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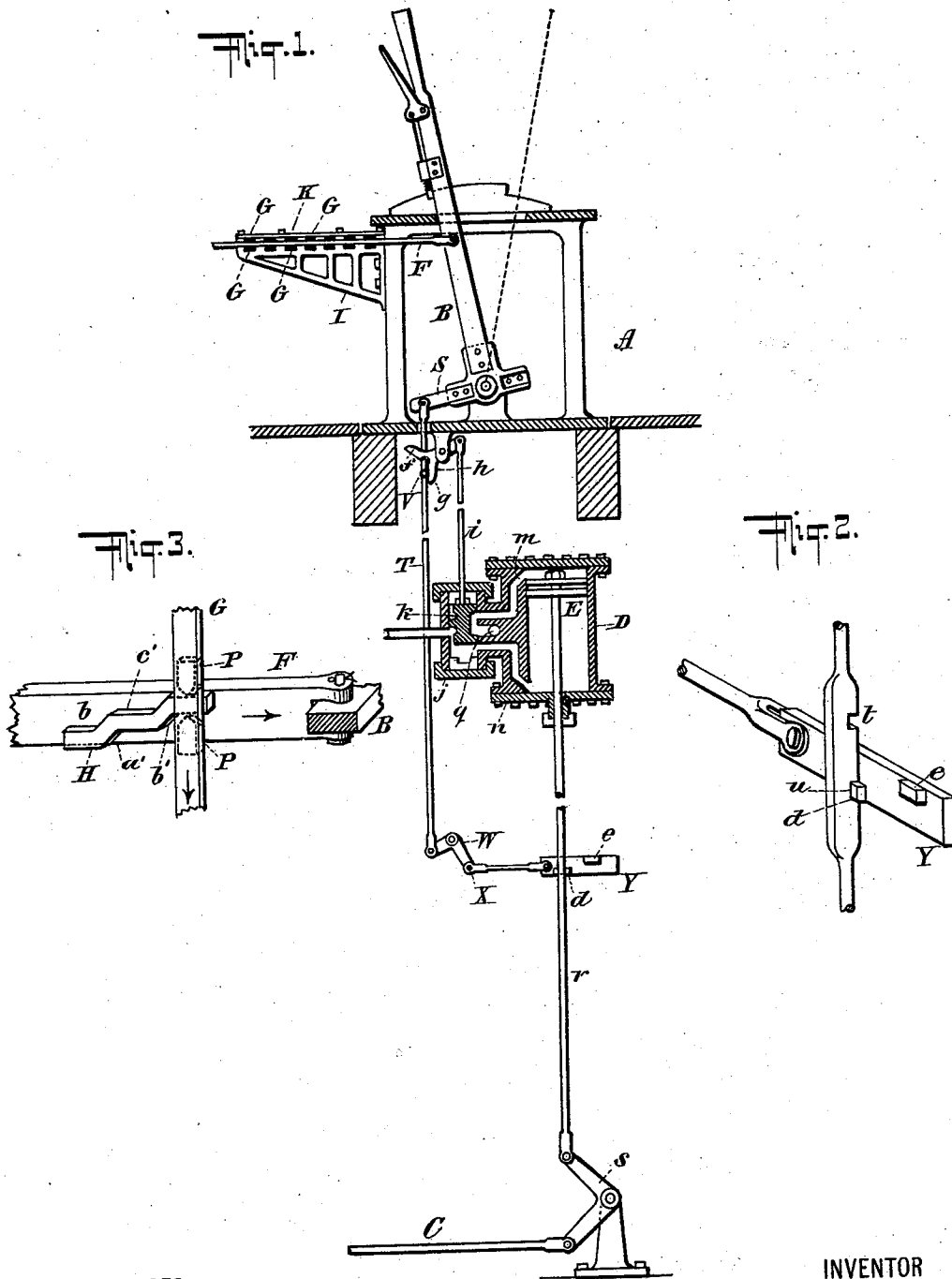
3 Sheets—Sheet 1.

J. T. CADE.

INTERLOCKING SWITCH AND SIGNAL MACHINE.

No. 568,333.

Patented Sept. 29, 1896.



WITNESSES:

John Kehlbeck
G. Dietrich

INVENTOR

John T. Cade,

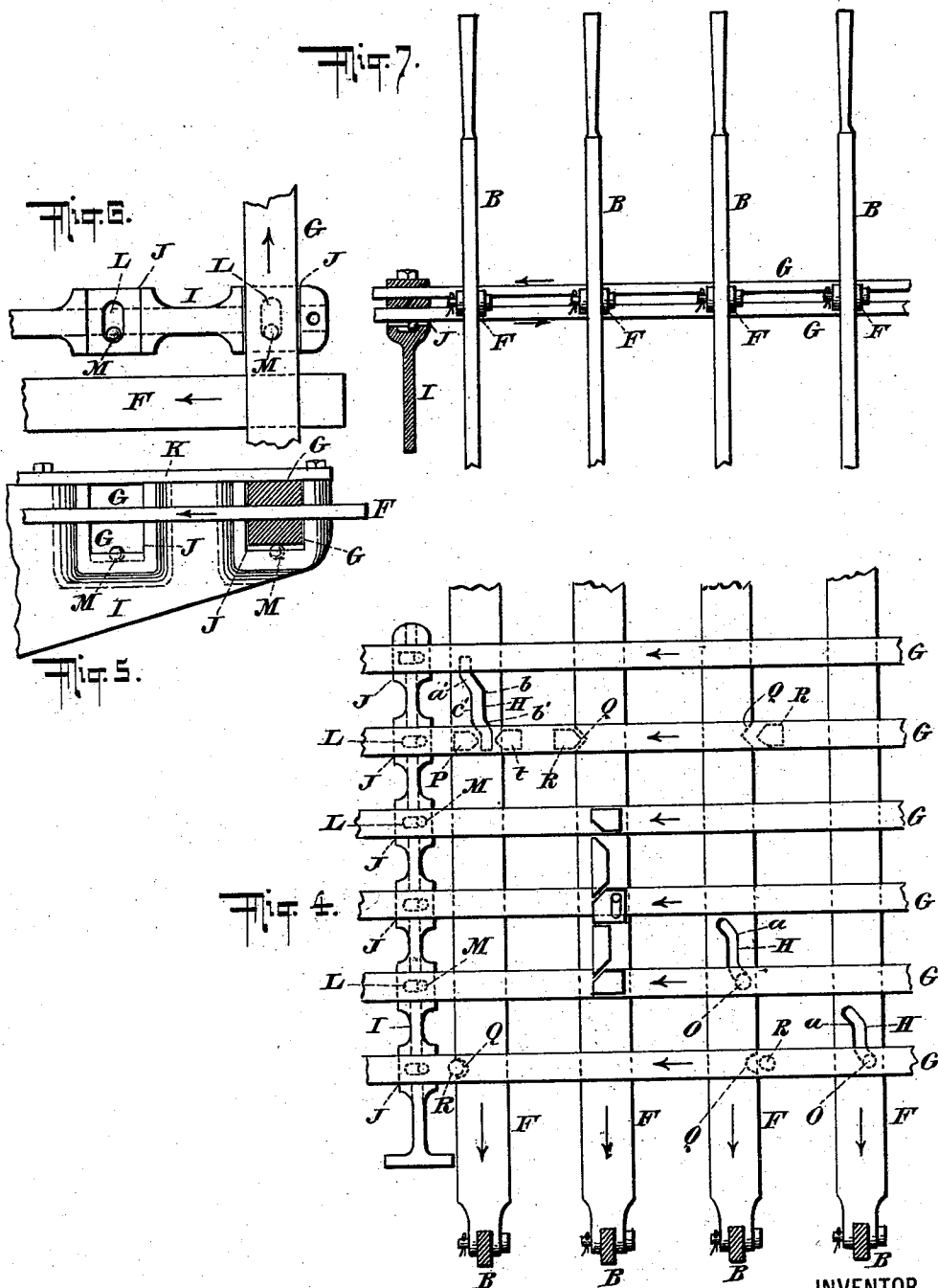
BY

Chas. C. Gill
" ATTORNEY

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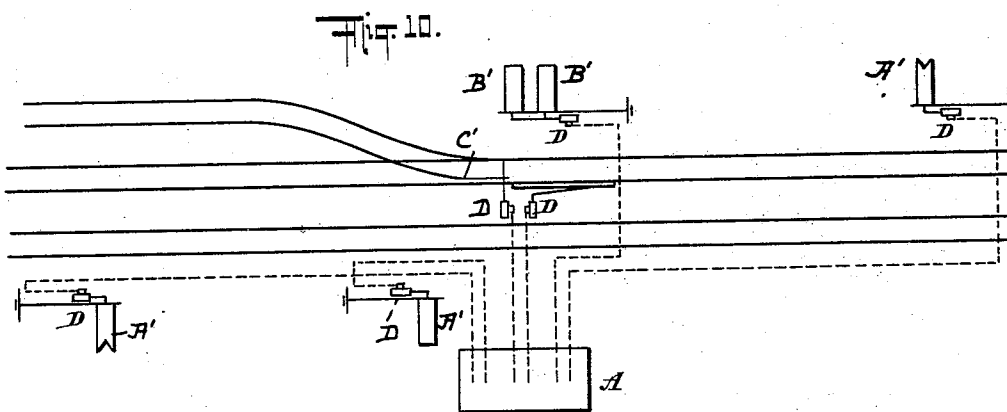
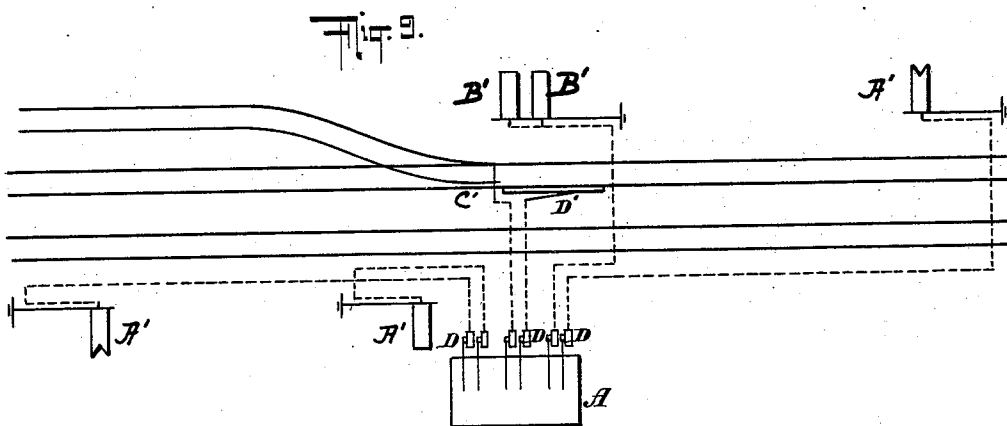
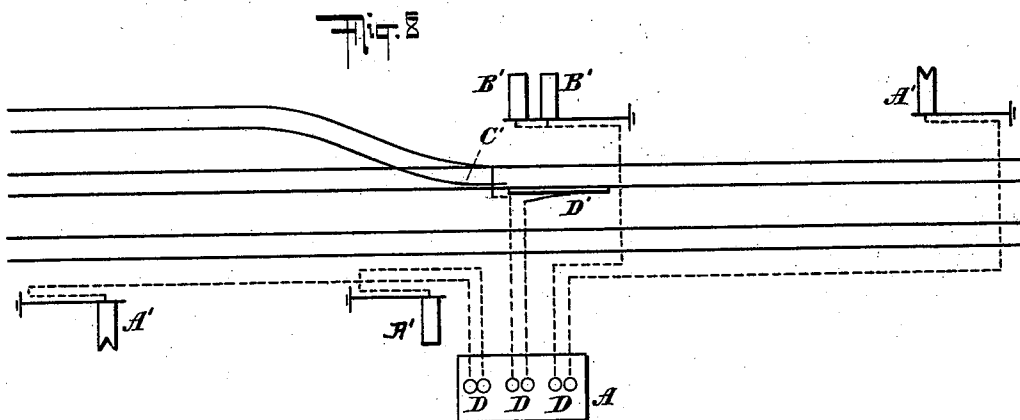
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INTERLOCKING SWITCH AND SIGNAL MACHINE.

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WITNESSES:

John Kehlenbeck
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INVENTOR

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UNITED STATES PATENT OFFICE.

JOHN T. CADE, OF ARCOLA, NEW JERSEY.

INTERLOCKING SWITCH AND SIGNAL MACHINE.

SPECIFICATION forming part of Letters Patent No. 568,333, dated September 29, 1896.

Application filed November 19, 1895. Serial No. 569,457. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. CADE, a subject of Her Majesty the Queen of Great Britain, and a resident of Arcola, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Interlocking Switch and Signal Machines, of which the following is a specification.

The invention relates to improvements in interlocking switch and signal machines, and comprises certain novel mechanical features intermediate the hand-levers and the switch, signal, or lock operating ground-rods, whereby by mechanical means the piston-rod of each power-cylinder is locked at each end of its stroke and so maintained until the hand-lever and cylinder-ports are in position and condition to render the further movement of said rod proper and desirable, and thereby, also by mechanical means, the operator, while moving the hand-lever to apply the power which is to move the switch, signal, or lock, may be instantly apprised whether the piston-rod and power mechanism are in position and condition to do their work or have performed their desired duty.

The nature, operation, and scope of the invention will be fully understood from the detailed description and claims hereinafter presented, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section through a signal-tower, showing one operating hand-lever and all the necessary mechanism intermediate the same and the rod leading to the switch, signal, or lock, the cylinder, valve-chest, and valve therein, whereby the power is applied to move the piston and devices intermediate the same, and the switch, signal, or lock being in section. Fig. 2 is a detached perspective view of a portion of the piston-rod and the means whereby it is locked at each end of its movement and prevented from moving except upon the existence of proper conditions. Fig. 3 is a detached perspective view of the adjoining portions of one each of the tappet-bars, locking-bars, and hand-levers. Fig. 4 is an enlarged top view of a portion of the bed of tappet-bars, locking-bars, and hand-levers, the latter being in section. Fig. 5 is an enlarged side elevation of a portion of one of the brackets supporting the locking-bars,

two of the latter being shown in position in section and two in end elevation and a tappet-bar being illustrated in position between the upper and lower locking-bars. Fig. 6 is a top view of a portion of one of the aforesaid supporting-brackets, showing a portion of a tappet-bar and locking-bar. Fig. 7 is a detached elevation, partly in section and partly broken away, of a group of operating-levers, tappet-bars, and locking-bars. Fig. 8 is a diagrammatic view of the tower with the power-cylinders therein and connections therefrom for operating the signals, switch, and lock. Fig. 9 is a like view of same, but illustrating the power-cylinders without the tower but adjacent thereto; and Fig. 10 is a like view, but showing the power-cylinders at points adjacent to the signals, switch, and lock to be operated.

In the employment of my invention no change in the usual ground-rods leading to the signals, switches, or locks becomes necessary, these rods being of usual or suitable form and construction and not being, therefore, specially referred to hereinafter further than necessary to render the parts comprising the invention thoroughly understood.

In Fig. 1 is illustrated one of the operating hand-levers with the proper power, locking, and telltale mechanism intermediate it and the ground-rod, and in practical use there will be a group of these hand-levers arranged side by side, and each lever will have intermediate it and its ground-rod the mechanism illustrated in Fig. 1 with respect to the lever there shown.

In the drawings, A designates the usual tower; B, the hand-lever; C, the ground-rod, and D the power-cylinder, whose piston E is controlled in its movement by the hand-lever and actuates at the proper time the ground-rod C and through it and its connections the signal, switch, or lock to which it may lead.

The means for locking the levers B against improper movement comprises the series of tappets or tappet-bars F and the series of locking-bars G, the latter traversing the tappet-bars at right angles to the latter and being, if preferred, in double series, with one series above and the other below the tappet-bars, as more clearly indicated in Figs. 5 and 7. The tappet-bars F and locking-bars G are

severally adapted to be reciprocated in line with their length, the tappet-bars receiving their motion directly from the hand-levers B, to which they are pivotally connected, and the locking-bars G being moved from the tappet-bars through the medium of the operating-cams H on the latter engaging said bars G, as hereinafter explained. The locking-bars are supported in the brackets I, as many of the latter as necessary being employed. The upper edge of the brackets I are formed with pockets J to receive the bars G, and also with a retaining-plate K, (see Fig. 5,) by which the bars G are preserved in position. At the base of the pockets J are formed the recesses L, within which are placed the balls or rollers M to support and facilitate the easy movement of the locking-bars G. The bars G are frequently of considerable length, and their movement is effected wholly by the manual force applied by the operator to the levers B, and hence the recesses L and balls or rollers M become features of importance and highly desirable, particularly when it is remembered that the bars at many stations are moved hundreds of times a day. The balls M of spherical outline may be used, or elongated rollers may be substituted for the balls, the balls and rollers being equivalents in this relation for one another.

The tappet-bars F are provided with the actuating-cams H above referred to, said cams being in the form of a slot or groove, as shown at *a*, or in relief, as shown at *b*, and the side surfaces of the said cams, however constructed, forming inclines, which act against pins or projections on the bars G to move the latter. When the cams H are in the form of slots or grooves, the bars G will be provided with the pins O to engage the same, and when said cams H are in relief the bars G will have the projections P to engage the opposite sides of same, as indicated in Figs. 3 and 4. When a tappet-bar F is moved by the lever B, the cam H on said bar will move the bar G engaged thereby by a direct positive unfailing action. While I do not limit the invention to any special outline of cam H, I regard the form of cam shown as of special importance when employed in a machine embodying the mechanism illustrated in Fig. 1, intermediate the hand-lever B and power-cylinder D, for the reasons fully explained hereinafter. The tappet-bars F and locking-bars G are respectively provided on their edges with the locking recesses and dogs Q R, which are usual with this class of machines and need not be specifically described.

Referring to my invention, attention is directed to Fig. 1, wherein it will be seen that the lower end of the pivoted hand-lever B is provided with a crank-arm S, to which is pivotally connected the rod T, carrying the pin V and pivotally connected with one arm of the bell-crank lever W, whose other arm, by means of a link X, is connected with the slide Y, having the lugs *d e*. The pin V is free be-

tween the arms *f g* at one end of the pivoted lever *h*, whose other end is pivotally connected with and actuates the valve-rod *i*, which passes into the chest *j* and is suitably connected with the valve *k* to operate the latter.

The cylinder D, to which the chest *j* is connected, is of well-known form and is provided with the customary end ports *m n* and exhaust-port *q* and will be used in connection with air, steam, or other power-generating fluid. The piston E is also of well-known or suitable form and construction and is connected with a rod *r*, whose outer end is, by means of a bell-crank lever *s*, connected with the ground-rod C. The rod *r* is provided adjacent to the slide Y with the recesses *t u*, which are adapted to respectively engage the lugs *e d*.

In the operation of the mechanism illustrated in Fig. 1 if it should be desired to reverse the position of the signal, for instance, by drawing the ground-rod C to the right, the operator on the second floor of the tower will draw the lever B toward him and to the position illustrated by the dotted line in Fig. 1. The movement of the lever B to the right causes the crank-arm S to draw upward on the rod T and through said rod T and the bell-crank lever W to draw the link X and slide Y to the left until the stud *d* has escaped from the recess *u* in the piston-rod *r*, whereby the latter is left free to act under the influence of the air or steam that may be admitted to the cylinder D above the piston E. The first part of the upward movement of the rod T has no effect upon the lever *h*, rod *i*, and valve *k*, since the pin V, carried by the rod T, is free between the arms *f g* of the lever *h* and ascends a definite distance before coming into contact with the arm *f*, and it is during this limited upward movement of the rod T prior to the pin V striking the arm *f* that the stud *d* is withdrawn from the recess *u*, and the piston-rod *r* thereby freed. As soon as the rod T has ascended sufficiently for the pin V to strike the arm *f* of the lever *h* the contact of said pin with said arm operates to turn the said lever *h* upon its pivotal bearing and to depress the rod *i* and valve *k*, the result being that the compressed air or steam will pass from the chest *j* into the upper end of the cylinder D through the port *m*, while the compressed air or steam which has been below the piston E will exhaust through the ports *n q*. Thus the piston E, upon the valve *k* having been moved, as described, will instantly descend with the rod *r* and cause the bell-crank lever *s* to actuate the ground-rod C and the signal, switch, or lock that may be connected therewith. The continued movement of the hand-lever B toward the right, acting through the rod T, bell-crank W, and link X, draws the slide Y toward the left sufficiently for the stud *e* on said slide to enter the recess *t* in the rod *r*, whereby said rod is locked in its

lower position. It is to be noted, therefore, that the first part of the movement of the lever B toward the right effects the withdrawal of the stud *d* from the recess *u* in the piston-rod and unlocks the latter; that the next portion of the movement of the said lever B toward the right results in the pin V actuating the lever *h* and rod *i* to move the valve *k*, whereby the compressed air or steam is admitted to the upper end of the cylinder D and exhausted from the lower end thereof, and the piston and rod caused to descend and actuate the rod C, and that the final part of the movement of the said lever B to the right causes the stud *e* to engage the recess *t* in said piston-rod, the latter having descended to its lower position. The stud *d* in connection with the recess *u* locks the rod *r* in its upper position, and the stud *e* in connection with the recess *t* locks the said rod in its lower position.

Upon the reversal of the movement of the hand-lever B or its movement from the right to the left, looking at Fig. 1, the first part of its movement will, through the rod T, bell-crank W, and link X, cause the slide Y to move toward the right sufficiently to free the stud *e* from the recess *t*, thereby unlocking the rod *r*, and the next portion of the movement of said lever B toward the left will cause the pin V to strike the arm *g* and turn the lever *h* to the position in which it is illustrated in Fig. 1, thereby elevating the rod *i* and valve *k* for the purpose of opening the port *n* to lower the end of the cylinder D and exhausting the air or steam from the upper end of said cylinder through the ports *m g*, whereby the piston E and rod *r* are caused to immediately ascend and actuate the ground-rod C and the devices connected therewith, while the latter portion of the movement of the said lever B toward the left causes the stud *d* to enter the recess *u* in said rod and lock the latter in its upward position, as shown.

The studs *d e*, adapted for engagement, respectively, with the recesses *u t*, are of very great importance. The stud *d* locks the rod *r* in its upward position until such time as the operator may manually move the proper lever B sufficiently to withdraw the stud from the recess *u*. Thus the operator on the second floor of the tower has positive knowledge that the rod *r* and piston E are in their upward position at the time when it is desired that they shall be in that position. When the piston E and rod *r* ascend to their upward position, the stud *d* may enter the recess *u*; but unless the said piston and rod have ascended under the influence of the mechanism set in motion by the lever B the stud *d* cannot enter the recess *u*, but will strike against the outer edge of the piston-rod and prevent the lever B from moving to its full position, whereby the operator is apprised that the machinery is not in perfect working order, and that the parts connected with the cylinder D are not in condition to

operate. The inability of the stud *d* to enter the recess *u* is an assurance directly conveyed to the operator that the mechanism is out of working order and requires attention. The stud *e*, when the piston-rod *r* is in its lower position, may enter the recess *t* and lock the rod *r*; but if for any reason the piston and rod have not made their descent to operate the switch, lock, or signal, or, in other words, have not responded to the movement of the lever B, the stud *e* cannot enter the recess *t*, and hence the operator will instantly know that the mechanism is not performing its duty. The studs *d e* thus not only serve, respectively, to lock the rod *r* in its upper and lower positions, but constitute telltale devices, by which the operator on the second floor of the tower is instantly apprised of any failure of the mechanical parts to perform their proper functions.

The power necessary for moving the ground-rod C and its connections is derived from the compressed air, steam, or other fluid which enters the power-cylinder D, and hence it will be observed that the only physical force necessary to be exerted by the operator is that applied in moving the lever B and through said lever the tappet-bar, valve *k*, and slide Y, and the movement of these parts is rendered convenient and easy by the nature of the connections intermediate the lever B and the valve *k* and slide Y, and also by the arrangement of the cams H on the tappet-bars F and the rollers M below the locking-bars G. A very light force applied to the lever B will move the valve *k* and slide Y, and, owing to the direct positive action of the cams H on the tappet-bars F, the latter may be readily and conveniently moved and their motion transmitted through the said cams to the locking-bars. The cams H are composed of the inclined surfaces *a'* and *b'* and the plain surfaces *c'*, the latter being intermediate the inclined surfaces *a'* *b'* and parallel with the longitudinal edges of the tappet-bars. During that portion of the movement of the lever B which results in the unlocking of the piston-rod *r* one of the inclined surfaces of the cam H will move against the engaging pin O or projections P, according to which is employed, and start the movement of the locking-bar, and at this time it will be observed that the force of the operator is only consumed in the partial movement of the slide Y, tappet-bar F, and locking-bar G. During the continued movement of the lever B to cause the pin V to actuate the lever *h* and depress the rod *i* and valve *k* the plain parallel surfaces *c'* of the cam H will move along the pin O or projections P without any tendency to move the locking-bar G. Thus during this second part of the movement of the lever B the force of the operator, acting through the lever B, is expended in simply moving the valve *k* and tappet-bar F, the latter at such time being practically free. During the latter part of

the movement of the lever B the piston-rod is locked at the end of its stroke and one of the inclined surfaces of the cam H acts upon the locking-bar G to move it to complete its
 5 action. Thus during the latter part of the movement of the lever B the strength of the operator is consumed only to the extent of locking the rod *r* and finishing the movement of the locking-bar G. It will thus be observed
 10 that not only is the force necessary to move the ground-rods derived from the power-cylinder D and relieved from the operator, but that the force necessary to set the power-cylinder in operation and the tappet and locking
 15 bars in motion is so distributed with respect to each other that the entire force of the operator is not expended at one time to effect the complete simultaneous movement of all of the parts referred to, but is, as above
 20 described, practically in succession applied to move first one and then another part during a continued motion of the lever B.

While I regard the special form of cam H when used in connection with the special arrangement of mechanism illustrated in Fig. 1 as of special importance, I do not limit the invention to the cams H.

Each of the levers B is provided with the mechanism illustrated in Fig. 1, and connected with one of the tappet-bars F. In
 30 Fig. 1 the power-cylinder D and its connections are illustrated as being within the tower A and directly below the second floor thereof, but it is to be understood that I do not limit the invention to the placing of the cylinders
 35 D directly within the tower A, since they may be placed directly without the tower, as illustrated in Fig. 9, or adjacent to the points at which the signals, lock, and switch may be
 40 placed, as illustrated in Fig. 10.

In Figs. 8, 9, and 10, A' A' designate the distant signals; B' B', the home signals; C', a switch, and D' a facing-point lock, all of these features being of well-known form and
 45 construction. In view of the fact that the power cylinders D may be arranged at the various points above referred to, it will be obvious that the invention is not confined to the special form or arrangement of rods and
 50 levers illustrated in Fig. 1, since these will necessarily change to meet the various localities which circumstances may render necessary or desirable for the cylinders D. When
 55 convenient, the cylinders D will be arranged with respect to the levers B in the manner illustrated in Fig. 1, and the slide Y will be arranged to directly engage the piston-rod. When necessary or desirable, however, the
 60 slide Y may indirectly engage the piston-rod by being arranged to directly engage some movable part of mechanism intermediate the piston-rod and the lock, switch, or signal to be actuated thereby.

Without therefore limiting myself to the
 65 details of construction or special arrangement of parts shown and described, what I

claim as my invention, and desire to secure by Letters Patent, is—

1. In a machine of the character described, the hand-lever, and the power-cylinder, combined with mechanism intermediate the said
 70 cylinder and lever for operating the former from the latter, the ground-rod connected with the piston-rod of said cylinder, and means independently and directly connected
 75 with and directly and manually actuated from the hand-lever for locking the piston-rod at each end of its movement; substantially as set forth.

2. In a machine of the character described, the hand-lever B, the tappet-bar pivotally
 80 secured to said lever and having the cam H, and the locking-bar directly engaging the said cam, combined with the power-cylinder, having its piston-rod provided with a recess,
 85 connections intermediate said cylinder and lever for operating the former from the latter, the slide having a projection for engagement with said recess, and connections intermediate said slide and lever for directly op-
 90 erating the former from the latter; substantially as and for the purposes set forth.

3. In a machine of the character described the hand-lever having the crank S, the rod T connected with said crank, the power-cylinder
 95 D having the valve-rod *i*, the rocking lever *h* connected with the rod *i* and arranged to be engaged by the said rod T, and the slide Y having the projections *d, e*, and connected with said rod T, combined with the piston-
 100 rod of said cylinder having recesses to be engaged by said studs *d, e*, and the ground-rod connected with said piston-rod; substantially as set forth.

4. In a machine of the character described, the hand-lever, the power-cylinder, and suitable
 105 connections intermediate said cylinder and lever and said cylinder and the signal or other device to be actuated, combined with means independently and directly connected
 110 with and directly and manually operated by said lever for engaging and disengaging a movable part of the mechanism intermediate said cylinder and the device operated upon
 115 at the opposite ends of the movement of said part; substantially as and for the purposes set forth.

5. In a machine of the character described, the hand-lever, the power-cylinder, mechanism
 120 intermediate said lever and cylinder for operating the latter from the former, and the ground-rod connected with the piston-rod of said cylinder, combined with means independently and directly connected with and
 125 directly and manually operated by said hand-lever for locking said piston-rod at the end of its stroke; substantially as and for the purposes set forth.

6. In a machine of the character described, the hand-lever, the power-cylinder having its
 130 piston-rod provided with recesses *t, u*, and connections intermediate said cylinder and

lever for operating the former from the latter, combined with the slide having projections *d, e*, for engagement with said recesses, and connections intermediate said slide and lever for operating the former from the latter; substantially as and for the purposes described.

7. In a machine of the character described, the hand-lever, the power-cylinder having its piston-rod provided with a recess, and connections intermediate said cylinder and lever for operating the former from the latter, combined with the slide having a projection for

engagement with said recess, and connections intermediate said slide and lever for operating the former from the latter; substantially as and for the purposes described.

Signed at New York, in the county of New York and State of New York, this 16th day of November, A. D. 1895.

JOHN T. CADE.

Witnesses:

CHAS. C. GILL,
E. JOS. BELKNAP.