(No Model.) 4 Sheets—Sheet 1.

A. G. CUMMINGS.

APPARATUS FOR OPERATING RAILWAY SWITCHES AND SIGNALS.

No. 271,808. Patented Feb. 6, 1883.

Fig. 1.

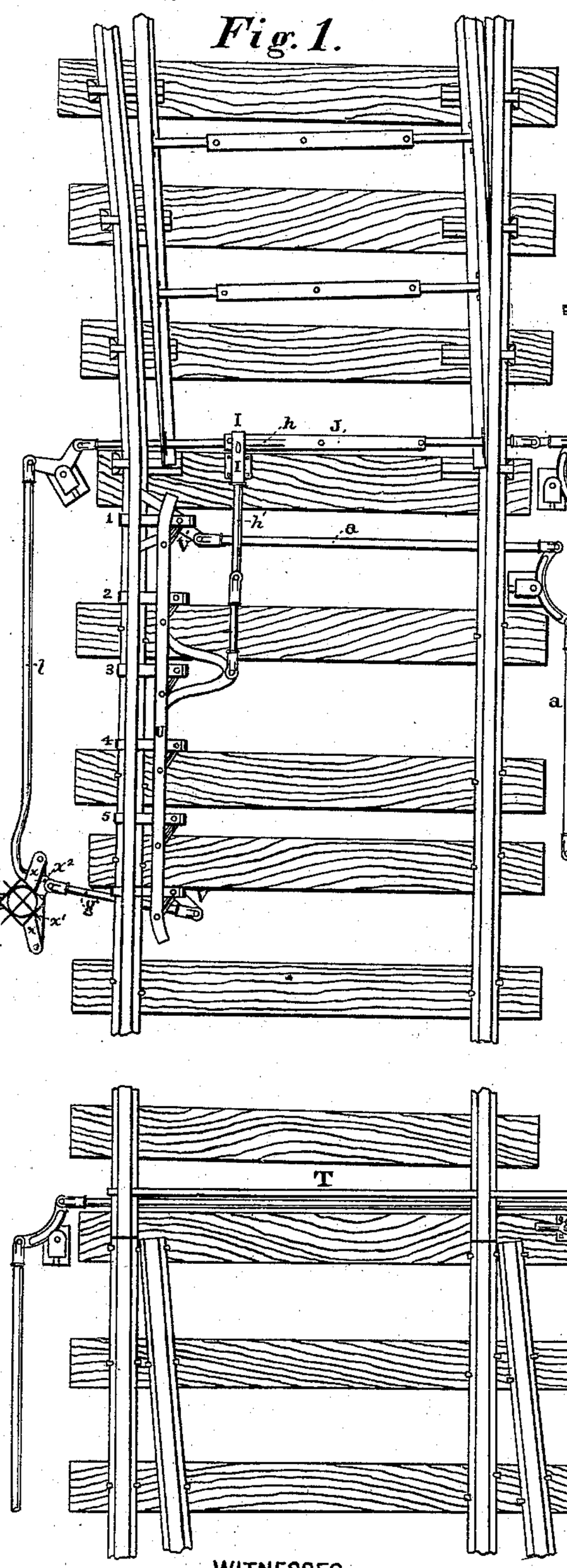
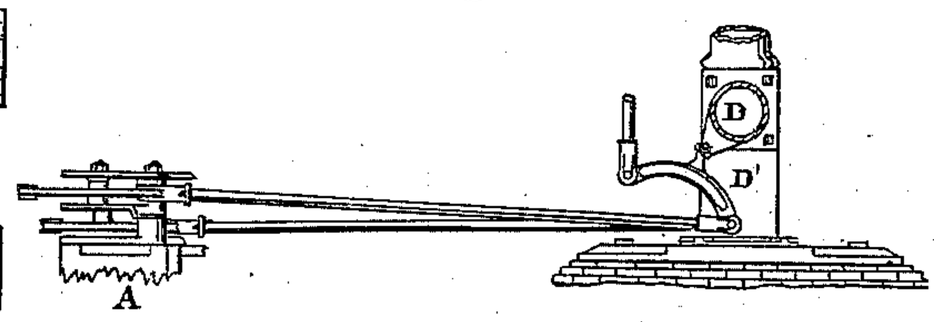
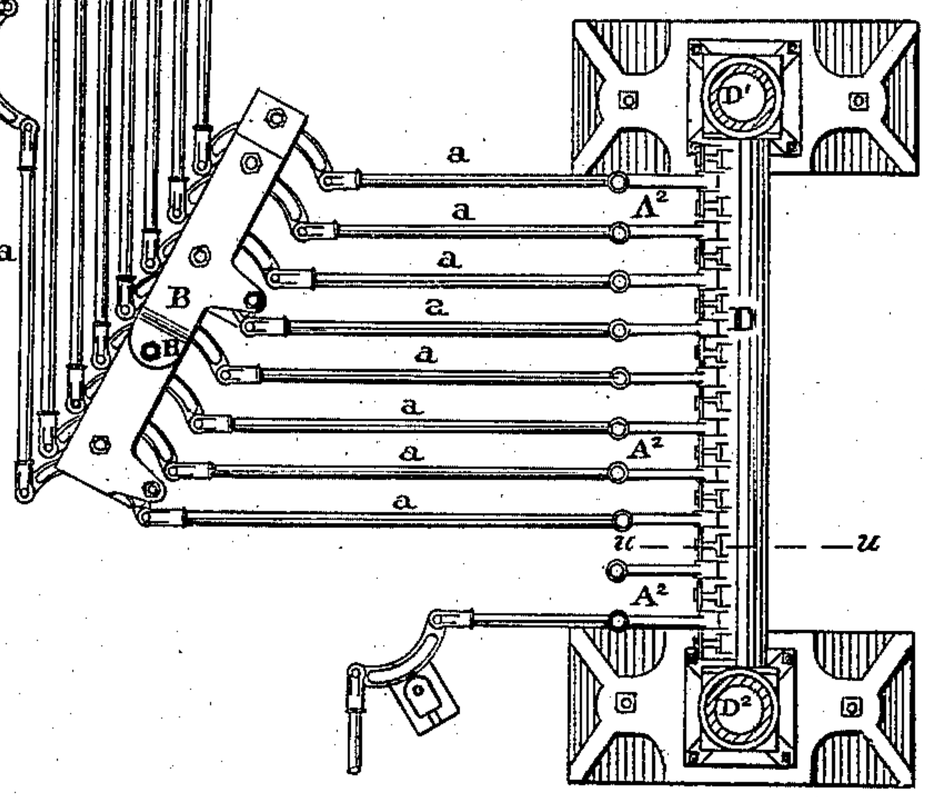


Fig. 2.





WITNESSES.

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William W. Farr Jr.

INVENTOR.

Albert G. Cummings.

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(No Model.) 4 Sheets—Sheet 2.

A. G. CUMMINGS.

APPARATUS FOR OPERATING RAILWAY SWITCHES AND SIGNALS.

No. 271,808. Patented Feb. 6, 1883.

Fig. 3.

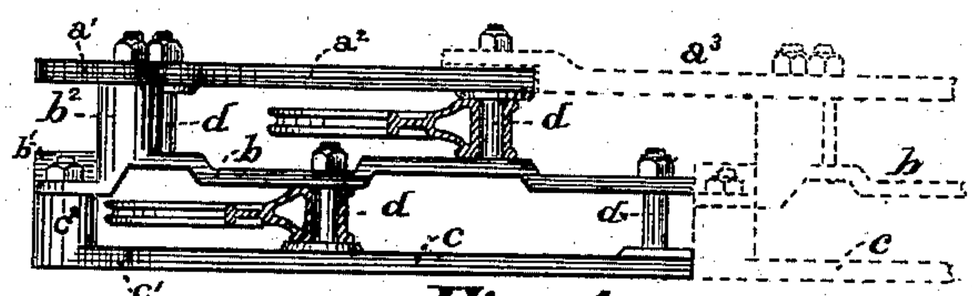


Fig. 4.

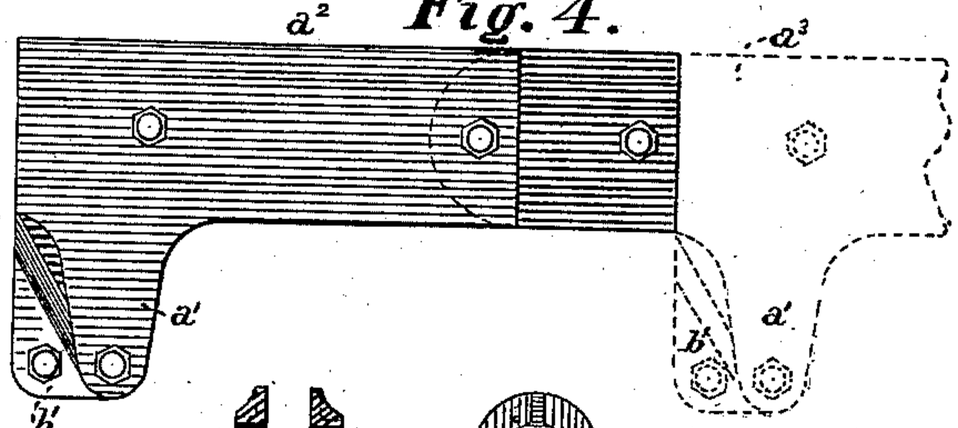


Fig. 5.

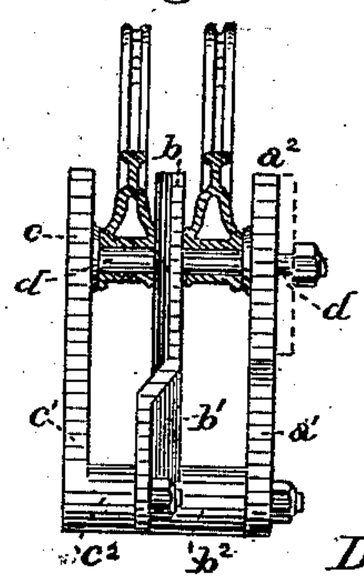


Fig. 8. *Fig. 9.*

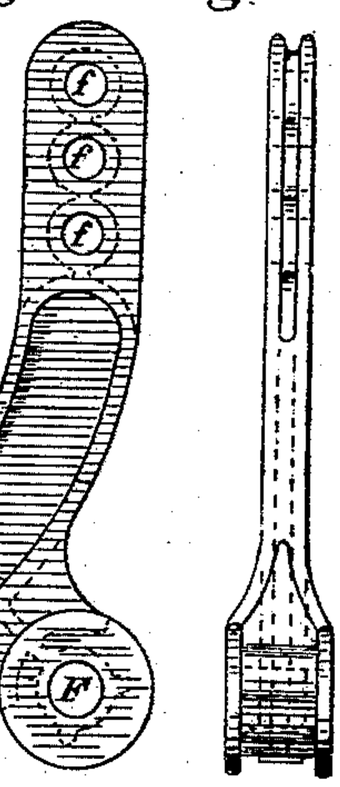


Fig. 6.

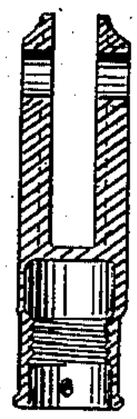


Fig. 7.

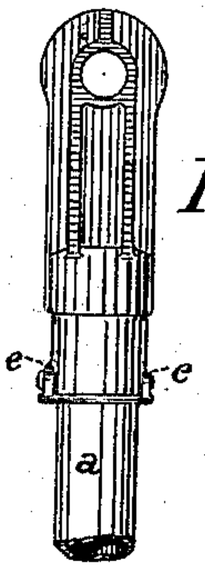


Fig. 10.

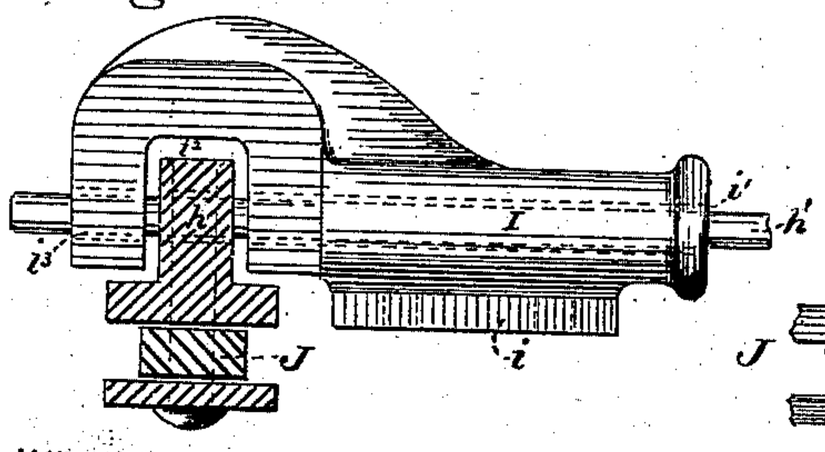
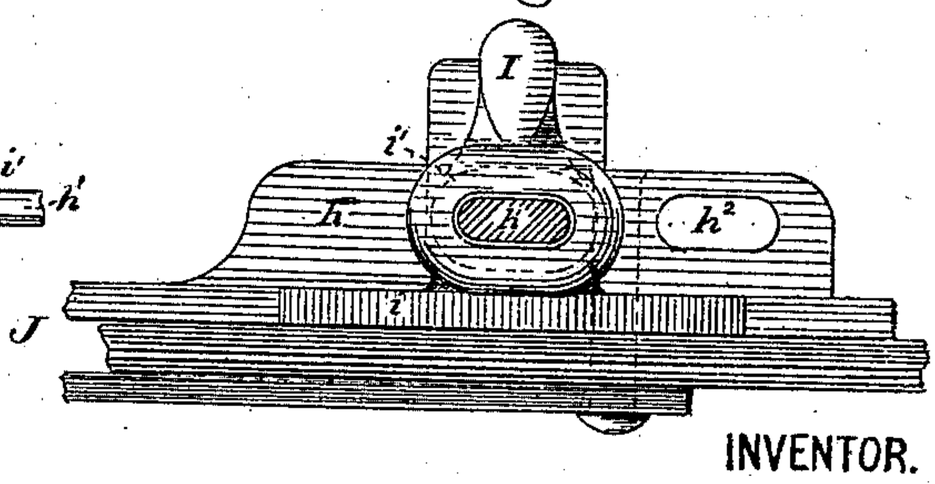


Fig. 11.



WITNESSES.

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4 Sheets—Sheet 3.

A. G. CUMMINGS.

APPARATUS FOR OPERATING RAILWAY SWITCHES AND SIGNALS.

No. 271,808. Patented Feb. 6, 1883.

Fig. 12.

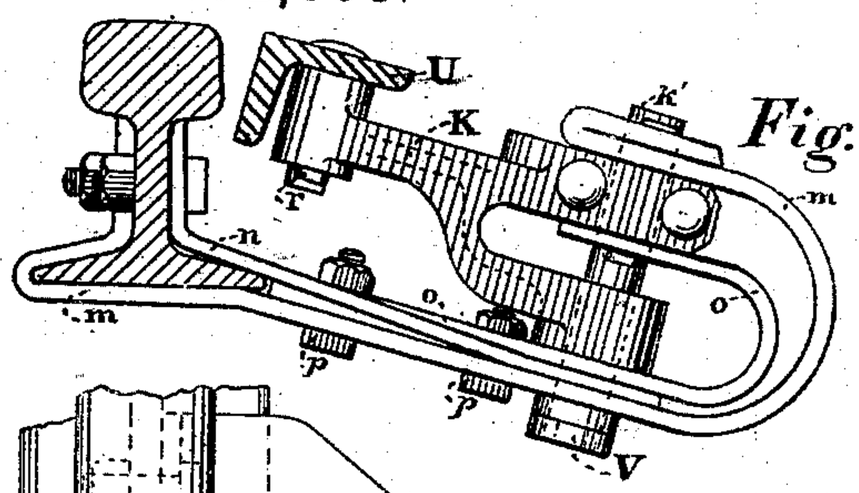


Fig. 13.

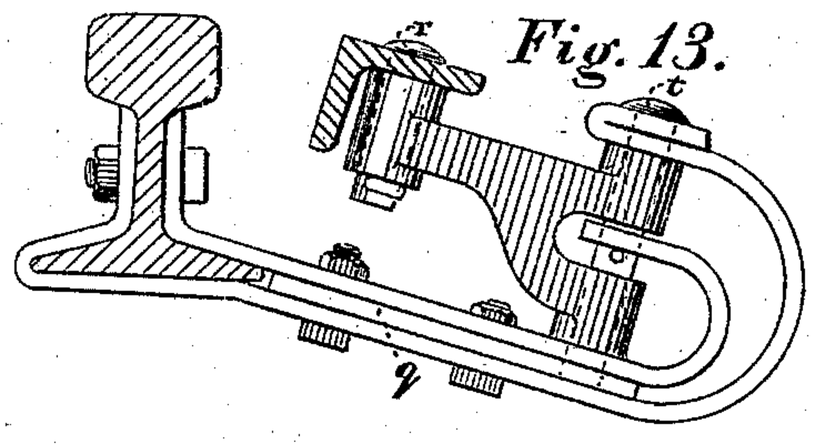


Fig. 14.

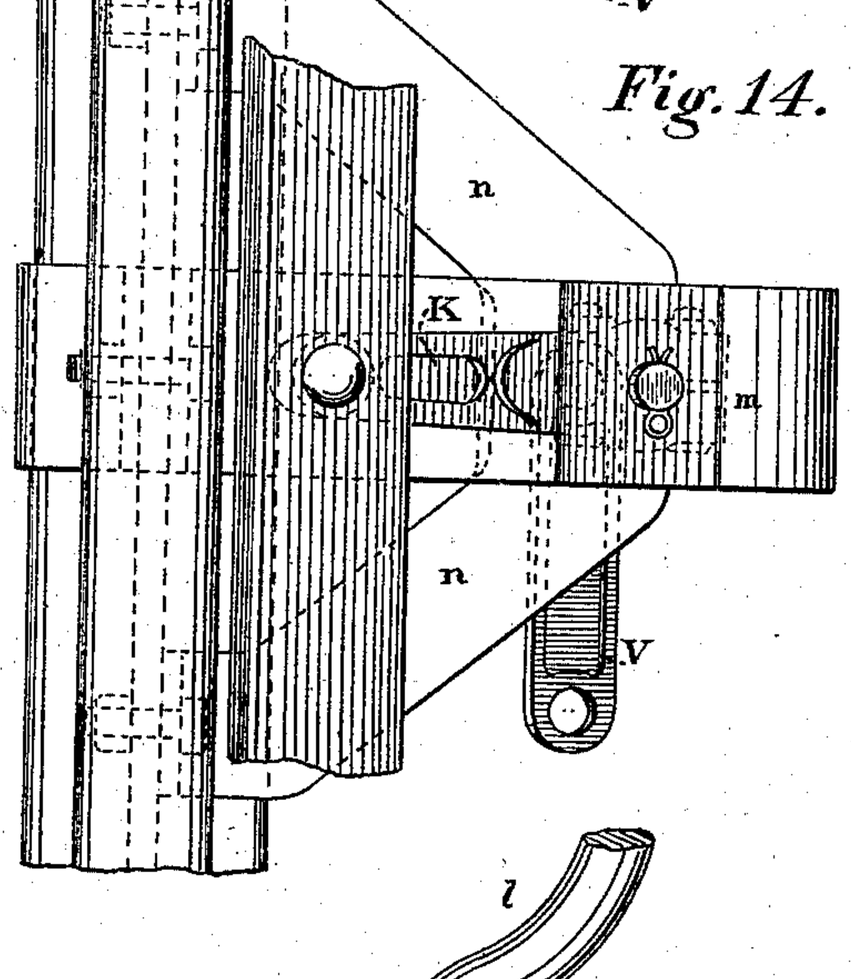


Fig. 15.

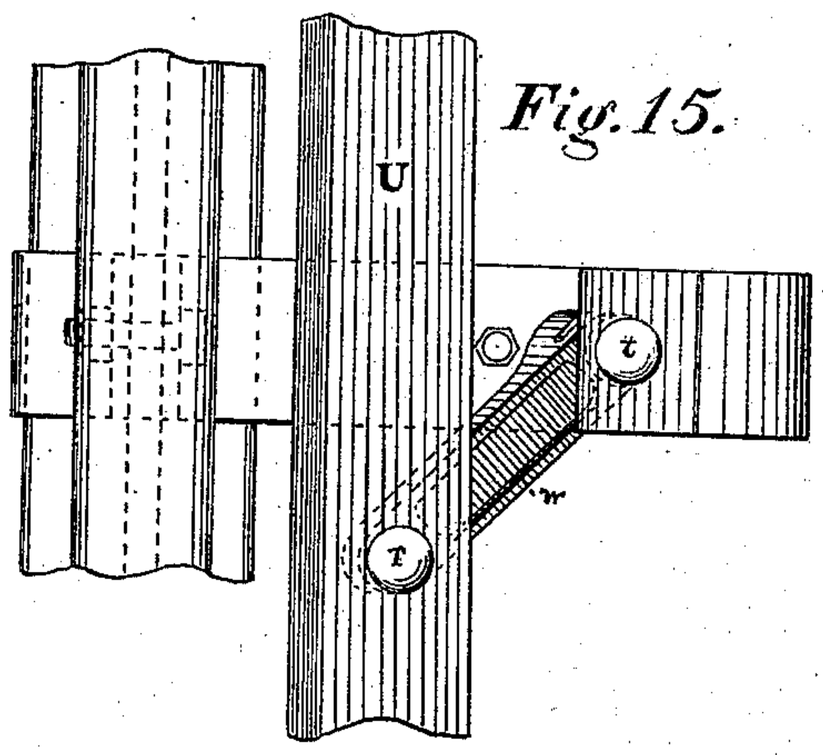


Fig. 16.

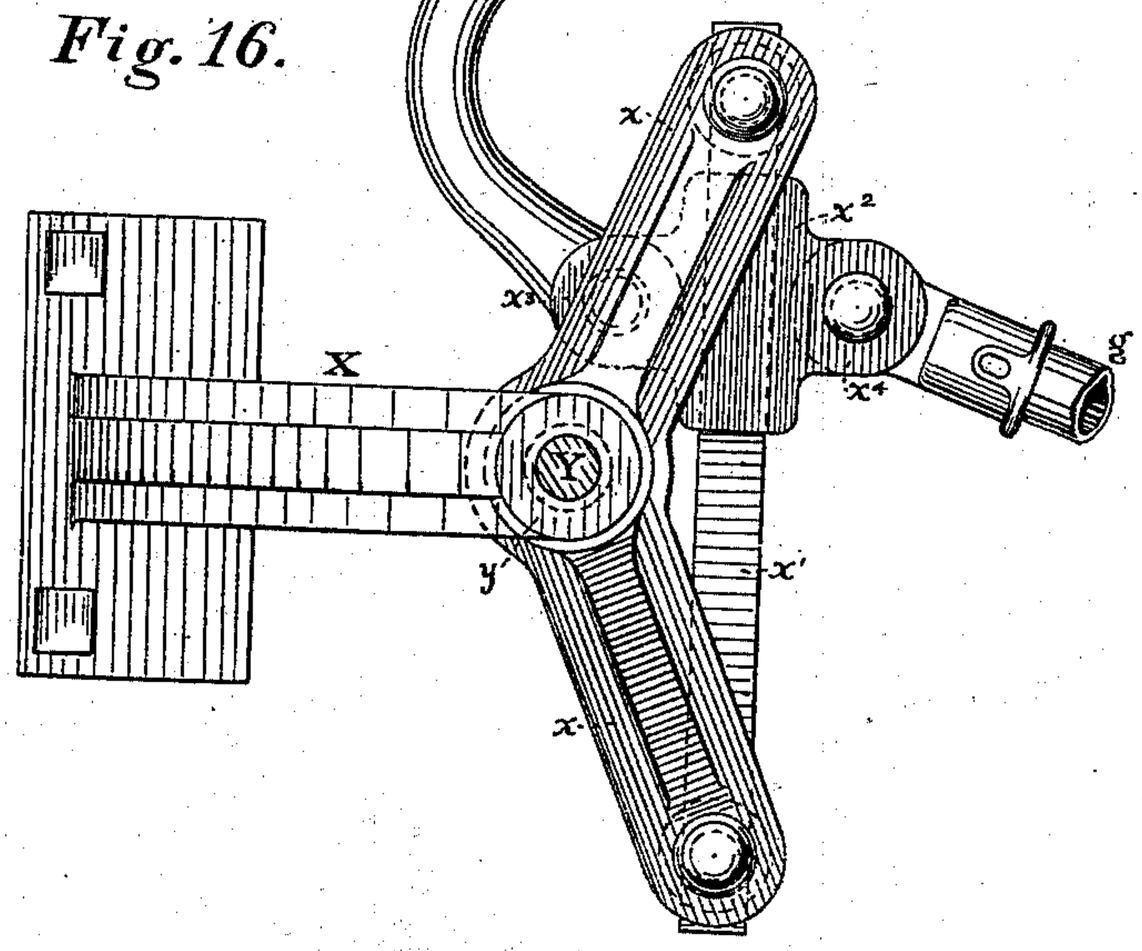
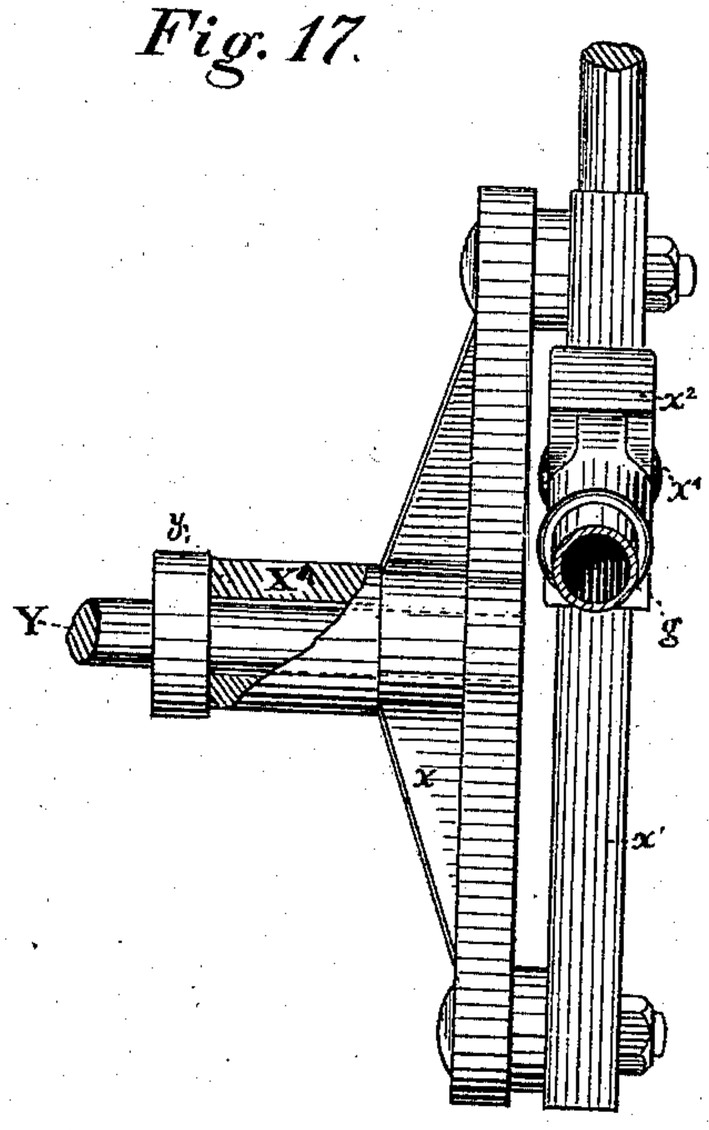


Fig. 17.



WITNESSES.

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(No Model.)

4 Sheets—Sheet 4.

A. G. CUMMINGS.

APPARATUS FOR OPERATING RAILWAY SWITCHES AND SIGNALS.

No. 271,808. Patented Feb. 6, 1883.

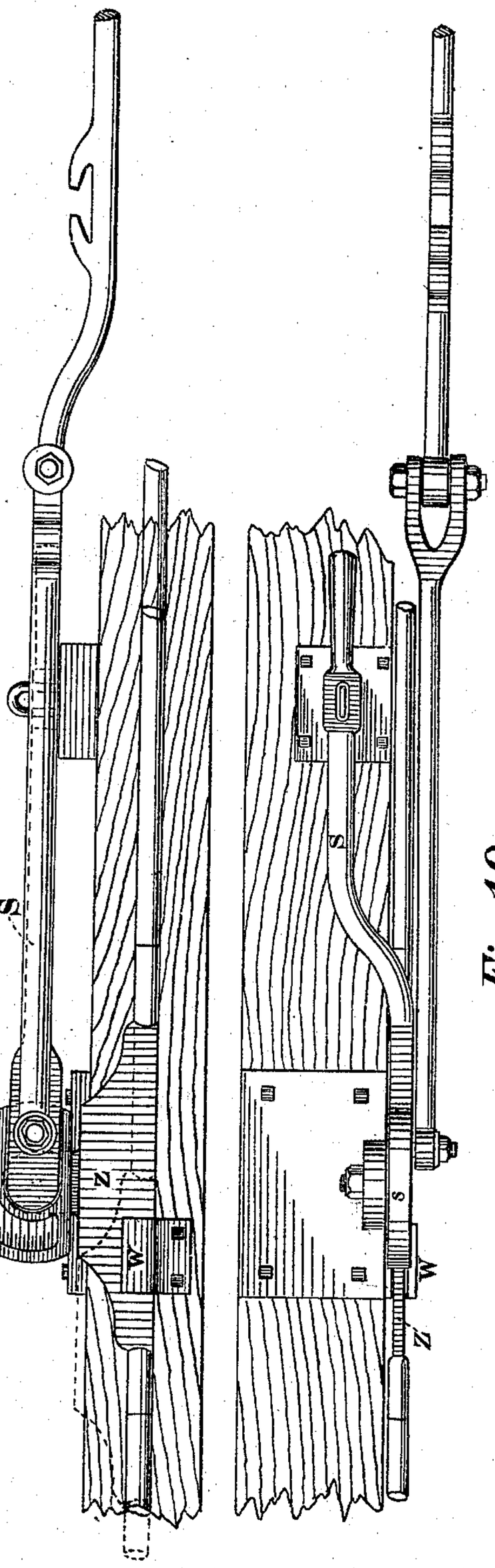

Fig. 18.

Fig. 19.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR OPERATING RAILWAY SWITCHES AND SIGNALS.

SPECIFICATION forming part of Letters Patent No. 271,808, dated February 6, 1883.

Application filed August 30, 1882. (No model.)

To all whom it may concern:

Be it known that I, ALBERT G. CUMMINGS, of Harrisburg, in the county of Dauphin and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Operating Railway Switches and Signals, of which improvements the following is a specification, reference being made to the accompanying drawings, which form part hereof, and in which—

Figure 1 is a general plan view of a track, two switches, and a target-signal, showing the application thereto of my improvements in the apparatus for operating and controlling the switches and the signal. Fig. 2 is a transverse section on the line *u u* of Fig. 1. The other figures relate to the details of my improvements, and will be respectively explained in the further course of this specification.

It is the general object of my invention to operate a system of switches, facing-point locks, with safety bars and signals, from a distance by means of levers (located at a convenient central point) which shall not only operate the switches immediately under their control, but at the same time may control other switches comprised within the system which they do not operate, but which are operated by hand; and to these ends my invention consists in the combinations and improved construction of parts hereinafter described.

In Fig. 1 I have shown the girt D, supporting a series of bell-cranks, A^2, in the usual manner, with connections *a a a a* leading to the switch. The girt is preferably constructed as shown and described in Letters Patent No. 226,499, issued to my assignee, The Pennsylvania Steel Company, under date of April 13, 1880.

The first feature of my present improvements relates to the construction of the frame which supports and carries the bell-cranks; and in the accompanying drawings, Fig. 3 is a side elevation, Fig. 4 is a plan view, and Fig. 5 an end elevation, of my improved frame, the object of which is to economize the space occupied and to facilitate the removal or replacement of the bell-cranks, at the same time providing for any extension of the series of supports that may be required. This frame rests upon a suitable foundation of wood-work, as indicated at A in Fig. 2, and is secured upon this foundation so as to rest firmly thereon. The frame is made up of sections, each section consisting of, first, a short flat top plate, a^2, having at its forward end a projection, a'; second, a longer middle plate, *b*, recessed alternately on opposite sides, and also having a projection, b', at its forward end; and, third, a flat bottom plate, *c*, corresponding in length with the middle plate, *b*, and provided with a corresponding projection, c'. These plates are secured together by bolts *d*, which also serve as pivots for the bell-cranks, and are maintained in their proper relative positions by shoulders on the pivot-bolts, and by distance-pieces b^2 c^2, which are fitted between the projections and secured by tie-bolts. The projection c' of the bottom plate also affords a broad base, through which the frame can be secured by additional bolts to the foundation. (See Fig. 5.) The outer surfaces of the frame thus made up being flat, its upper surface is not in the way, and its lower surface is afforded a firm level support. The interior of the frame being recessed as shown and described, affords adequate space for two tiers of bell-cranks within the smallest practicable compass. The distance-pieces, being at one end of the frame, do not obstruct the movement of the bell-cranks or connection-rods, and their opposite ends are also thus left free to be connected with another similar sectional frame, as shown by dotted lines, Figs. 3 and 4, extending the series of pivots as far as required; and the entire arrangement of parts is such as to permit ready access to any one or all of the bell-cranks for removal or replacement. It will be observed in Fig. 3 that the top plate, a^3, of the dotted frame-section is longer than the top plate, a^2, of the first section by so much as is necessary to afford the requisite overlapping for securing the two sections together, as seen at B, Fig. 1; but with this exception the succeeding sections will all be the same as the first one above described, and specially shown in the drawings.

The second feature of my improvements relates to the construction of the jaws or couplings by means of which the pipe-connections between the bell-cranks are made, and this improvement is shown in section and in plan in Figs. 6 and 7, respectively, of the accompany-

ing drawings. This improved jaw should be a malleable iron or steel casting. A portion of the interior of the shank, Fig. 6, next the bottom of the jaw is cored out to provide clearance for the end of the tap with which another portion of the interior is threaded to receive the screwed part of the connection pipe or rod, and from this threaded portion outward the interior of the shank is counterbored to fit the plain exterior of the pipe or rod. Suitable bosses, *e*, near the end of the shank, are provided with holes coinciding with holes in the sides of the jaw and through the connection-pipe, and through all of these holes a rivet is driven, (the holes through the connection-pipe being punched after the pipe is screwed home in the jaw,) the object of this riveting being to prevent the pipe from unscrewing. The counterbored end of the jaw, fitting snugly upon the outer surface of the connection pipe or rod *a*, stays it firmly against lateral strains, which, in the absence of such support, would frequently break the pipe at the end of the threaded part, and by giving the connection this form the continuous sides of the counterbored jaw co-operate with the threaded portions of the jaw and the pipe or rod connection and the rivet-fastening to make a strong, light, and solid coupling, well braced against lateral and torsional strains.

The third feature of my present improvements relates to the construction of the bell-cranks themselves. Heretofore they have been made in the ordinary form—that is, with a rectangular extension of the arms—and have necessarily been heavy in order to give them the requisite strength to sustain the transverse strains through their axes. The expense of this excessive weight of metal is so serious that efforts have been made to reduce it without diminishing the strength too much by making these bell-cranks of malleable casting and annealing them; but this has not been satisfactorily effected by reason of the impossibility of properly annealing such a thickness of metal as was still necessary. It is the object of this branch of my improvements to make these bell-cranks of less weight than heretofore without sacrificing their strength; and to this end my improvement consists in giving the bell-crank the form shown in the accompanying drawings, of which Fig. 8 is a plan view and Fig. 9 an edge view. As thus shown, my improved bell-crank consists of a bar, D^3, curved on an arc, E, at that part where the strains are applied, and having its axis F in a projecting lug or boss outside of this arc, so that the strains are transmitted directly from one end of the bar D^3 to the other without passing through the axis F. A series of holes, *f f*, are provided in each end of the bell-crank, the centers of these holes being in lines at right angles to each other, and the axis of the bell-crank being located at the intersection of these lines. I core out the central part of the bar D^3, as shown in Figs. 8 and 9, in order to reduce the thickness of the metal at this part of the bar and around the holes *f*, and by reason of such reduction this bell-crank can be made of malleable-iron casting, and can be thoroughly annealed.

The object of the next feature of my invention is to secure the switch in position after it has been thrown; and this improvement consists in a lock-bolt housing, of which Fig. 10 is a side elevation with the switch-rod J shown in cross-section; and Fig. 11, an end elevation, the switch-rod being shown in side elevation. The housing I is a strong casting of the form shown, having a base-plate, *i*, through which it is to be secured to the track, a hollow shank, *i'*, through which the switch-bolt *h'* passes, and a strong jaw, i^2, which incloses the switch-rod J, and through the lip i^3 of this jaw there is a hole coinciding with the hollow shank *i'*. The points of the switch are connected by the bar J, on which there is a projecting rib, *h*, with holes h^2 through it to correspond and at the different positions of the switch to respectively coincide with the openings in the housing, so that the switch-bolt *h'* can pass with the movements of the safety-bar through the rib *h* and into and out of the lip i^3, thus locking or unlocking the switch-bar, as desired. The arrangement of these parts will be seen and their operation understood upon reference to Fig. 1.

It is the next object of my improvements to prevent the lock-bolt from being withdrawn from the switch-bar and the switch moved before the train has passed entirely beyond the switch; and to this end my invention further consists in devices by means of which the lock-bolt and housing are combined with the safety-bar, so that the bolt and the bar cannot be moved independently of each other. My devices for this purpose are shown in Figs. 12 14, and 13 15 of the accompanying drawings, Fig. 12 being a side elevation of the swinging arm and supporting-bracket which support and force the safety-bar in the direction in which it is moved by the lever, the rail and safety-bar being shown in cross-section and in their relative position at the center of the movement. Fig. 14 is a plan view of the same parts, showing the lateral brace used in connection with the swinging forcing-arm. Fig. 13 is a side elevation of one of the swinging arms and supporting-brackets which support (but do not force) the safety-bar in its movements and positions, the rail and safety-bar being shown in cross-section and in their relative positions at the extremity of the movement; and Fig. 15 is a plan view of the same parts shown in Fig. 13.

The bracket which supports the swinging forcing-arm is composed of three thin bars of steel, *m*, *n*, and *o*, the outer one, *m*, being bolted by one of its ends to the outside of the rail, and being carried down under the rail and bent into a loop at its free end, which is also doubled over upon itself. The middle bar, *n*, is flat and bent into a triangular form, both of its ends being turned up so as to fit the web of the rail, and being bolted to the rail on the inside. The inner bar, *o*, is bolted

by one of its ends to the inside of the rail, and is carried down over the flange of the rail and over the middle bar, *n*, parallel with the outer bar, *m*, and is also bent into a loop, so that its free end is parallel with the free end of the bar *m*. These three plates are fastened together by bolts *p p* with a liner, *q*, Fig. 13, interposed in the usual manner. The bracket is depressed below the rail at its lower side, and stands away from the rail at its free end.

The swinging forcing-arm K is made of steel and of the form shown, its forked inner ends being pivoted between the bracket-bars *m* and *o* upon a strong shaft, *k'*, while its outer end is enlarged so as to receive a strong bolt, *r*, which secures the safety-bar U in its position upon the arm, yet leaves the safety-bar free to turn on the bolt. It will be seen in Fig. 14 that this bracket is well braced against the rail through the ends of the bar *n*, and well secured to the rail through the ends of its plates or bars *m* and *o*, so that the swinging arm is adequately supported against the strains to which it is subjected, and in turn affords adequate support to the swinging arm K, which carries one end of the safety-bar U. A rigidly-attached link, V, connects the shaft *k'* with the connection-rod *a*, (see Fig. 1,) so that by the movement of the bell-crank the swinging arm is correspondingly moved inward or outward, and forces the safety-bar toward or away from the adjacent rail of the track, according to the extent of movement given to the bell-crank. The other swinging arms and supporting-brackets of the safety-bar, 2 3 4 5, Fig. 1, are made, as shown in Figs. 13 and 15, in the same manner as the one above described, except that the middle plate, *n*, is omitted, since these arms only support the bar, (without forcing it, as the first one does,) and therefore do not require the points of resistance afforded by the plate *n* in the first instance, and the arm *w*, Fig. 15, suffices for turning the arm and carrying the safety-bar conformably with the movement imparted to the safety-bar through the forcing-arm, as above described. In either form of this device the pivots or shafts *t* should all be equidistant from the rail, so that in its longitudinal movement the safety-bar shall first approach the adjacent rail, and then diverge from it after approaching so near the rail that the flange of a wheel interposed between it and the rail would prevent the further movement of the safety-bar.

It has already been stated that the inner or lower ends of the brackets are depressed below the rail, and the upper ends, carrying the pivots or shafts *k'* and *t*, are inclined away from the top of the rail. It follows from this that the vibrating ends of the swinging arms, carrying the safety-bar, in making their movements, rise as they approach the rail, and descend as they recede from the rail. By this depression of the brackets, also, I am enabled to keep their inner ends and the pivots or shafts *k' t* below the top of the rail and out of danger from anything depending from a passing train. By reason of the inclination given to the upper ends of the brackets, if the safety-bar is moved while a train is passing, and the bar has approached the rail just in time for a wheel to strike it, the inclination of the bar being away from the rail, the wheel will not mount the bar, but will tend, by reason of this construction of the brackets, to push the bar away from the rail without injury, and the weight of the bar and the arms also tends to keep the bar at the proper distance from the rail when it is not being moved.

It is the object of the next feature of my improvements to have the position of the switch indicated by an automatic signal; and to this end my invention further consists in combining with the switch a target operated by the above-described movements of the switch and safety-bar, my improved device for this purpose being represented in the accompanying drawings, in which Fig. 16 is a plan view, and Fig. 17 a side elevation, of the connections through which the target-signal is operated, a portion being broken away to show the shaft within the bearing-box in which it is supported.

On the outside of the track, and opposite to the forward end of the safety-bar U, I secure to one of the ties or upon other suitable foundation a bracket, X, at right angles to the track. In the forward end of this bracket I provide a bearing-box, X', through which I pass a vertical shaft, Y, the lower end of which projects below the bracket, while the upper end of this shaft carries a target-signal and a lamp-case. Upon the shaft Y, I also provide a collar, *y*, which supports it upon the upper surface of the bracket and steadies it in its position and movements. Upon the lower projecting end of the shaft Y, I suspend, underneath the bracket X, a yoke, *x*, Figs. 16, 17, the weight of which is borne by the collar *y*, and I connect the arms of this yoke by a bar, *x'*, upon which bar I fit a sliding box, x^2, having a lug, x^3 x^4, projecting from each side. The bar *x'* is attached to the yoke, so that a line drawn through the center of the shaft Y and the sliding box x^2 will be at angle of forty-five degrees to the center of the bar. I connect the sliding box with the switch through the lug x^3, and with the safety-bar U through the lug x^4 by the connection-pipes *l* and *g*, respectively.

The operation of this device is as follows: Assuming the apparatus to be in the position shown in Fig. 1—that is to say, the switch being unlocked—the signal indicates "danger." To lock the switch, the safety-bar U is now moved so as to lock it with the bolt *h'*, and this movement of the safety-bar turns the shaft Y (through the connection *g*) one-eighth of a revolution and brings the signal to the position indicating "safety." To restore the switch to the position shown in Fig. 1, the safety-bar is moved so as to withdraw the lock-bolt *h'* from the switch-bar, and this movement of the safety-bar is accompanied by a backward

movement of the sliding box x^2 through the connection g, this movement, of course, also turning the shaft Y one-eighth of a revolution and bringing the signal again to indicate the fact that the switch is unlocked. The switch is then moved over so as to change the track, and this movement of the switch operates, through the connection l, to slide the box x^2 upon the bar x' to the opposite side of the center of the shaft Y, but without turning the shaft, and then the movement of the safety-bar to lock the switch operates, through the connection g, to turn the shaft Y again one-eighth of a revolution, and this makes it indicate not only that the switch is locked, but that the track has been changed. By this combination the preliminary movement of unlocking the switch causes the signal to show two colors, thus giving warning that the switch is unlocked, and it is only when the switch is locked that the signal can be in position to indicate "safety" and show how the switch is set.

The arrangement shown in Fig. 1 is a good manner of connecting the signal; but the connection may be made directly to any locking device that moves in one direction to release the switch and in the opposite direction to lock it in several ways, which will be suggested by convenience under the special circumstances of the case.

The next feature of my improvements relates to the connections for controlling the movement of trains over a system of switches, my object being to render it impossible to operate the switches either by hand or otherwise in any case where the erroneous movement of them might involve danger, and I have shown my preferred device for this purpose in the accompanying drawings, of which Fig. 18 is a plan view, and Fig. 19 a side elevation, of the interlocking connection with a signal or switch and its operation by a hand-lever, illustrating the improvement, though I do not limit myself to this specific device. This interlocking connection with the signal R works directly under the lever S, located at the switch T, as shown in Fig. 1. A bracket, W, is attached to the tie at this point to support and guide the connection. Upon this part of the connection I secure a lug, Z, having a flat top and concave sides, this enlargement working longitudinally in the bracket W. The pivoted end of the lever S is provided with a flat under face, and has a segmental enlargement, s, on its upper side, these surfaces corresponding respectively with the flat top and concave sides of the lug Z.

It will readily be seen that so long as the flat top of the lug or any portion of it is immediately under the flat face of the lever the lever cannot be raised, and when the flat face of the lug is moved from under the lever and the lever is raised to throw the switch or signal the convex face of the lever will be locked in the concave face of the lug, and it will be impossible to move the connection. Thus the hand-lever in one position is controlled by the switch or signal, and in the other position controls the switch or signal, and it will be impossible for an operator to change the position of the one, except when the other has been properly adjusted to admit of such movement. The switch or signal operator can therefore at all times before moving his switch or signal be absolutely certain that the hand-levers are in position for any proper movement he desires to make, or else that his proposed movement of the switch or signal cannot be made until he has had the hand-lever properly adjusted.

It will readily be seen that the operation of this interlocking device can be obtained in various ways within the skill of a constructer without departing from the principle of my invention.

Having thus described the nature and objects of my invention, what I claim herein as new, and desire to secure by Letters Patent, is, as improvements in interlocking switch and signal apparatus—

1. The sectional frame for carrying the bell-cranks, such frame being constructed substantially as and for the purposes described.

2. The improved coupling-jaw, having the threaded and counterbored shank, substantially as and for the purpose described.

3. The improved curved and cored bell-crank, having its axis located out of the line of strains, substantially as and for the purposes described.

4. The combination, with the switch-bar and the locking-bolt, of the lock-bolt housing, constructed substantially as and for the purposes described.

5. The supporting-brackets, in combination with the swinging arms and the safety-bar, substantially as and for the purposes described.

6. The supporting-bracket depressed below the rail and inclined away from the rail, substantially as and for the purposes described.

7. The combination, with the switch and the safety-bar, of a signal automatically operated by the movements of the switch and the bar, substantially as described.

8. The combination, with a switch or signal connection and a hand-lever pivoted on a fixed fulcrum, of an interlocking device, whereby the switch or signal operator can from a distance control the hand-lever and prevent its being moved, or the operator at the hand-lever can prevent the switch or signal from being changed from a distance, substantially as described.

9. The combination of the enlarged lug on the signal or switch connection with the segmental end of the hand-lever, substantially as and for the purpose described.

ALBERT G. CUMMINGS.

Witnesses:
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J. H. SHOPP.