No. 748,451. PATENTED DEC. 29, 1903.

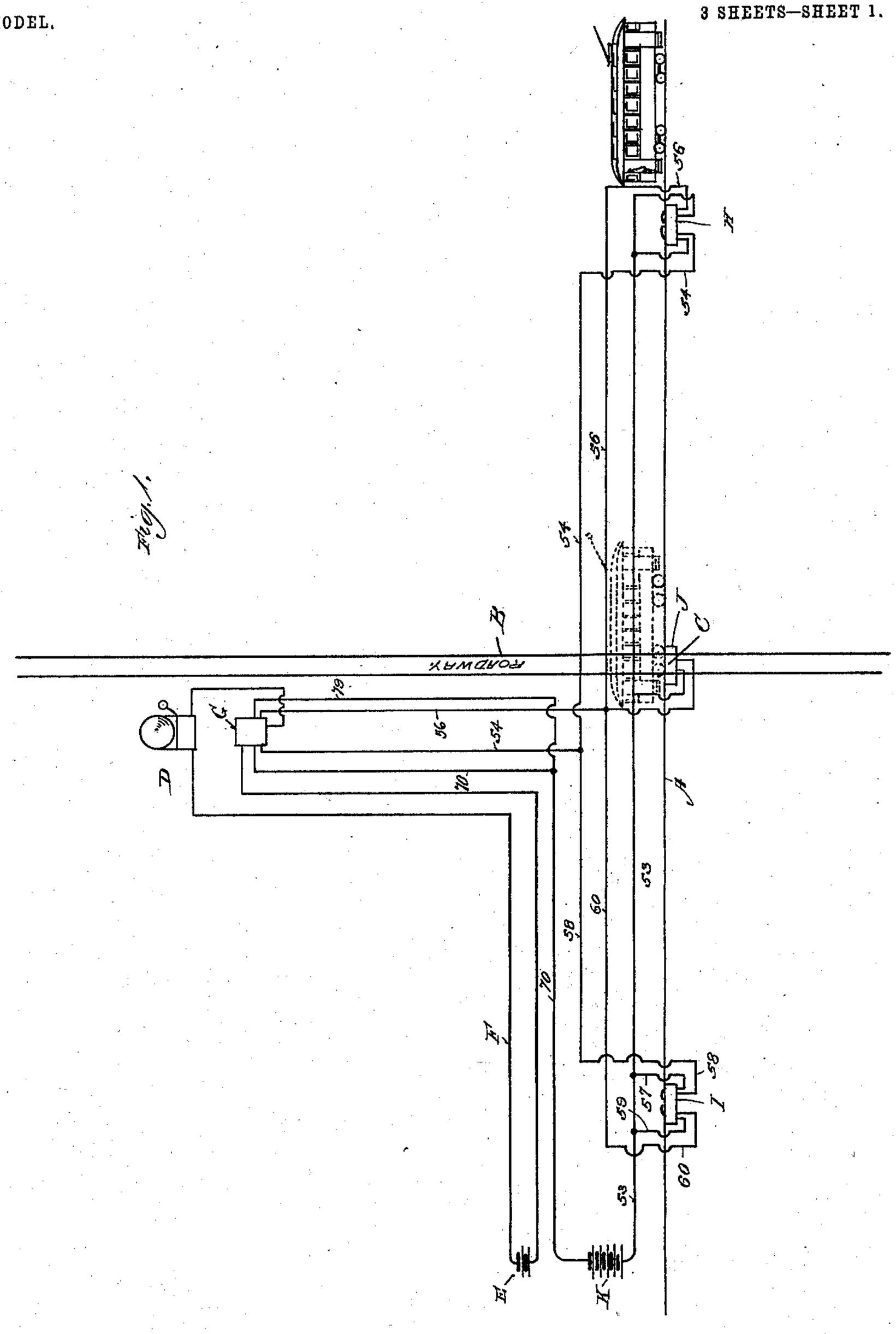
E. E. WOLF & J. B. WILLIAMS.

RAILWAY CROSSING SIGNAL.

APPLICATION FILED JUNE 20, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



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NO MODEL. 3 SHEETS—SHEET 2.

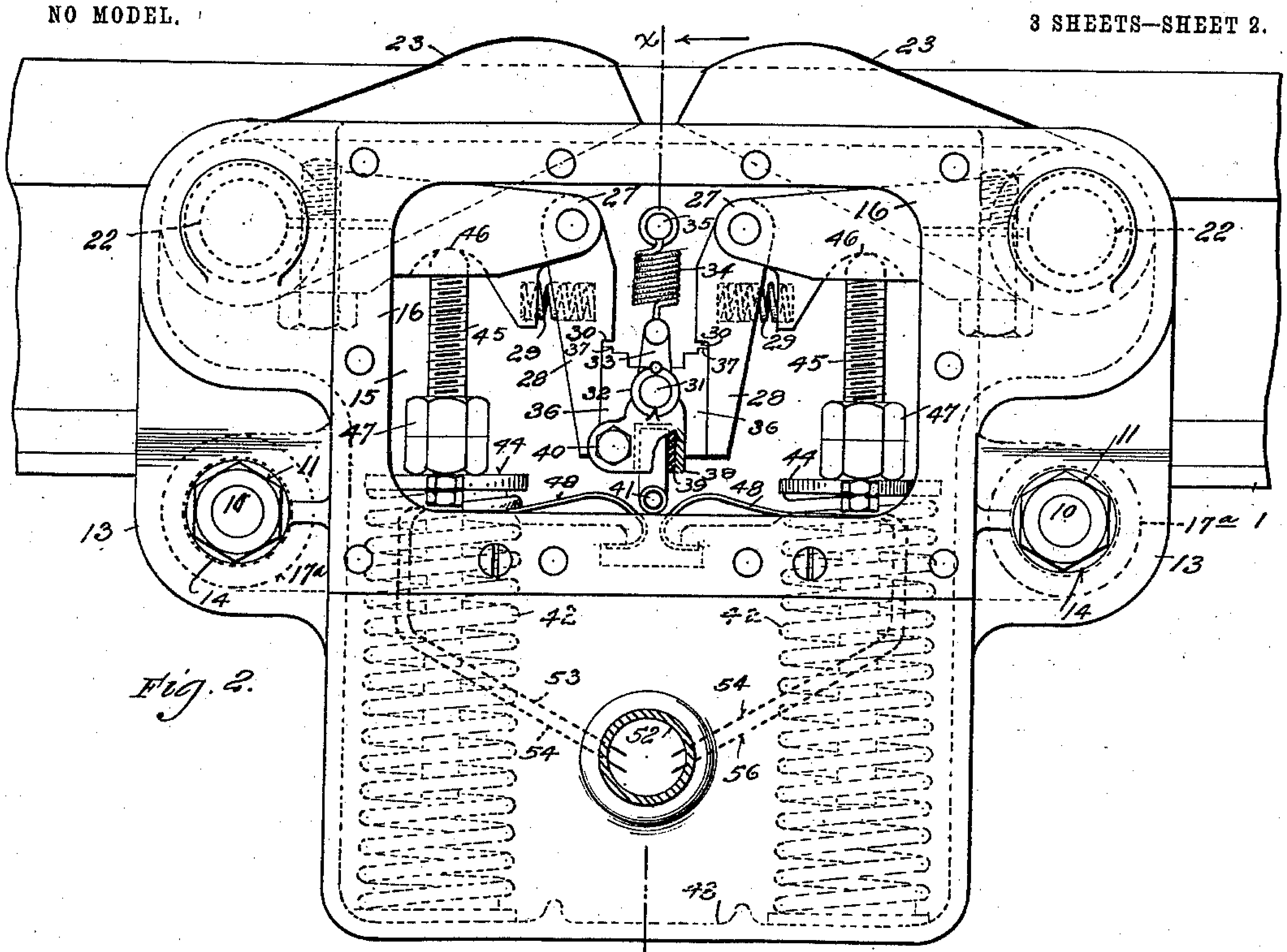

Fig. 2.

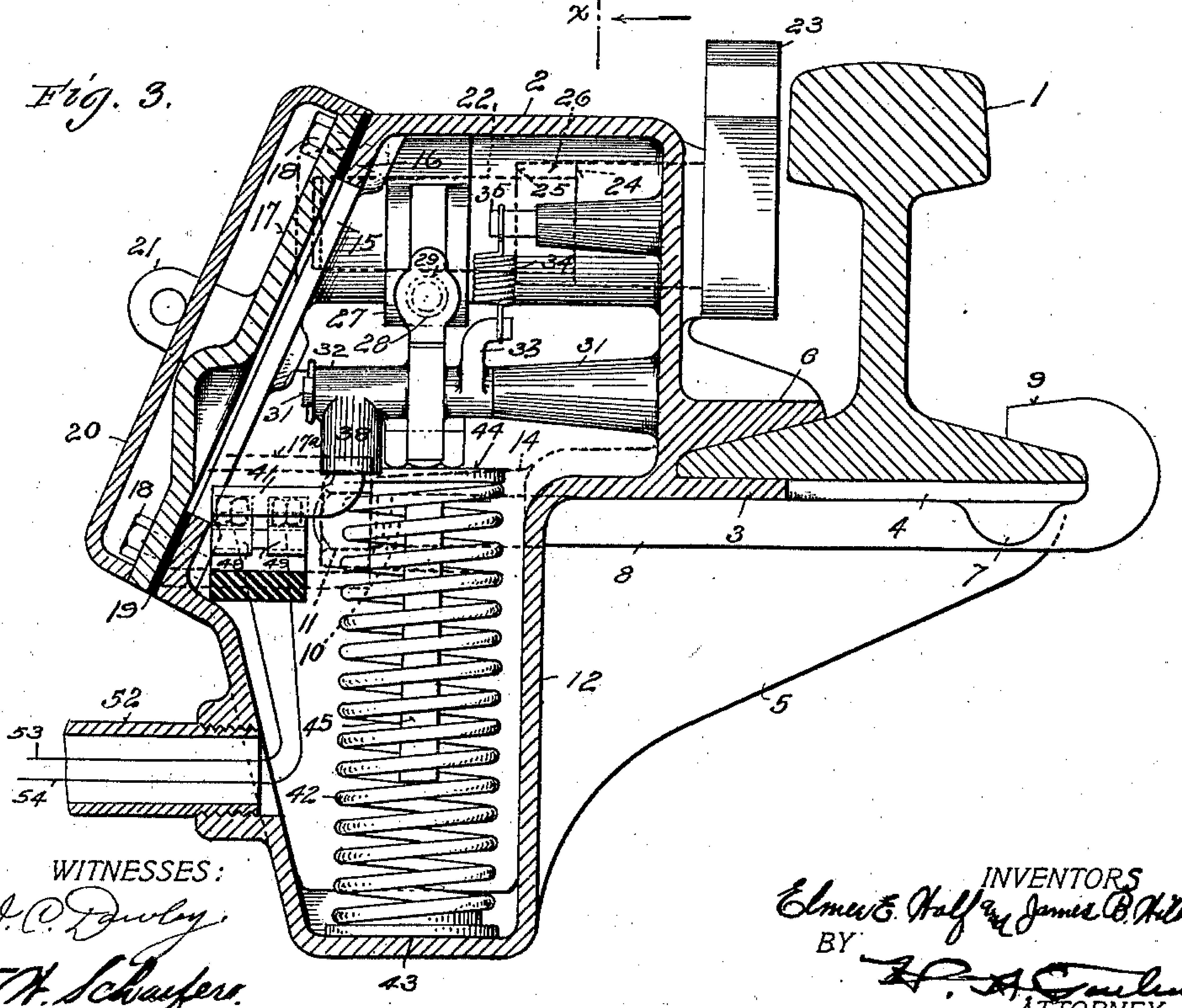

Fig. 3.

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APPLICATION FILED JUNE 20, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 4.

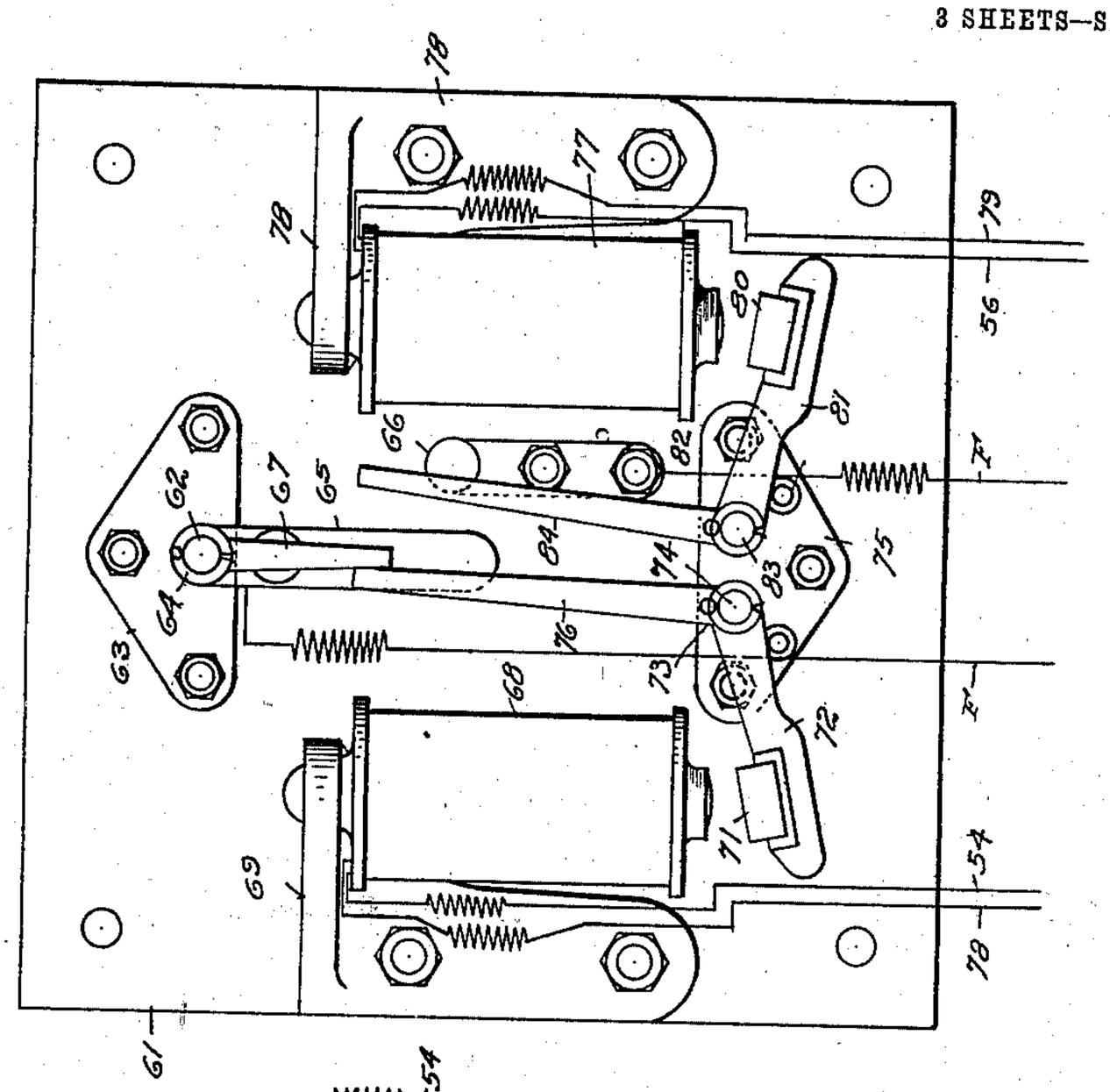
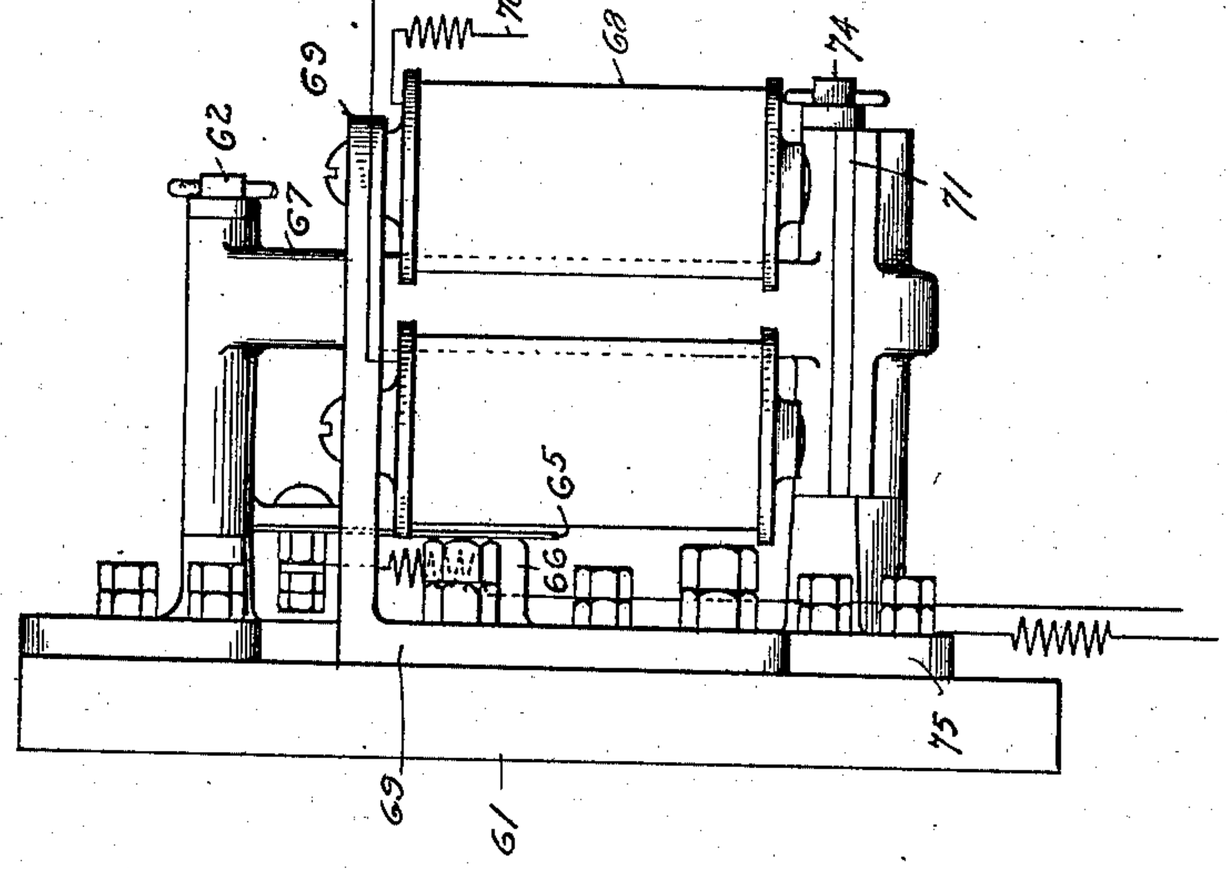


Fig. 5.



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UNITED STATES PATENT OFFICE.

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RAILWAY-CROSSING SIGNAL.

SPECIFICATION forming part of Letters Patent No. 748,451, dated December 29, 1903.

Application filed June 20, 1902. Serial No. 112,416. (No model.)

To all whom it may concern:

Be it known that we, ELMER E. WOLF and JAMES B. WILLIAMS, citizens of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Railway-Crossing Signals, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to railway-crossing signals, and more particularly to that class of signals employed for the purpose of indicating at the crossing of a highway by a railway the approach of a train, although it is obviously capable of other applications.

The main object of our invention is to provide means whereby the signal will be rendered operative upon the approach of a train within a given distance from either direction and will be rendered inoperative as soon as the train has passed the crossing or in case it reverses its direction and backs away without passing the crossing. Such signals have heretofore been usually operated by means of controlling devices actuated by the train and located about equidistantly on either side of the crossing, the signal being located at the crossing and being rendered operative or set by the contact of the train with the first operating device, continuing to operate until the train has passed the crossing and travels as far as the controlling device on the farther side of the crossing. It results from this that the signal remains operative or set during the entire time that the train is on the section of track between the two controlling devices, which is disadvantageous in many ways. For instance, if the train has passed the crossing and then stops before passing the second controlling device the signal continues operative and blocks traffic on the highway, since there is frequently no means of telling whether the train has or has not passed the highway. Moreover, there is ordinarily no provision for setting the signal to "safety" or stopping its operation in case the train after passing the first controlling device stops and backs out before reaching the highway-crossing.

It is the main object of our invention to overcome these objections, and to this and other ends our invention consists in certain novel features, which we will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is a diagrammatic view of a system embodying our invention in one form. Fig. 2 is an elevation of one of the track-boxes with the cover removed. Fig. 3 is a vertical sectional view of the same, taken on the line *x x* of Fig. 2 and looking in the direction of the arrows. Fig. 4 is a front elevation of the switch-box with the cover removed, and Fig. 5 is a side elevation of the same.

Referring first to Fig. 1 of the drawings, A indicates the railway, and B the roadway or highway, the two crossing at C. D indicates a bell or other suitable audible or visible signal, which in practice is located at the crossing C and which is operated by means of a battery or other source of electricity E, the signal being located in a circuit F, including said battery and a switch-box G, containing a switch, hereinafter described, by means of which said circuit may be opened or closed, the signal being operative when the circuit is closed. H and I indicate track-boxes, located adjacent to the railway on opposite sides of and at suitable distances from the crossing C. J indicates a similar track-box, located at the crossing C. These track-boxes comprise circuit-controlling devices adapted to be operated by the trains or cars upon the railway and are in circuit with a battery or other source of electricity K, which is also in circuit with the switch-operating mechanism of the switch-box G, by means of which the switch of the signal-circuit is actuated to open or close said circuit.

We will now proceed to describe in detail the construction of one of the track-boxes, which is illustrated more particularly in Figs. 2 and 3 of the drawings, it being understood that the same description is equally applicable to the other track-boxes, with the exceptions hereinafter pointed out. Referring to said Figs. 2 and 3, 1 indicates a rail of the railway, and 2 the outer casing or box proper, within which the mechanism, with the excep-

tion of the track-levers, is inclosed. This consists of a water-tight casing adapted to be secured to the rail in any suitable manner. The construction we prefer for this purpose is that shown, in which the rear face of the track-box is provided with a horizontal flange 3, extending under the base of the rail and having horizontal extensions 4, also extending under the base of the rail to the farther side thereof, the space between these extensions being cut away. Vertical flanges or ribs 5 serve to strengthen this flange 3 and its extensions 4, and a horizontal flange or extension 6 at the rear of the box fits over the top of the base of the rail in order to more surely engage the parts. Each extension 4 is provided on its inner edge with a downwardly-extending lip or flange 7. The box is held in place by bars or bolts 8—two in number—each fitting between the corresponding rib 5 and lip 7 and having a hooked inner end 9 to engage the base of the rail, its other or outer end 10 being threaded to receive a nut 11. The rear lower wall 12 of the box is extended beyond the body of the box on each side thereof, as shown at 13, each extension 13 being provided with a cylindrical boss 14, through which the threaded end of the corresponding bar 8 extends and beyond which it projects to receive the nut 11, which seats against the end of said boss. The upper part of the body of the box has an opening 15, surrounded by a flat marginal flange 16, to receive a cover 17, secured in position by screw-bolts 18, a packing or gasket 19 being interposed between the cover and flange 16 to make a water-tight joint. The cover 17 is provided with sleeve-like projections 17^a, which extend over and inclose the nuts 10 to prevent access thereto. In order to prevent unauthorized tampering with the mechanism inclosed within the box or removal of the box, we employ an auxiliary cover 20, which incloses the bolts 18 and prevents access thereto, said cover being secured in position by means of an apertured lug 21 on the cover 17 extending through a slot in the cover 20 and adapted to receive a padlock or other locking device. In this way unauthorized access to the nuts 10 or bolts 18 is prevented.

In each end of the track-box there is mounted in a water-tight bearing a shaft 22, carrying at its inner end, which projects beyond the box, a track-lever 23, lying adjacent to the rail, so as to be operated on by the tread or flange of a passing wheel. In order to make the bearing of each shaft 22 water-tight, we prefer to construct each shaft with a reduced end portion, thus forming a shoulder 24. (Indicated in dotted lines in Fig. 3.) The bearing-aperture for said shaft is correspondingly reduced at one end, but for a less distance, thus forming a shoulder 25, between which and the shoulder 24 is located a packing 26 to make a water-tight joint. In other words, there is in each of the upper corners of the box an integral mass of metal bored out, so as to closely surround and bear upon the shaft 22 throughout its length, with the exception of the space between the shoulder 24 on the shaft 22 and the shoulder 25 on the bearing, which space contains the packing just referred to. Each shaft 22 has secured thereon an arm 27, extending into the interior of the upper part of the box and having pivoted to its inner end a dog 28, forced normally outward by a spring 29 and having about midway of its outer face a contact-shoulder 30. Between these dogs there extends forward from the rear wall of the box a fixed shaft or bearing-pin 31, on which is mounted a sleeve 32. This sleeve has an upwardly-extending arm 33, connected by a spring 34 with a pin 35, extending forward from the rear wall of the box. Upon the sleeve 32, on opposite sides thereof, are formed projections 36, having flat outer edges which rest normally against the flat lower edges of the dogs 28, as shown in Fig. 2, each projection 36 terminating at its upper end in a shoulder 37, lying normally in the path of the shoulder 30 of the corresponding dog. At its forward end the sleeve 32 is provided with a downwardly-extending clamping-socket 38, having an insulating-lining 39 and adapted to grip by means of a clamping-screw 40 the upwardly-extending shank of a horizontal contact-arm 41.

The track-levers 23 and the parts operated thereby are held normally in the position shown by means of coiled springs 42, resting upon the base 43 of the box at their lower ends, their upper ends bearing against washers 44, mounted on threaded thrust-rods 45, having rounded upper ends, which bear in sockets 46 in the lower faces of the arms 27. Nuts 47, mounted on the threaded portions of the thrust-rods 45, serve to adjust the position of the washers 44 thereon, and consequently to correspondingly adjust the thrust of the springs. On each side of the contact-arm 41 there are located two yielding or spring contact-pieces 48 and 49. These contact-pieces are supported on a bar 50, of insulating material, and are so arranged that when the sleeve 32 is turned in one direction the contact-arm 41 will establish an electrical connection between the contacts 48 and 49 on one side of said arm, while when the sleeve and arm are turned in the opposite direction said arm will establish an electrical connection between the contacts 48 and 49 on the other side of said arm. The normal position of the contact-arm is the central position shown, in which there is no electrical connection between either of said pairs of contacts.

The lower end of the box is provided in its front or outer face with a threaded opening 51 to receive the correspondingly threaded end of a pipe or conduit 52, through which the wires are led which are connected with the contacts 48 and 49.

Assuming that the track-box shown in Figs.

2 and 3 is the track-box H of the diagram of Fig. 1, then the right-hand lever 23, which is farthest from the crossing, will be what we may term the "cutting-in" lever, for the reason that it cuts in or renders operative the the signal D, while the left-hand lever 23, which is nearest the crossing, will be termed the "cutting-out" lever, since it cuts out or renders inoperative the signal D. The left-hand contacts 48 and 49 have respectively connected to them wires 53 and 54, the former of which is connected with the battery K, while the latter extends to the switch-box G and is there connected to the cutting-in magnet in the manner hereinafter described. The right-hand contacts 48 and 49 have respectively connected to them wires 55 and 56, the former of which is connected to the battery K direct, preferably by connecting it with the wire 53, while the latter or wire 56 extends to the switch-box G and is there connected with the cutting-out magnet, as hereinafter described.

It will be seen that a train or car moving along the track A toward the crossing C, from that side thereof on which the track-box H is located, will first come into contact with the right-hand or cutting-in lever 23 and will operate its rock-shaft 22 so as to depress the inner end of the arm 27 and cause the shoulder 30 of the right-hand dog 28 to engage with the shoulder 37 of the right-hand projection 36 on the sleeve 32. This will swing the contact-arm 41 over the left-hand contact-springs 48 and 49 and will in the manner hereinafter set forth cause the cutting-in magnet to so operate the switch as to render the signal operative. Immediately after and almost simultaneously with the depression of the right-hand or cutting-in lever 23 of the box H the left-hand or cutting-out lever 23 is also depressed; but such depression has no effect, for the reason that at this time the sleeve 32 is so turned that the lower end of the left-hand projection 36 has forced the lower end of the adjacent dog 28 outward, while the shoulder 37 at the upper end of said left-hand projection swings inward, so that upon the downward movement of the dog 28 the shoulder 30 will not engage the shoulder 37 on the left-hand side, and the downward movement of the dog will have no effect upon the sleeve 32 and its contact-arm. After the train has passed both track-levers and all the remaining parts are returned to their normal position by the springs 42. Similarly, a train or car moving in the opposite direction or from the crossing will first depress the left-hand or cutting-out lever 23, and thus establish a connection between the right-hand contact-springs 48 and 49, which are, as hereinbefore explained, in circuit with the magnet which operates the switch to open the signal-circuit, and thus render the signal inoperative. When the left-hand lever is thus first operated, the depression of the right-hand lever immediately following has no effect upon the sleeve or its contact-arm for the reasons already explained, one lever being inoperative while the other is depressed. The contact-box I is similarly but oppositely arranged—that is to say, the lever farthest from the crossing is the cutting-in lever and serves to connect contacts which are connected by a wire 57 with the battery K and by a wire 58 with the cutting-in magnet, while the lever nearest the crossing is adapted to connect the left-hand contacts of said box, which are connected by a wire 59 with the battery and by a wire 60 with the cutting-out magnet. The construction of the track-box J, located at the crossing, will be hereinafter more particularly referred to.

Referring now more particularly to the switch-box, which is shown in detail in Figs. 4 and 5, it comprises an insulating-base 61, on which is mounted a stud-shaft 62, supported by a bracket 63 and carrying a sleeve 64, provided with a contact-arm 65, which is connected with the signal-circuit F. 66 indicates a fixed contact, mounted on the base 61 and also connected with the signal-circuit F, so that when the arm 65 is in contact with the projection 66 the bell or signal-circuit is closed and the bell or signal is operative. The sleeve 64 is also provided with a projection or arm 67, by means of which said sleeve and the contact-arm 65 are actuated. The cutting-in magnet is connected at 68 and is supported by a bracket 69 on the base 61. The coils of this magnet are connected at one end with the wire 54, which directly and through the wire 58 is connected with the cutting-in contacts of the track-boxes H and I. The other end of these coils is connected by a wire 70 with the battery K. The armature 71 of this magnet 68 is mounted upon one arm 72 of a lever 73, pivoted on a stud 74, extending from a bracket 75, secured to the base 61. The other arm, 76, of the lever 73 is adapted to engage the arm 67 of the sleeve 64, which carries the contact-arm 65, so that when the magnet 68 is energized the arm 76 will by its engagement with the arm 67 so turn the sleeve 64 as to bring the contact-arm 65 into engagement with the contact projection 66, and thus close the signal-circuit. Thus when any one of the cutting-in levers of the track-boxes is operated the signal-circuit will be closed and will remain closed until the cutting-out magnet is energized, the lever 65 remaining in engagement with the contact 66, although the energizing of the magnet 68 is only momentary, and the lever 73 returns at once to its normal position. The cutting-out magnet is indicated at 77 and is supported by a bracket 78, mounted on the base 61. One end of the coils of this magnet is connected by the wire 56 and the wire 60, which is connected therewith, to the cutting-out contacts of the track-boxes H and I. The other end of the coils of the magnet 77 is connected by a wire 79 with the battery K, or, what amounts to the same

thing, with the wire 70, which is itself connected with said battery. The armature 80 of this magnet is mounted on one arm 81 of a lever 82, pivoted on a stud 83, extending outward from the bracket 75. The other arm, 84, of the lever 82 is adapted when the magnet 77 is energized to engage the arm 67 of the sleeve 64 and move the same back to the position shown in full lines in Fig. 4, thereby breaking the contact between the contact-arm 65 and the contact projection 66. It will thus be seen that when any one of the cutting-out levers of the track-boxes is operatively depressed, so as to connect the cutting-out contacts of said box, the cutting-out magnet 77 will be energized and will swing the contact-arm of the switch in such a way as to open or break the signal-circuit, and thus render the signal inoperative.

It will be understood that the levers 73 and 82 may be returned to their normal position (shown in full lines in Fig. 4) in any suitable manner—as, for instance, by an excess of weight on the part of the arms of said levers, which carry the armatures in conjunction with stops 85 on the bracket 75—to limit the disengaging movement of said levers.

The track-box J at the crossing C has its contacts connected only with the battery K and with the cutting-out magnet 77. This may be accomplished by constructing said box after the manner of the box shown in Figs. 2 and 3, connecting the contacts 48 and 49 on each side thereof to the cutting-out magnet and battery K, respectively, or it may be accomplished by employing a box from which one track-lever and its coöperating parts are omitted. In either case the passage of a train or car over the crossing track-box results in cutting out the signal.

Referring now to the operation of the apparatus as a whole, as a car or train approaches the crossing—say from the right-hand side, as illustrated in Fig. 1—it will first pass over the track-box H and will depress both track-levers thereof in immediate succession. The depression of the first or cutting-in lever will energize the cutting-in magnet and close the signal-circuit, thereby rendering the signal operative, the depression of the second or cutting-out lever of said box H having no effect whatever. As the car or train proceeds toward the crossing the parts of the track-box H will immediately return to their normal position, but the signal will continue operative or at "danger" until the crossing is reached. If the car or train passes the crossing, it will in crossing over the crossing track-box J energize the cutting-out magnet and thereby break or open the signal-circuit, thus rendering the signal inoperative, so that as soon as the car or train has passed the crossing the signal by its inoperativeness indicates that the crossing is free and that no train or car is approaching the same. If, on the other hand, the car or train before reaching the crossing stops and backs or returns upon its path, as soon as it passes over the track-box H it will first operate the cutting-out track-lever, and thus energize the cutting-out magnet, thereby opening the signal-circuit and rendering the signal inoperative, so that it will no longer block the crossing. It will be understood, of course, that the immediately subsequent depression of the cutting-in track-lever of the box H will be without any effect upon the mechanism, for the reasons already explained. If, however, the car continues in its original direction after passing over the crossing, and subsequently passes over the track-box I, it will first depress the cutting-out lever of said box, which will have no effect upon the signal, as said signal is already cut out, and will immediately after depress the cutting-in lever of said track-box I, this movement of said cutting-in lever being inoperative, as already explained, for the reason that the cutting-out lever has already been depressed and has not had time to return to its normal position.

It will be understood, of course, in the case of a train or car moving in the direction opposite to that already described, or, in other words, from left to right of Fig. 1, the same results will follow, the signal being rendered operative as soon as the car or train passes over the track-box I and being cut out or rendered inoperative as soon as the train passes over the crossing track-box J in its forward course or over the track-box I in a reverse direction in case it backs off before passing the crossing. A system of crossing signaling is thus produced in which the crossing is not blocked after the train or car has passed the crossing or in case it approaches the crossing and then recedes from the same without passing it, so that the blocking of the roadway is reduced to a minimum without impairing the efficiency of the signal as a safety device.

While we prefer to employ an audible signal, such as a bell, in connection with the signal-circuit, it is obvious that a visible signal set to "danger" when the circuit is closed and at "safety" when the circuit is open may be employed or any other suitable signaling device controlled by the signaling-circuit. It is also obvious that while the apparatus is shown in connection with a single track it may be readily arranged for use in connection with a plurality of tracks. Moreover, various modifications in the details of construction and arrangement of the parts may be made without departing from the principle of our invention, and we therefore do not wish to be understood as limiting ourselves to the precise details hereinbefore described and shown in the accompanying drawings.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a railway-crossing signal, the combination, with a signal-circuit and a signal located therein at the crossing, of a switch in

said circuit for opening and closing the same, an electromagnet for operating said switch to close the signal-circuit, another electromagnet for operating said switch to open said signal-circuit, track devices controlling said first-mentioned electromagnet, located on opposite sides of the crossing and adapted to be operated by a car or train approaching the crossing, other track devices located adjacent to said first-mentioned track devices, controlling said second electromagnet and adapted to be operated by a car or train receding from the crossing, a track device located at the crossing, also controlling the second electromagnet and adapted to be operated by a car or train moving in either direction, an electric circuit including said first-mentioned track devices and electromagnet, and an electric circuit including said second-mentioned track devices, the crossing track device and the second-mentioned electromagnet, substantially as described.

2. In a railway-crossing signal, the combination, with a signal-circuit and a signal located therein at the crossing, of a switch in said circuit for opening and closing the same, an electromagnet for operating said switch to close the signal-circuit, another electromagnet for operating said switch to open said signal-circuit, track devices controlling said first-mentioned electromagnet, located on opposite sides of the crossing and adapted to be operated by a car or train approaching the crossing, other track devices located adjacent to said first-mentioned track devices, controlling said second electromagnet and adapted to be operated by a car or train receding from the crossing, a track device located at the crossing, also controlling the second electromagnet and adapted to be operated by a car or train moving in either direction, an electric circuit including said first-mentioned track devices and electromagnet, and an electric circuit including said second-mentioned track devices, the crossing track device and the second-mentioned electromagnet, the track devices on opposite sides of the crossing being grouped in pairs and comprising normally elevated track-levers adapted to be temporarily depressed in rapid succession, circuit-contacts for each lever, a contact-arm actuated by the lever first depressed, said arm being unaffected by the depression of the second lever when said arm is so actuated, and means for returning the parts to normal position, substantially as described.

3. In a railway-crossing signal, the combination, with a signal and signal-circuit, said circuit comprising a fixed contact projection and a vibrating contact-arm, of an actuating arm or projection connected with said contact-arm to move the same, electromagnets located on opposite sides of said last-mentioned arm, a lever coöperating with each magnet and having one arm provided with an armature therefor and another arm adapted to engage the actuating-arm, said levers operating on said last-mentioned arm from opposite directions and on opposite sides thereof, electric circuits for said magnet, and track devices controlling said circuits, substantially as described.

4. In a railway-crossing signal, the combination, with a signal and signal-circuit, said circuit comprising a fixed contact projection and a vibrating contact-arm, of an actuating arm or projection connected with said contact-arm to move the same, electromagnets located on opposite sides of said last-mentioned arm, a lever coöperating with each magnet and having one arm provided with an armature therefor and another arm adapted to engage the actuating-arm, said levers operating on said last-mentioned arm from opposite directions and on opposite sides thereof, electric circuits for said magnet, and track devices controlling said circuits, said track devices operating to temporarily close the respective circuits upon the passage of a car or train in one direction or the other, respectively, substantially as described.

5. In a railway-signal, the combination, with a casing, of signal "cutting-in" and "cutting-out" circuits having contact-terminals located therein in opposite pairs, an oscillating or rocking part or sleeve provided with a contact-arm adapted to contact with the terminals of and close either circuit, according to the direction of its movement, means for holding said contact-arm normally central between and out of contact with said contact-terminals, track-levers arranged to be successively depressed by a passing car or train, arms connected with said track-levers and provided with dogs to engage said oscillating part when the corresponding track-lever is depressed, one of said dogs being inoperative when the other dog is in operative engagement with said oscillating part, and means for returning said track-levers, arms and dogs to their normal positions when released, substantially as described.

6. In a railway-signal, the combination, with a casing, of rock-shafts mounted therein and having external track-levers and internal arms provided with spring-dogs having contact-shoulders, spring circuit-terminals arranged in opposite pairs within said casing, an oscillating sleeve mounted in said casing and provided with a contact-arm, and lateral projections adapted to be engaged by the shoulders of the dogs, a spring for holding said sleeve and contact-arm in a normal central position, said projections and dogs having bearing-surfaces below the shoulders of the dogs, whereby, when one dog is depressed, the rocking of the sleeve swings the other dog so as to prevent engagement of its shoulder with the corresponding projection, and means for returning the track-levers and their connected parts to normal position, substantially as described.

7. In a railway-signal, a track-box, com-

prising a water-tight casing having rock-shafts mounted on packed bearings therein and provided with external track-levers, arms secured to said rock-shafts within the box or casing and provided with dogs, a sleeve mounted within said box or casing, provided with a contact-arm and adapted to be engaged and operated by the dogs, two signal-controlling circuits having contact-terminals arranged in pairs within said box or casing on opposite sides of said contact-arm, a conduit for said circuits, connected with said box or casing by a water-tight joint, said box or casing being provided with an opening to give access to the interior thereof, and a packed cover for closing said opening, substantially as described.

8. A track-box provided with external track-levers and internal circuit-controlling mechanism operated thereby, said box being provided with flanges to engage the base of the rail, lateral bosses or projections, and an opening having a bolted cover, in combination with hooked bars to engage the base of the rail, said bars having threaded ends extending through the bosses or projections and provided with terminal nuts bearing thereon, said bolted cover having sleeve-like tubular projections to inclose the nuts on the ends of the bars, a secondary or locking cover fitting over the first cover and the bolts thereof, and means for locking said secondary cover in place, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

EILMER E. WOLF.
JAMES B. WILLIAMS.

Witnesses:
E. O. HAGAN,
IRVINE MILLER.