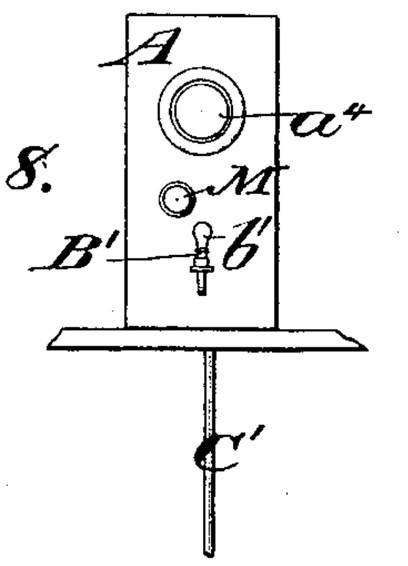
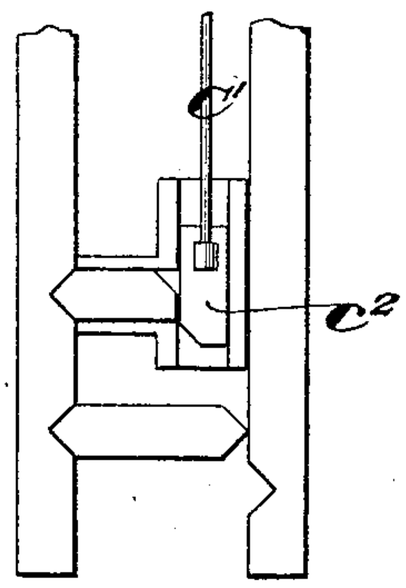


Fig. 8.





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(No Model.) 4 Sheets—Sheet 3.

T. H. PATENALL.

BLOCK SIGNAL APPARATUS.

No. 480,411. Patented Aug. 9, 1892.

Fig. 3.

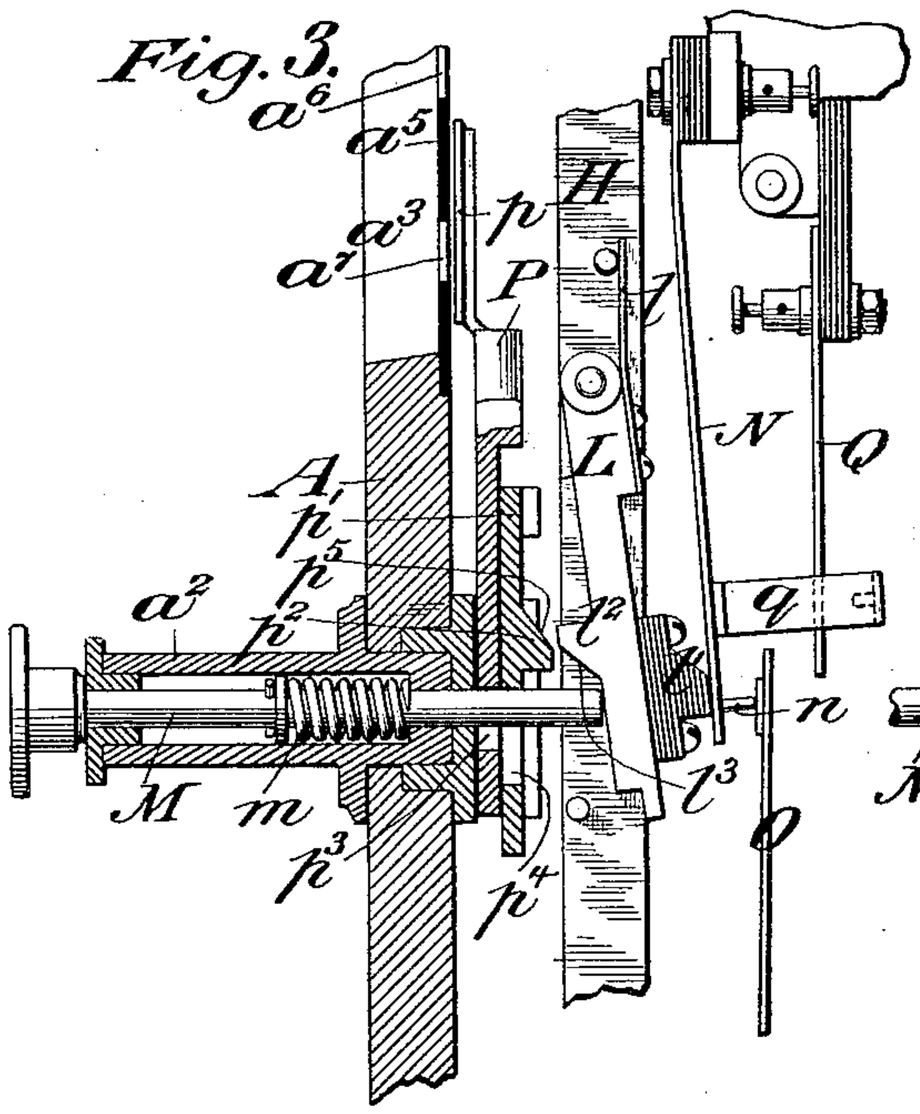


Fig. 4.

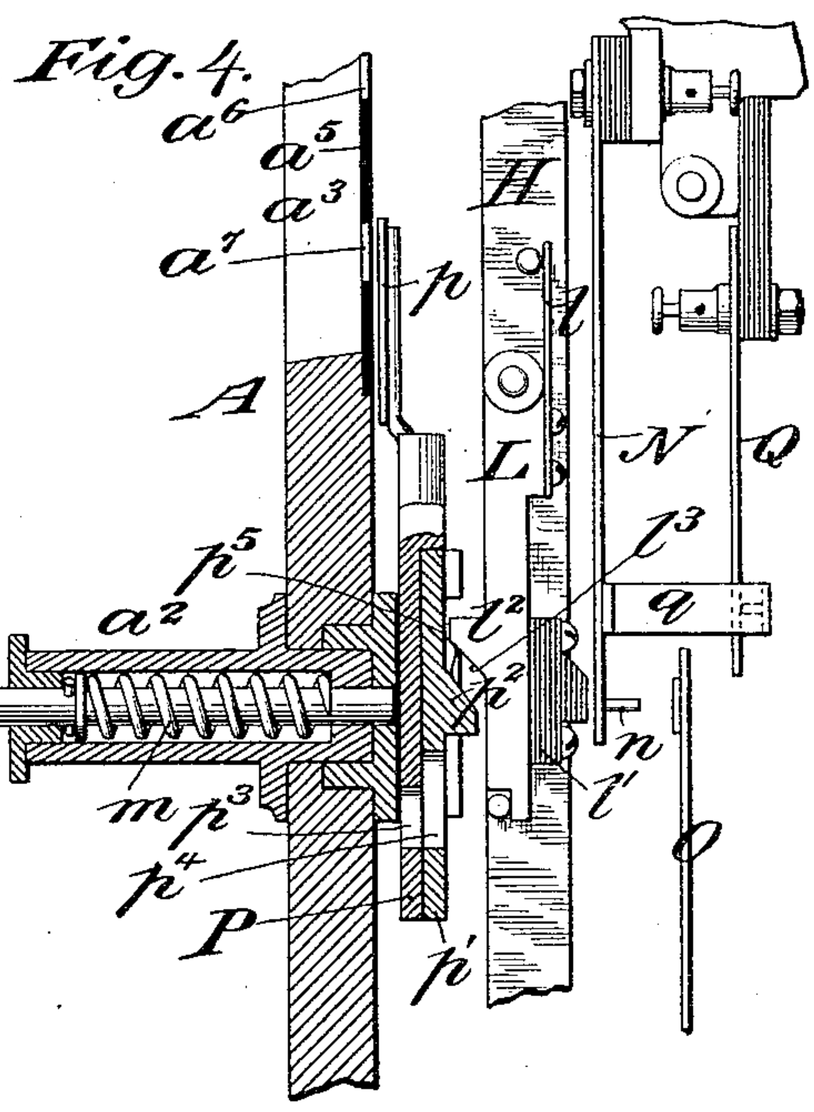


Fig. 5.

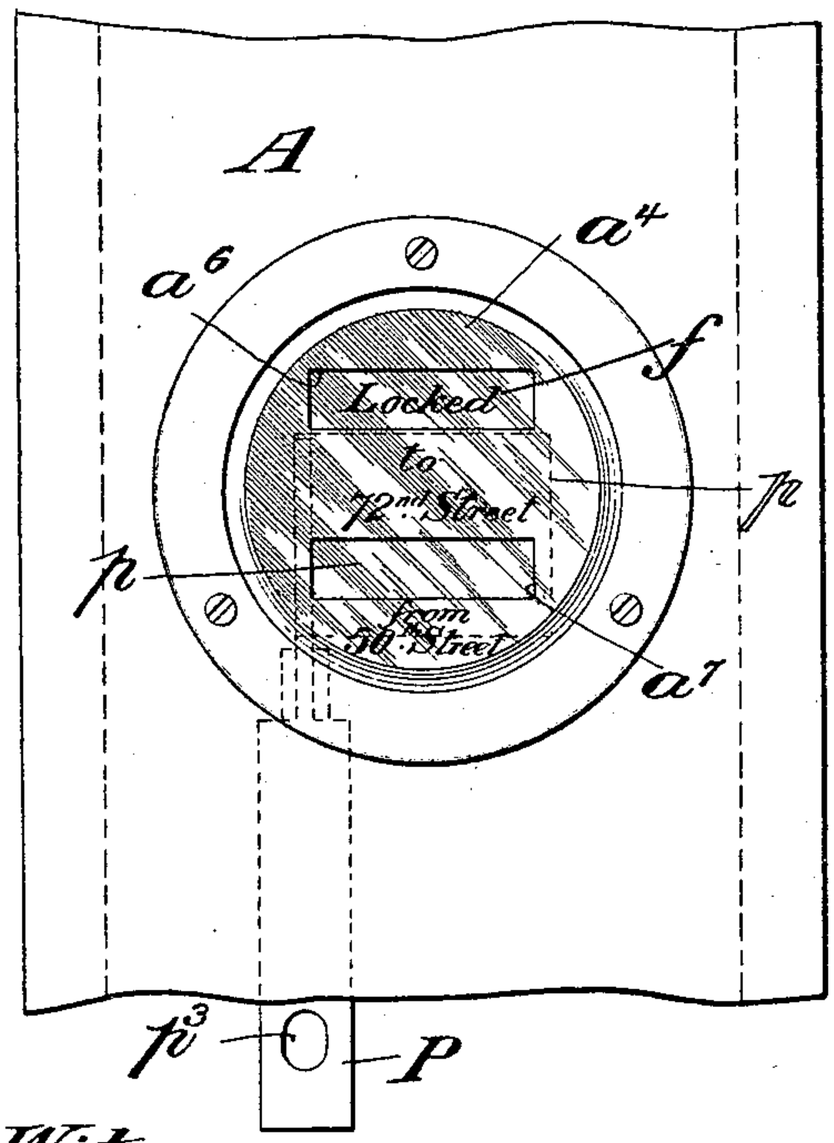


Fig. 6.

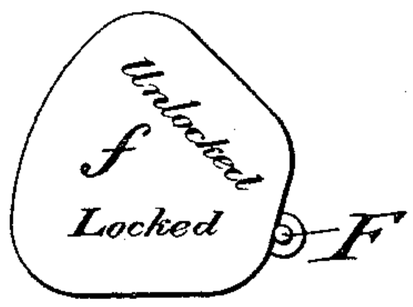
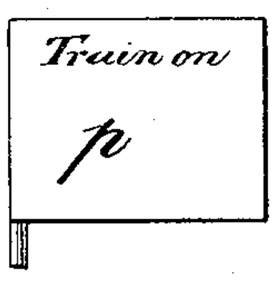


Fig. 7.



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4 Sheets—Sheet 4.

T. H. PATENALL.

BLOCK SIGNAL APPARATUS.

No. 480,411. Patented Aug. 9, 1892.

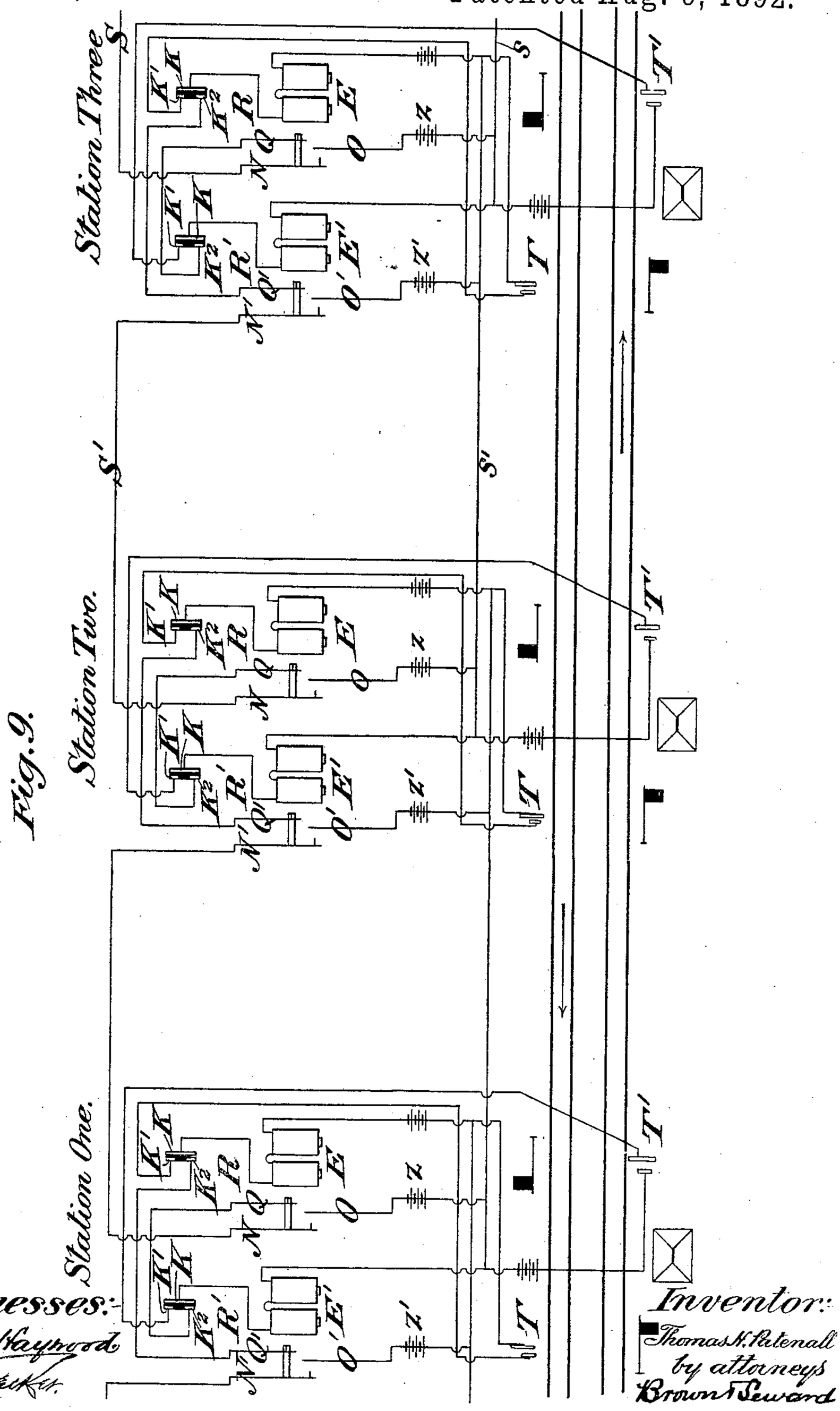

Fig. 9.

UNITED STATES PATENT OFFICE.

THOMAS H. PATENALL, OF RAHWAY, NEW JERSEY.

BLOCK-SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 480,411, dated August 9, 1892.

Application filed February 10, 1892. Serial No. 420,949. (No model.)

To all whom it may concern:

Be it known that I, THOMAS H. PATENALL, of Rahway, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Block-Signal Apparatus, of which the following is a specification.

My invention relates to an improvement in block-signal apparatus for controlling the movements of trains along a railway route.

While my present apparatus embodies some of the generic features of what is commonly known as the "Sykes" block-signal system, it differs fundamentally therefrom in this, that while in the Sykes system the signal-operating levers are locked in both the positions of "line blocked" and "line clear" my present apparatus provides for locking the signal-operating mechanism in the position of "line blocked" only, leaving it when in the position of "line clear" free to be manipulated to throw the signal either to "danger" or "safety," as may be desired, while at the same time I provide means for preventing "plunging" to a preceding station a second time until the train shall actually have passed out of the block and into the next succeeding block.

My invention further contemplates a normally twice-broken plunger-circuit requiring an intentional setting of an instrument at any station before it can be successfully plunged to by the next succeeding station, means for shifting the closed plunger-circuit to the closed treadle-circuit, and the simultaneous breaking of the plunger-circuit, means for regulating the movement of the plunger and indicator in connection therewith, and in various details of structure and arrangements of parts.

For the purpose of illustrating my invention I have shown a diametrical representation of three successive towers or stations along a double-track railway indicating the signals, track-treadles, and the electric connections and circuits. I have also shown one of the several instruments employed for the purpose of locking and releasing the signal-operating mechanism, and it is to be understood that two such instruments are to be employed at each station or tower, one or more for each track.

In the accompanying drawings, Figure 1 represents a vertical sectional view from front to rear of one of the instruments, showing the operating parts therein in side elevation. Fig. 2 is a horizontal section through the instrument, showing the operative parts therein in top plan. Figs. 3 and 4 are detailed views of the plunger and mechanism under its immediate control, showing in Fig. 3 the position of the parts when the plunger has reached the limit of its inward movement and in Fig. 4 the position of the parts when it has been withdrawn. Fig. 5 is a front view of the indicator. Figs. 6 and 7 are views in detail of the indicating-plates. Fig. 8 shows the connection of the instruments with the locking mechanism for locking and releasing the signal-operating levers, and Fig. 9 is a diametrical illustration of three successive towers or stations along a double track.

I will first describe the structure and operation of the several parts comprising one of the instruments and will then describe the practical operation of a series of such instruments by referring to the diagram Fig. 9 and assuming that each of the stations there noted is provided with two instruments similar to the one which I shall particularly describe.

The casing of the instrument is represented by A, and it may be of oblong rectangular form, as herein shown, or any other form which may be found desirable. Within the casing A there is mounted a longitudinally-sliding bar B, which projects at its front end through the casing and is there provided with a section B′, hinged to the section B, as at b, and provided with an operating-handle b'. The section B′ is also provided with a downwardly-extending lip b^2, adapted to engage the abutments a and a' on the bracket A′, projecting from the front of the casing A, and thereby hold the bar B in the desired longitudinal adjustment. The bar B is further provided with an elongated notch b^3 and a shorter notch b^4, located at its upper edge. An angle-plate C is pivotally secured to a support at the bottom of the casing and has its upwardly-extending arm or portion provided with a bearing c for the reception of a stud b^5 on the side of the bar B to rock the plate in the direction to lift the operating-rod C′, secured to the horizontal arm of the rock-plate

C. The upper portion of the plate C is further provided with a bearing-shoe c', along which the stud b^5 is adapted to move as the bar B is slid, so as to admit of a predetermined longitudinal movement of the said bar B before it effects a rocking of the plate C, while at the same time the movement of the bar B in the opposite direction will tend to rock the plate C in the direction to return it to its normal position with the rod C′ depresed. The rod C′ extends downwardly and connects with a slide c^2 for locking and releasing the signal-operating levers in any well-known or approved manner. In the present instance the elevating of the rod C′ serves to unlock the signal-operating levers, while its depression serves to lock them.

The bar B is allowed at all times, save when it is at the limit of its outward thrust, a longitudinal sliding movement corresponding to the length of the recess b^3. Such movement is sufficient to place the lip b^2 in position between the abutments a and a'. Beyond this the bar B cannot be slid until it is unlocked by the lifting of the latch d, secured to the end of a vibrating lever D, pivoted to a suitable support, as at d', and carrying the armature d^2 of an electro-magnet E. The latch d is a gravity-latch and rests in contact with the bar B whenever it is not positively held out of engagement therewith, either under the influence of the energized magnet E or a catch d^3. The catch d^3 depends from a lever d^4, pivotally secured at d^5 and counterbalanced by a weight d^6. The forwardly-extending arm of the lever d^4 is connected by a rod d^7 with an arm d^8 on the rock-shaft F, mounted in the upper portion of the casing and having secured to its forward end an indicator-plate f. The rock-shaft F is provided with a counterbalance-weight f' to counterbalance the weight of the indicator-plate f and leave the shaft F free to be rocked by the movement of the lever d^4, through the connecting-rod d^7. The counterbalancing of the lever d^4 and rock-shaft F is so arranged that the forwardly-extending arm of the lever d^4 tends normally to fall under the influence of gravity, and thereby swing the catch d^3 to the right. If the lever D be lifted by the attraction of the magnet E, the catch d^3 will take under the end of the lever D and hold the latch d out of engagement with the bar B until the lever d^4 has been positively rocked in a direction to release the catch d^3. Such positive movement of the lever d^4 is effected by an upwardly-extended cam G, fixed to the bar B and adapted to engage an anti-friction roller d^9, mounted in bearings depending from the under side of the lever d^4 as the bar B is slid back and forth.

A vertically-sliding bar H is held in position within the casing by bearings h and h' and is connected with the horizontally-sliding bar B, so as to fall as the bar B is pulled out and rise as the bar is pushed in. I have shown the connection between the bars B and H as consisting of arms h^2 and h^3, fixed to and radiating from a common rock-shaft h^4 and provided at their free ends with elongated open-ended slots h^5 and h^6, adapted to receive studs, the one b^6 extending from the side of the bar B and the other b^7 extending from the side of the vertically-sliding bar H.

A vibrating arm I is pivotally secured, as at i, to a support within the casing and has a loose connection, in the present instance a slot-and-pin connection at i', with the vertically-sliding bar H, and at its opposite end it carries a pair of circuit-making jaws i^2 and i^3, insulated from the arm I, but electrically connected with each other by one or both of the fastening-screws i^4.

Three contact-plates K K′ K² are normally insulated from each other and secured to the interior of the casing, so that as the sliding bar H is lowered and the jaws i^2 and i^3 thereby elevated the latter will simultaneously come in contact the one with the plate K² and the other with the plate K, and thereby bring the two plates into electric communication with each other. The arrangement is such that as the bar H further descends it will swing the jaws i^2 and i^3 past the plate K² and bring them into simultaneous communication, the one with the plate K′ and the other with the plate K, and thereby establish electrical communication between the plates K′ and K and break communication between the plates K² and K. In the present instance I have shown the plate K separated from the two plates K′ and K² by an intervening layer k of insulating material, and the plates K′ and K² occupying positions on the opposite side of the layer of insulating material k from the plate K and separated from each other by a strip of insulating material k'. The plate K² is in normal electrical communication with the line-wire S′. (See Fig. 9, station 3, instrument R.) The plate K′ is in permanent electrical communication with the treadle T, and the plate K is in permanent electrical communication with the electro-magnet E, for purposes which will hereinafter appear.

The vertically-sliding bar H carries on its side a vibrating arm L, located in the path of the plunger M and provided with a spring l, the tension of which tends to keep the arm normally swung toward the plunger. The arm L is provided with a block of insulating material l', the nose of which is in position to engage a flexible electrical conducting-strip N, depending from a suitable support within the casing and carrying a contact-pin n, adapted to be thrown into and out of contact with an electrical conducting-strip O, uprising from the lower portion of the casing. The strip N is in permanent electrical communication with the line-wire S, and the strip O with the battery z, and through it with a wire s, leading to the electro-magnet of the preceding instrument. (See Fig. 9.)

The plunger M is housed by a barrel a^2, fixed to the front of the casing, and is provided with an actuating-spring m, the tend-

ency of which is to throw the plunger outward to the limit of its movement. Within the casing and in the path of the plunger there is located a drop-plate P, carrying at its upper end an indicator p. (Shown in detail in Fig. 7.) The drop-plate P is provided with a movable section p', so attached to its inner face as to drop a predetermined distance independently of the plate P. The section p' is provided with an inwardly-extending nose p^2, adapted to interlock with a corresponding nose l^2 on the arm L. The plate P is provided with an opening p^3 therethrough sufficiently large to give the plunger a clearance therein, but not elongated or enlarged sufficiently to admit of the plate P dropping when the plunger is inserted through the plate sufficient to bring the indicator p into position to show "train on." The movable section p' is provided with an opening p^4 therethrough, which normally registers with the opening p^3 in the plate P, but which is sufficiently elongated to allow the section p' to drop when the plunger is inserted a distance sufficient to allow the nose p^2 to move downwardly past the nose l^2 on the arm L, as indicated in Fig. 3. When the section p' has reached the position shown in Fig. 3, the withdrawal of the plunger will permit the arm L to swing toward the front and will carry its nose l^2 above the nose on the section p', and thereby permit the drop-plate P and its movable section p' to drop to the limit of their downward movement to bring the indicator p into position to show "train on." If the plunger be only partially withdrawn, so that it still remains to some extent within the opening p^3, the section p' will drop far enough past the opening p^3 to prevent the plunger from being again pushed in into contact with the arm L until the drop-plate has been elevated to its normal position. The drop-plate and its movable section are held normally in their elevated adjustment by the engagement of the nose l^2 of the arm L under the nose p^2 of the section p', and after the said drop-plate has been once lowered it can only be raised by the subsequent lowering of the bar H under the impulse of the sliding bar B, so as to carry the nose l^2 on the arm L downwardly underneath the dropped position of the drop-plate P. For the purpose of allowing the nose l^2 to ride past the nose p^2, and for the further purpose of enabling the return forward movement of the arm L to exert a downward pressure upon the movable section p^2, I provide the upper side of the nose p^2 and the lower side of the nose l^2 with beveled faces p^5 and l^3, respectively.

The indicators f and p occupy positions behind an opening a^3 in the casing, through which they may be seen. The opening is conveniently covered by a glass plate a^4 at the front and at the rear by an opaque plate a^5, provided with slots a^6 and a^7, through which the indicating words or symbols may be read when the operating mechanism has been moved into the proper position to bring such indicating-symbols into position.

For the purpose of utilizing a single line-wire for connecting the instruments for moving the train on both the incoming and outgoing tracks I provide a connecting-strip Q, in permanent electric connection with the contact-plate K^2 of the companion instrument at any station (see Fig. 9) and normally connected with the line-wire leading to the adjacent station by means of a connecting-arm q, carried by the depending strip N. When the strip N is swung inwardly under the impluse of the plunger, the arm q will be disengaged from the strip Q and the circuit through the companion instrument broken, while the circuit through the electro-magnet at the next preceding station is closed.

In the diagrammatic illustration Fig. 9 I have denoted the stations from left to right as "station 1," "station 2," and "station 3." The incoming and outgoing tracks are indicated by arrows. The treadles in connection with the incoming track are denoted by T, and in connection with the outgoing track by T'. The instruments for moving the trains along the outgoing track are represented by R', and those for moving the trains along the incoming track by R. The electro-magnets of the instrument R are denoted by E, and those of the instruments R' by E'. The contact-strips of the instruments R are denoted by N, O, and Q, and of the instruments R' by N', O', and Q'.

It is to be understood that the several instruments R and R' are similar to that which has been hereinabove particularly described, and their practical operation will now be set forth by referring to the several parts of the different instruments, conveniently indicated in the diagram Fig. 9 by the same letters and figures which have been used to indicate those parts in the one instrument which has been described.

Suppose a train to be on the outgoing track and moving from station 1 toward station 2. The operator at station 2, before he can place his signal at "safety" to allow the train to pass toward station 3, must have his sliding bar B unlocked by the operator at station 3, so that he—viz., the operator at station 2—may draw his bar B outward to its full extent and thereby unlock his signal-operating levers. Furthermore, before the operator at station 2 can have his instrument unlocked by the operator at station 3 it is necessary for him (the operator at station 2) to slide his bar B of instrument R' outwardly the distance permitted by the recess b^3 in its upper edge, which will enable the lip b^2 upon the swinging section B' to drop between the abutments a and a' and will lower the bar H, and thereby lift the jaws i^2 and i^3 into contact with the plates K and K^2, thereby placing the electric circuit through the electro-magnet E' of his instrument R' in condition to be closed by

the inward thrust of the plunger of the instrument R′ at station 3. By following the diagram Fig 9 it will be observed that this circuit is complete through the contact-strips N and Q of the instrument R at station 2 through the line-wire S′ and the track-wire *s′* and the strips N′ and O′ of the instrument R′ at station 3. The operator at station 2 having been plunged to by the operator at station 3 and his sliding bar B having been unlocked by the energizing of the electro-magnet E′ at station 2 and the consequent lifting of the latch *d* out of engagement with the bar B, the latter will remain held out of contact with the bar B by the engagement of the catch d^3 with the end of the lever D. The swinging of the lever d^4 will at the same time through the connecting-rod d^7 and the rock-shaft F drop the indicator *f* into position to read "unlocked." The operator at station 2 may now draw the bar B outwardly to its full extent, so as to lift the connecting-rod C′, and thereby unlock the signal-operating levers. As the bar B is drawn outwardly to unlock the signal-operating levers the cam G engages the roller d^9, depending from the lever d^4 and rocks it so as to momentarily release the catch d^3 from the end of the lever D and allow the latch *d* to again drop into engagement with the bar B, so that when the latter reaches its outward limit the latch will engage the notch b^4 in the bar B and lock it in its outwardly-drawn position until the electro-magnet E′ of the instrument R′ at said station 2 shall be again energized to release the latch. The outward movement of the bar B to unlock the signal-operating levers will further depress the bar H, and thereby swing the jaws i^2 and i^3 from their position in contact with the plates K K^2 into contact with the plates K K′, and by so doing will break the plunging-circuit and place the track-treadle circuit in condition to be closed by the passing train. The energizing of the electro-magnet E′ to unlock the lever B will take place only when the train has passed station 2 and by so doing has operated the track-treadle T′ at said station 2, and thereby closed the circuit through the contact-plates K K′ and the wires leading thence, the one directly to the treadle and the other through the electro-magnet to the battery and thence to the treadle. The signal-operating mechanism is independent, in a broad sense, of the lock-controlling mechanism, and from this it follows that while the bar B remains locked in its outwardly-drawn adjustment the signal-operating levers may be manipulated to set the signal at "safety" or "danger" at pleasure, and the switch-operating levers, which by a well-known mechanism are commonly interlocked with the signal-operating levers, may be manipulated to shunt trains. While the operator at station 2 may change his signals and switch at pleasure to control the train approaching his station from station 1, he cannot plunge to station 1 so as to unlock the instrument at station 1, and thereby allow the operator at that station to pass another train onto the block between stations 1 and 2, until the train which has been assumed as approaching station 2 has actually passed that station and by its action upon the track-treadle T′ at that station released the bar B, and thereby permitted the bar B to be thrust inward and the plunger thereby left free to be operated. The inward thrust of the bar B brings the cam G again into engagement with the roller *d′*, and thereby rocks the catch d^2 and permits the lever to drop and thereby lock the bar B, and also elevates the indicator-plates to their normal positions. (Shown in Fig. 1.) The locking of the plunger in the instrument R′ at station 2 is assumed to have taken place before the operator at that station asked to be released by the operator at station 3 and in the following manner: When the operator at station 1 asked the operator at station 2 to unlock his instrument in the same manner as the operator at station 2 asked the operator at station 3 to unlock his instrument, as hereinabove referred to, the operator at station 2 plunged to the operator at station 1 and in so doing swung the arm L out of engagement with the drop-plate P and its section *p′* and allowed the said plate to drop and thereby shut off any possible second inward thrust of the plunger M until the bar H had been lowered by the full outward movement of the bar B and the subsequent inward thrust of the bar B and the consequent raising of the bar H and with it the drop-plate P. As has been already described, the inward thrust of the bar B can only take place after it has been unlocked by the passage of the train over the treadle at that station, and hence there can be no plunging from the station 2 to accept another train until the train already on has actually passed that station.

The same operation as described with reference to station 2 will take place at station 3 and each succeeding station along the line, and similar operations will take place in the instruments R at the stations 3, 2, and 1 and each succeeding station in that direction in the movement of trains on the incoming track.

In referring to track-treadles and track-treadle circuits in the foregoing description it is to be understood that what is commonly known as the "track-circuit" as distinguished from the track-treadle might be employed.

In using the word "independent" to distinguish the relation between the lock-controlling and signal-operating mechanisms I have employed it in the broad sense of "independent" so far as operation is concerned.

It is obvious that changes might be resorted to in the construction and arrangement of the several parts described without departing from the spirit and scope of my invention. Hence I do not wish to limit myself strictly to the construction and arrangement herein described; but

What I claim is—

1. The combination, with signal-operating mechanism and means for locking and releasing it independent of the signal-operating mechanism, of means for controlling the unlocking of said mechanism from a remote point along the line, and means for controlling the locking of said mechanism from another remote point along the line, the said signal-operating mechanism when once unlocked being free to be repeatedly manipulated to denote "safety" or "danger" at pleasure until again locked, substantially as set forth.

2. The combination, with a plurality of signal-operating mechanisms, of instruments for controlling the locking and unlocking of said operating mechanisms, one of the instruments being under the control of a succeeding instrument to unlock it, and hence the signal-operating mechanism connected therewith, and under the control of the passing train to permit the locking of the said signal-operating mechanism, and a movable stop under the control of the locking mechanism for preventing the unlocking of a preceding instrument while the signal-operating mechanism at the succeeding instrument remains unlocked, substantially as set forth.

3. The combination, with a sliding bar under the control of the operator, a movable part under the control of the sliding bar, and means for locking and releasing the signal-operating mechanism, also under the control of the sliding bar, of a latch for locking and releasing the sliding bar, means for operating the latch, a plunger, an electric circuit adapted to be closed by the plunger to unlock a remote instrument, and a plunger-locking device under the control of the aforesaid movable part to prevent the second operation of the plunger until the said sliding bar is returned to its normal position, substantially as set forth.

4. The combination, with the signal locking and releasing mechanism, of the normally twice-broken electric circuit for plunging to a preceding station and means for positively closing said circuit at the station to be plunged to for securing a release of the signal-locking mechanism, substantially as set forth.

5. The combination, with the signal locking and releasing mechanism, of the normally twice-broken electric-plunging and track-treadle circuits, a circuit-closer, and means for moving the circuit-closer successively into position to close the plunging-circuit and then in position to break the plunging-circuit and close the track-treadle circuit, substantially as set forth.

6. The combination, with the bar for mechanically unlocking and locking the signal-operating mechanism, of a gravity-latch for locking the said bar in position to lock the signal-operating mechanism and in position to release the signal-operating mechanism and an electro-magnet for releasing the latch, the said latch being under the control of the said bar to allow it to fall into engagement with the bar, substantally as set forth.

7. The combination, with the bar for unlocking and locking the signal-operating mechanism, of a gravity-latch for locking said bar in its positions to lock and unlock the signal-operating mechanism, an electro-magnet for withdrawing the latch, and an indicator under the control of the latch to indicate "locked" or "unlocked," the said latch being under the control of the said bar to allow it to fall into engagement with the bar, substantially as set forth.

8. The combination, with the plunger and the plunger electric circuit, of the drop-plate through which the plunger passes to plunge and the movable section on the drop-plate, the latter having a sliding movement independently of the drop-plate in a direction transverse to the plunger, substantially as set forth.

9. The combination, with the plunger, the electric plunger-circuit, and the swinging contact-piece provided with a nose, of a drop-plate through which the plunger passes to plunge and a movable section carried by the drop-plate and provided with a nose adapted to interlock with the nose on the contact-piece, the said movable section having an extended dropping movement while the plunger is thrust in to carry its nose past the nose on the contact-piece, substantially as set forth.

10. The combination, with separate instruments at a station for controlling the movements of trains in opposite directions, of electric plunging-circuits, one in connection with each instrument, each circuit comprising a portion of the plunger-actuated circuit-closing mechanism of the other instrument to complete the plunging-circuit through its own electro-magnet, substantially as set forth.

11. The combination, with the means for connecting the sliding bar with the device for unlocking and locking the signal-operating levers, of the sliding bar having a predetermined movement relatively to said connecting means without effecting the unlocking or locking, the latch for locking the bar and at the same time permitting said predetermined movement, the circuit-closer under the control of the said bar, and the normally twice-broken electric circuit adapted to be closed as to one of the breaks by said circuit-closer, substantially as set forth.

THOMAS H. PATENALL.

Witnesses:
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