No. 798,452. PATENTED AUG. 29, 1905.

J. P. SAUER & S. E. JOHNSON.

ELECTRICAL SIGNALING SYSTEM.

APPLICATION FILED SEPT. 19, 1904.

5 SHEETS—SHEET 1.

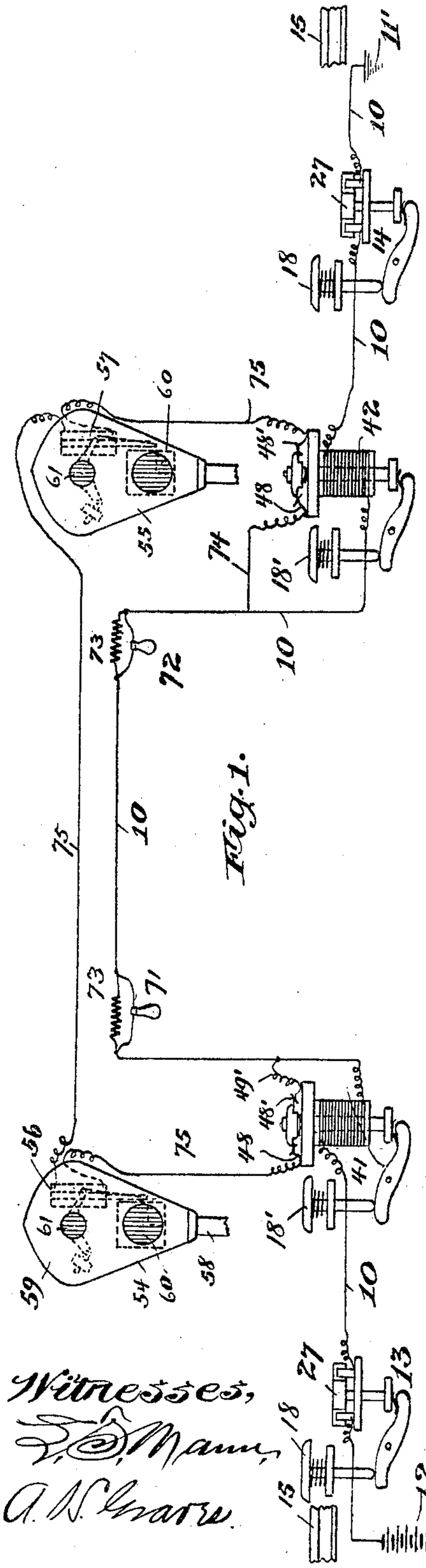

Fig. 1.

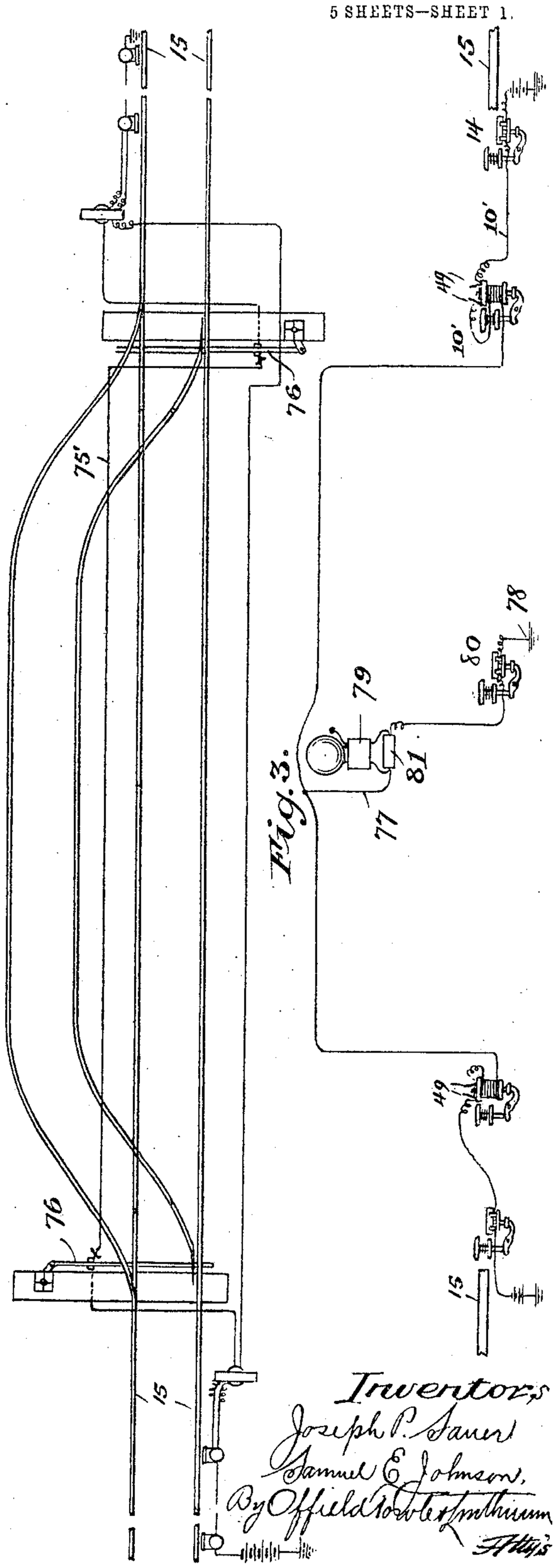

Fig. 2.

Fig. 3.

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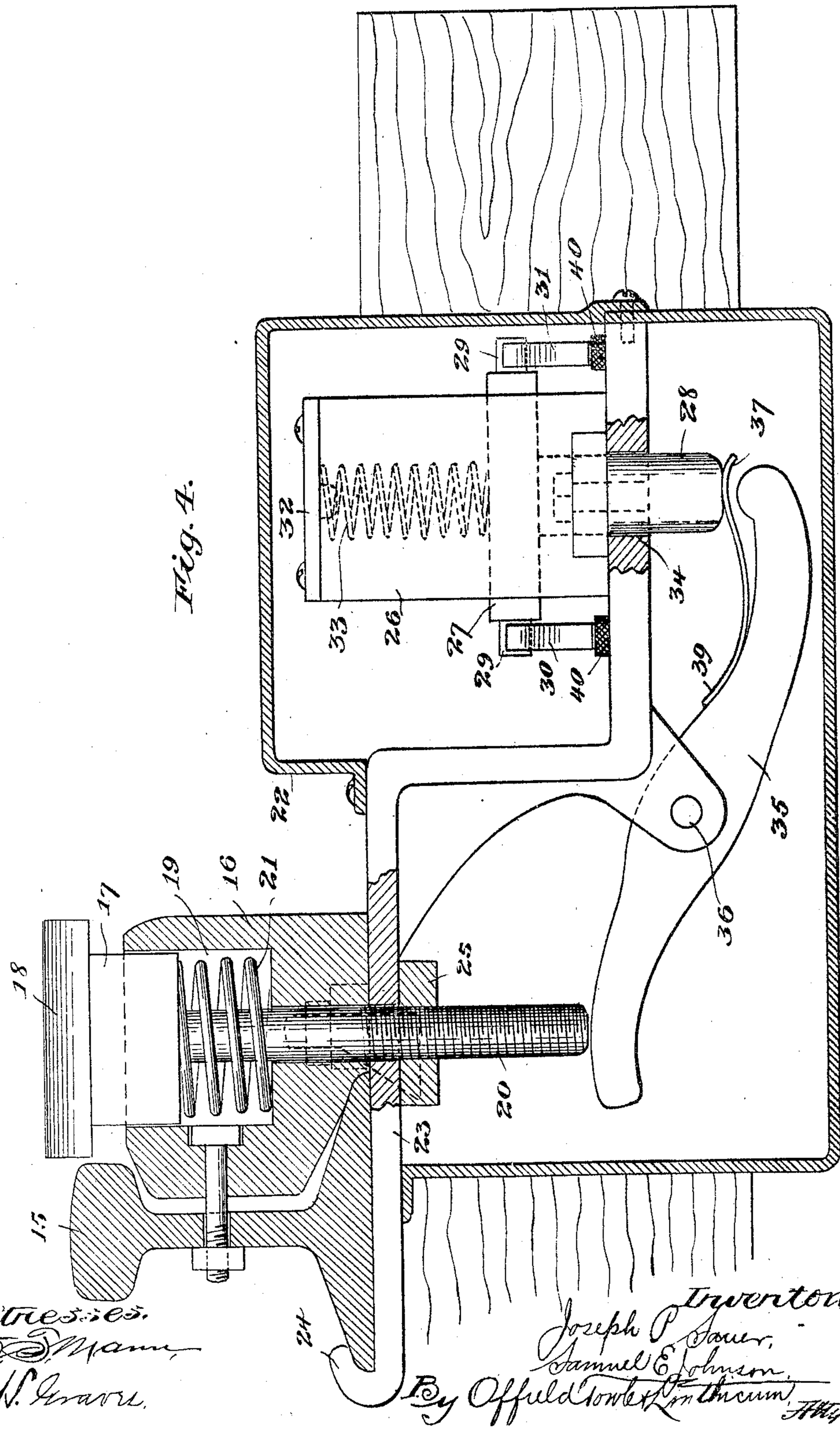
5 SHEETS—SHEET 2.

Fig. 4.



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5 SHEETS—SHEET 3.

Fig. 5.

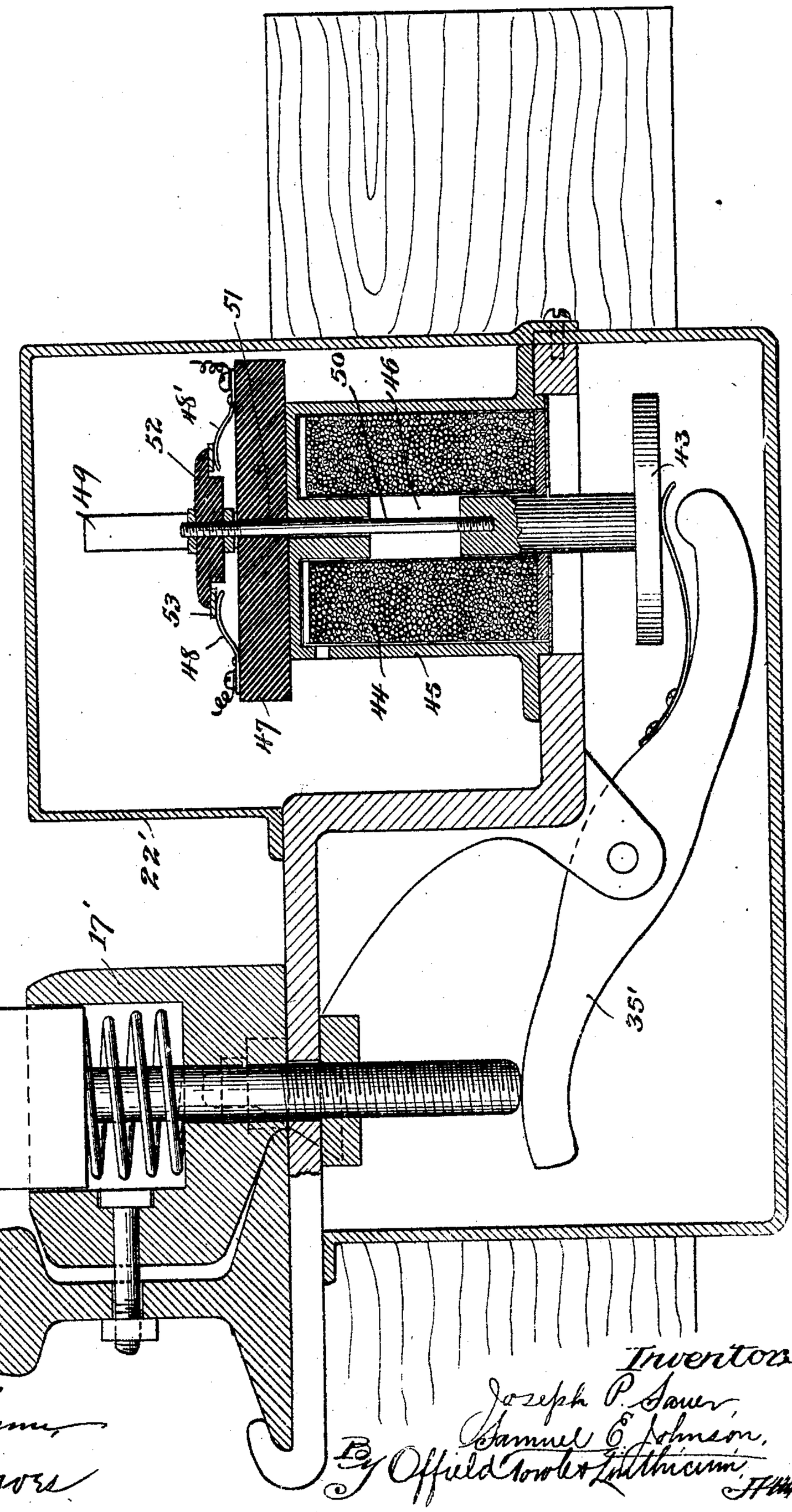

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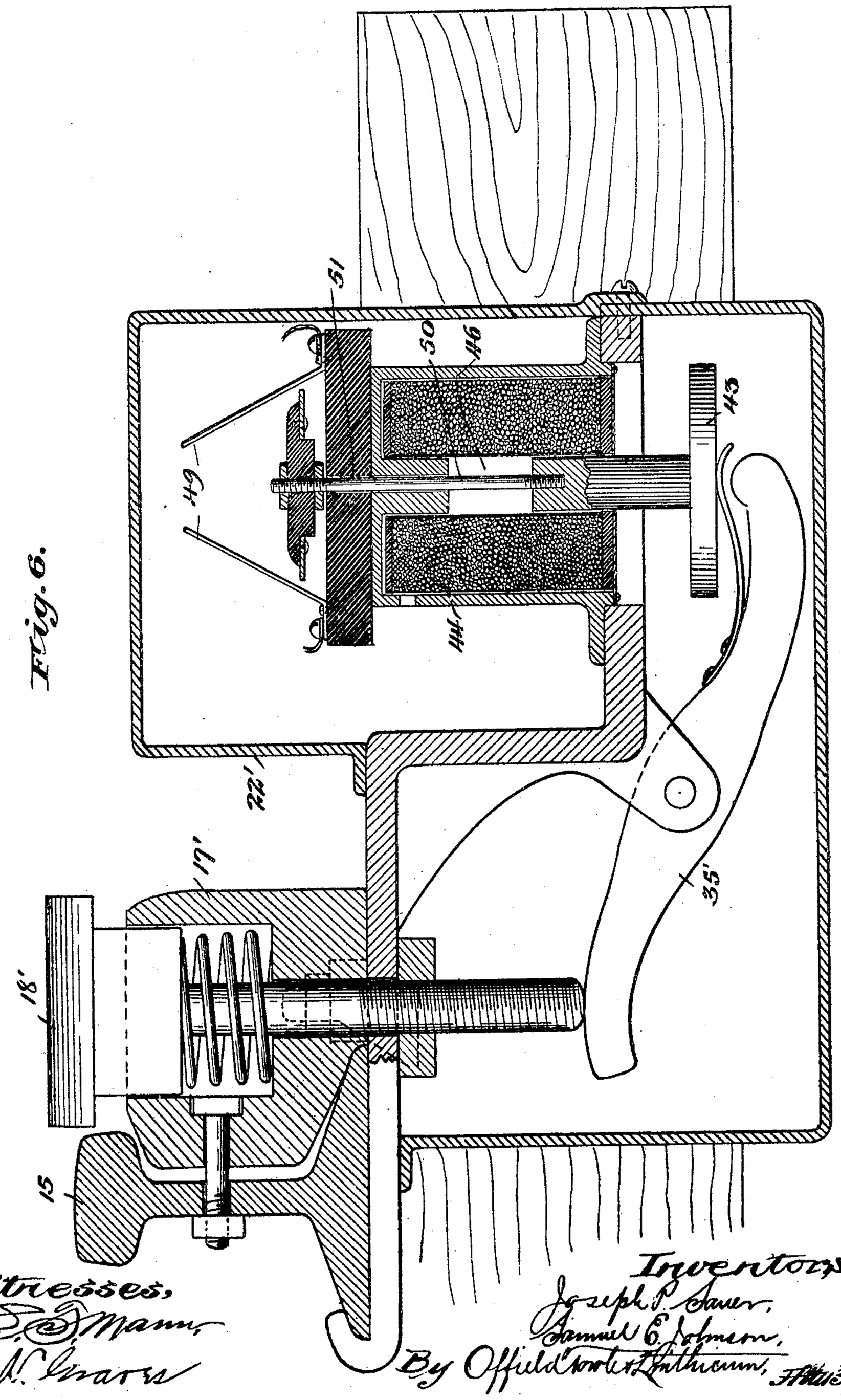
Fig. 6.



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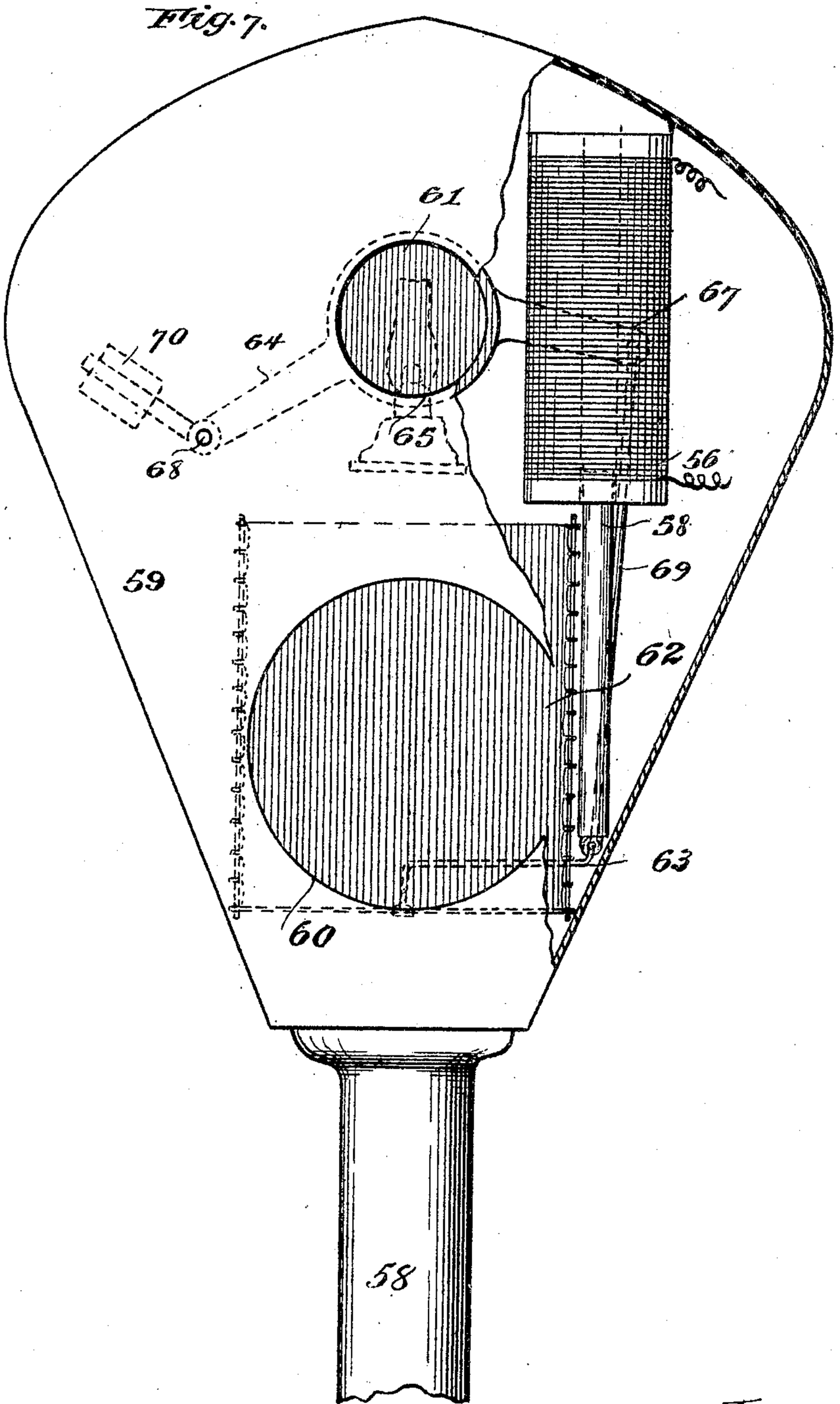
5 SHEETS—SHEET 5.

Fig. 7.



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UNITED STATES PATENT OFFICE.

JOSEPH P. SAUER, OF WHEATON, AND SAMUEL E. JOHNSON, OF LOMBARD, ILLINOIS.

ELECTRICAL SIGNALING SYSTEM.

No. 798,452. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed September 19, 1904. Serial No. 225,041.

To all whom it may concern:

Be it known that we, JOSEPH P. SAUER, residing at Wheaton, and SAMUEL E. JOHNSON, residing at Lombard, Illinois, citizens of the United States, have invented certain new and useful Improvements in Electrical Signaling Systems, of which the following is a specification.

This invention relates to improvements in signaling systems, and refers more specifically to what is commonly known as a "block" system for railways and the like.

Among the salient objects of the present invention are to provide a system wherein signals arranged at each end of each block are simultaneously changed to show that the block is occupied whenever a car enters the block from either direction; to provide in such a system mechanism operating to automatically restore the signals to their normal position or that indicating a clear way as the car leaves the block in either direction; to provide in such a system a normally closed circuit or circuits which are depended upon to retain the signals in "open-block" position, so that in case of failure of the circuit for any reason whatever the signals will automatically assume the danger or "closed-block" position; to provide in such a system extremely simple and dependable apparatus capable of being readily protected against weather and accidental disarrangement; to provide in such a system of the character referred to a novel form of circuit-controlling device which enables certain auxiliary circuits and auxiliary mechanical devices to be retained in either of their two positions without necessitating the opening of that circuit which operates said circuit-controller; to provide means operating in conjunction with the track-switches to set the signals against the block whenever one or both of the track-switches are in any other position than their normal positions; to provide an extremely simple system of duplex signals having definite coöperative relations, so that failure of either form of signal would not lead to accident, and, in general, to provide simple and improved apparatus and features of arrangement in a system of the character referred to.

To the above ends the invention consists in the matters hereinafter described, and more particularly pointed out in the appended claims.

The invention will be more readily understood by reference to the accompanying drawings, in conjunction with the description, in which—

Figure 1 is a diagrammatic view of a preferred embodiment of the system. Fig. 2 is a diagrammatic view showing the application of the system to a railway-track provided with a turnout. Fig. 3 is a diagrammatic view showing a modified embodiment of the invention. Fig. 4 is a view, partly in elevation and partly in transverse section, of a circuit-breaking mechanism forming one feature of the system. Fig. 5 is a similar view of a circuit-controlling mechanism adapted to both make and break circuits. Fig. 6 is a view of a modified construction of the device shown in Fig. 5. Fig. 7 is an elevation, partly in section, of a semaphore adapted for use in connection with the system.

Referring to the drawings, Fig. 1 shows diagrammatically the equipment of one complete block. 10 designates the main conductor or wire, which in the instance shown is grounded at each end, as indicated by 11 11′, includes a battery 12, and is uninterrupted throughout its length except at the points where it passes through circuit-breakers, (respectively designated as a whole 13 and 14.) Describing one of said circuit-breakers, the two being alike, and referring more particularly to Fig. 4, 15 designates a track-rail against one side of which is secured a suitable frame member 16 and within which is movably seated a depressible shoe 17. Said shoe 17 conveniently takes the form of a plunger, the upper end of which forms a rounded head portion 18, normally rising slightly above the tread-surface of the track-rail and adjacent to one side thereof, so that the shoe will be depressed by the wheel of the car traversing the rail. Within the frame member 16 is formed a socket 19, within which the upper end of the plunger works, the stem of the plunger 20 being extended downwardly below the base of the track-rail and a coil expansion-spring 21 being interposed between the head portion of the shoe and the bottom of the recess 19 of the frame member, so as to normally hold the shoe lifted.

22 designates as a whole a closed box of suitable construction to form a frame-support for mechanism now to be described, as well as serving to inclose the principal parts of

said mechanism. At one side said box is provided with an arm-like extension 23, which underlies and engages the base-flange of the track-rail 15, the end of said arm being provided with a hook 24, engaging the remote edge of the flange, while the frame member 16 is rigidly bolted to the arm, as indicated at 25, at the opposite side of the rail and serves as an opposing clamp to secure the arm and connected box immovably to the rail. Within the casing 22 and mounted upon the bottom thereof is a vertically-disposed guide-frame 26, comprising an upright the upper portion of which is vertically slotted to permit the arrangement therein of a switch-blade 27. Such switch-blade is mounted upon the upper end of an actuating-stem 28 and is in the form of a bar having parallel sides, which engage the sides of the slot formed in said upright and guide the bar accurately in its bodily rising-and-falling movement. The main body of the bar terminates at each end in a thin blade portion 29, which blade portions are adapted to engage pairs of spring-blades 30 31, mounted upon the base portion of the box at the respective ends of the bar. A cap member 32 is secured across the divided upper end of the upright, and between said cap member and the upper side of the switch-bar is interposed a coil expansion-spring 33. The lower end of the stem 28 extends downwardly through a suitable aperture 34 in bottom of the casing and is operatively connected with the shoe 17 by means of a lever 35, fulcrumed between its ends upon a suitable bracket upon the box 22, as indicated at 36, the ends of said lever underlying the lower ends of the stem 20 and stem 28, respectively. Inasmuch as the shoe 18 is depressed very suddenly by a hammer-like blow as the wheel engages same, a cushioning-spring 37 is desirably interposed between the end of the lever and the lower end of the stem 28, said spring conveniently taking the form of a leaf-spring secured to the upper side of the lever, as indicated at 39, and standing slightly away from the lever at its free end. The pairs of blades 30 and 31 are insulated from their support, as indicated at 40.

The circuit-breakers 14 are interposed in main line 10, the respective ends of said main line being connected with the pairs of blades 30 and 31, as shown clearly in Fig. 1. From each circuit-breaker the main line leads to and through a circuit-controller, (respectively designated as a whole 41 and 42.) The construction of one of these circuit-controllers is shown in detail in Fig. 5, by reference to which figure it will be seen that the general construction is like that of the circuit-breaker last described, the differences of construction residing in the mechanism arranged within the main box 22′—that is to say, there is provided a shoe 18′, mounted in a frame 17′, secured adjacent to the track-rail 15, and this shoe 18′ actuates a lever 35′, which in turn acts upon the lower end of a vertical reciprocatory member 43, which in this instance consists of the core or movable member of a solenoid, all arranged in the same general manner as in the construction of the circuit-breaker. Describing said solenoid, 44 designates a solenoid-coil arranged with its axis vertically disposed within a suitable casing 45, which latter is suitably secured upon the bottom of the casing 22′. The coil is of usual construction, having an axial passage 46, within which is arranged to reciprocate the armature or core 43. The lower end of said core is enlarged or provided with a head to afford additional weight, for a purpose which will hereinafter appear. Upon the upper end of the casing 45 is mounted an insulating-block 47, which carries two pairs of diametrically opposite spring contact-strips, as 48, 48′, and 49. 50 designates a stem connected with the upper end of the core 43 and extending in axial alinement with the latter upwardly through a suitable guide-passage 51, formed through the block 47. Upon the upper end of said stem is mounted a head 52, carrying upon its under side a contact-ring 53, adapted to rest upon the contact-springs 48 48′ when the solenoid-core is at its lower limit of movement. The ring 53 is arranged to project at its periphery beyond the margin of the head 52, and the contacts 49 are arranged to extend obliquely upwardly and inwardly toward each other in such relation that when the core is held in its uppermost position the periphery of said ring 53 engages both contact-strips 49. The exact arrangement of the strips 49 will be clear by reference to Fig. 6, in which a similar pair of contact-strips is shown. The windings of the solenoid-coil are included in the main conductor 10, as shown clearly in the drawings.

54 and 55 designate block-signal devices respectively located adjacent to the entrance ends of the block and preferably somewhat inside of the circuit-controllers 41 and 42. These block-signals may be of any preferred type, but both embody as a salient feature a holding-magnet, as 56 and 57, included in an auxiliary circuit hereinafter to be described. In the present instance each block-signal comprises, as best seen in Fig. 7, a standard 58, carrying a suitable box 59, within which is mounted a main target 60 and a bull's-eye 61. Within the box 59 is mounted in vertical position the solenoid or retaining magnet 56 or 57, hereinbefore referred to, and provided with a core 58, which extends downwardly alongside of the target 60. 62 designates a curtain, usually red, arranged to reciprocate vertically across the target 60, the lower end of said curtain being connected with lower end of the solenoid-core 58 by means of an arm 63, so as to rise and fall with said core.

A shutter or screen, usually of red glass, is also arranged to control the bull's-eye 61, and at this end a frame 64 is provided which carries said screen or shutter 65, said frame being provided with oppositely-extending arms 66 and 67, the former of which is fulcrumed, as indicated at 68, within the casing at one side of the bull's-eye. The end of the arm 67 is operatively connected with the lower end of the solenoid-core by means of a link 69. In order to relieve the solenoid from unnecessary lifting, the frame 64 is counterweighted, as indicated at 70. It will be understood that the construction of the signal is such that a lamp or other suitable light may be arranged within the casing behind the bull's-eye for night use, while the main target 60 and screen constitute the day-signals.

In a preferred embodiment of the invention lamp-signals are arranged in the main circuit 10 at points transversely opposite the block-signals 54 and 55, as indicated at 71 and 72, Fig. 1. These lamps will be illuminated at all times when current is flowing through the main circuit, and suitable resistances 73 will be arranged in parallel with said lamps, so as to shunt through the latter the proper amount of current.

The block-signals 54 and 55 are connected in an auxiliary circuit arranged in shunt relation to the main circuit as follows: From the main conductor 10 at a point inside of the circuit-controller a conductor 74 leads from the conductor 10 to one of the contact-strips, as 48, of the circuit-controller. From the opposite strip 48′ a conductor 75 leads to and through the two coils 56 and 57 of the block-signals in series and thence to the contact-strip 48 of the second controller at the other end of the block. From the other side of the latter circuit-controller a conductor 49′ connects that to the main conductor 10, thus completing the shunt.

The operation of the apparatus thus far described is as follows: Assuming a car approaching a block from the left, one of its advance wheels in traversing the rail 15 will first engage and depress the shoe 18 of the circuit-breaker, thus lifting the switch-bar 27 and momentarily opening the circuit. Normally the cores of the circuit-controllers 41 and 42 will be in their dropped or lowermost positions notwithstanding the fact that current may be flowing through the main circuit 10 from ground to ground, it being understood that the construction of the solenoids of said circuit-controllers and the strength of current employed are such that the solenoids will not lift their cores unassisted. The momentary opening of the circuit as the car enters the block will therefore have no substantial effect upon the signaling apparatus, since although the coils of the block-signals may be momentarily deprived of current they will be immediately restored as soon as the car-wheel leaves the shoe 18, thus permitting the switch-bar to be forced back to closed position by its spring 33. In the further progress of the car the wheel encounters the shoe 18′ of the circuit-controller, thus lifting the core of the latter far enough to bring it within the holding control of the windings of the solenoid and at the same time opening the shunt-circuit through its contacts 48 48′. This opening of the shunt-circuit deënergizes the coils of the block-signals and the latter drop to closed or danger positions, in which positions they remain while the car is traversing the block. As the car goes out of the block it first encounters the shoe 18′ of the circuit-controller, thus a second time opening the shunt-circuit and placing the core of that circuit-controller under the holding control of the solenoid. In its further progress the car-wheel encounters the shoe 18 of the second circuit-interrupter, and thus opens the circuit positively at this end of the line and deënergizes the coils of both circuit-controllers. The deënergizing of the circuit-controllers closes the shunt-circuit. As the car leaves the shoe 18 the main circuit is again closed, whereupon the block-signals in the shunt-circuit are restored to their normal or clear positions. It will be obvious that the lamps 71 and 72 will be illuminated whenever there is current passing over the main circuit, which is practically all the time, the main circuit being interrupted only momentarily as the car enters and as it leaves the block.

It will be obvious from the foregoing that the motorman or engineer is able to determine before entering the block whether or not it is clear, and, further, that he will be enabled to determine definitely whether the main line is in working order, since any interruption of this line will extinguish the lamps therein. It will be further obvious that the moment the car enters the block the danger-signals will be set up and maintained at both ends of the block until the car has passed out and that these results are all accomplished by the use of a single practically continuous grounded line provided with the single shunt which controls the block-signals.

In Fig. 2 precisely the same arrangement of the apparatus shown in Fig. 1 is employed, excepting only that an ordinary electric switch is interposed in the shunt branch 75′ at a point transversely opposite each track switch-bar 76, which controls the track-rails at the entrance to the turnout. The movable member of the electric switch is mechanically connected with the switch-bar 76 in such manner that whenever the track-switch is shifted to any other position than that which provides for clear way past the turnout the electric switch will be open, the shunt interrupted, and the block-signals thus set against approaching cars.

In Fig. 3 is shown a simplified modification

of the system in which an audible alarm—such, for example, as a continuously-operating gong or bell—is set into operation upon the entrance of the car to the block and continues to operate until the car leaves the block. In this modification the relative location and arrangement of the circuit-interrupters, the circuit-controllers, and the main line are the same as shown in Fig. 1. In this instance, however, a battery is necessarily employed at each end of the main line between the circuit-interrupter and ground. In this instance also the circuit connections through the circuit-controllers are such that the controller operates as a circuit-holding as well as circuit-interrupting device. For this purpose the main conductor 10′ extends from the circuit-interrupter 14 to and is connected with one of the upstanding contacts 49 of the controller. From the opposite contact 49 an extension of the main line leads to and through the coil and thence on to the opposite end of the block, at which end the same connections are repeated, of course in reverse order. At a point midway between the two circuit-controllers a branch conductor 77 leads to ground 78. In this branch is interposed an audible signal, such as a bell 79, and a circuit-interrupter 80 similar to one of the circuit-interrupters 13 or 14. A resistance 81 is arranged in parallel with the bell-coils to insure an uninterrupted holding-circuit. The operation of this last-described apparatus is as follows: Normally the solenoid-cores of the two circuit-controllers will be in their lower positions, and accordingly the main circuit will be open at each end. As a car enters the block it will momentarily open the circuit-interrupter at that end, but without effect. When it encounters the shoe of the circuit-controller at the entrance end, however, it will lift the solenoid-core, thus closing a circuit through the latter and to ground at 78 through the bell. Thereupon the bell will operate and will continue to operate until the car encounters the shoe of the circuit-interrupter 80. The opening of the circuit at this point will deënergize the circuit-controller at the entrance end of the block, and thus silence the bell. As the car leaves the block it will first close the circuit through the controller at that end, thus momentarily sounding the bell; but it will almost immediately afterward open the circuit at the interrupter, thus deënergizing the last-encountered circuit-controller and silencing the bell. Obviously the operation will be identical with the car passing in either direction, since the arrangement is symmetrical. The last-described modification is particularly adapted for use in short blocks controlling grade-crossings.

From the foregoing description it will be seen that we accomplish the several objects of our invention enumerated in a simple, practical, and reliable way, which avoids much of the complication and features of uncertainty usually pertaining to signal systems of this general character.

While we have herein shown and described what we deem preferred embodiments of our invention, yet it will be obvious that the details of construction and arrangement may be modified without departing from the invention, and accordingly we do not limit ourselves to these details except to the extent that they are made the subject of specific claims.

We claim—

1. An electric signal system, comprising in combination with a block or signal section of a railway system, an electrically-operated signal at each end of said signal-section, an electric circuit including said signals, a circuit-interrupting device connected in said circuit at one end of said signal-section, and a circuit-controlling device connected in said circuit at the opposite end of said signal-section, said circuit-controlling device comprising a magnet adapted to be mechanically moved and electrically held in operative position, both said circuit-interrupting and circuit-controlling devices being mounted to be mechanically engaged and operated by a passing car, whereby to simultaneously set said signals upon entering said block or signal section and to simultaneously restore said signals to normal position in leaving said block or signal section.

2. An electric signal system, comprising in combination with a block or signal section of a railway system, an electrically-operated signal at each end of said signal-section, a main circuit, a shunt-circuit including said signals, a circuit-controlling device connected in said main circuit at one end of said block or signal section and controlling said shunt-circuit, and a circuit-interrupting device connected in said main circuit, said circuit-controlling and circuit-interrupting devices arranged to be mechanically engaged and operated by a passing car, whereby to simultaneously set said signals upon entering said block or signal section and to simultaneouly restore said signals to normal position upon leaving said block or signal section.

3. An electric signal system, comprising in combination with a block or signal section of a railway system, an electrically-operated signal at each end of said block or signal section, a main circuit, a circuit-controlling device connected in said main circuit at each end of said signal-section, a shunt-circuit including said signals and said controlling devices, and a circuit-interrupting device connected in said main circuit at each end of said block or signal section, said circuit-controlling and circuit-interrupting devices arranged to be mechanically engaged and operated by a passing car, whereby to simultaneously operate said signals upon entering said block or signal section and to simultaneously restore them to

normal position upon leaving said block or signal section.

4. An electric signal system, comprising in combination with a block or signal section of a railway system, an electrically-operated signal, an electric circuit including said signal, circuit-interrupting and circuit-controlling devices connected in said circuit and adapted to be mechanically engaged and operated by a passing car, said controlling device comprising a magnet the armature of which is adapted to be mechanically moved and electrically held in operative position whereby said signal is operated when a car enters said block or signal section, and restored when the car leaves said block or signal section.

5. An electric signal system, comprising in combination with a block or signal section of a railway system, an electrically-operated signal, an electric circuit including said signal, a circuit-controlling device and a circuit-interrupting device connected in said circuit in series with each other at each side of said signal, said controlling device comprising a magnet the armature of which is adapted to be mechanically moved and electrically held in operative position said devices being so positioned as to be mechanically engaged and operated by a passing car, whereby to actuate said signal when a car enters a block or signal section and to restore it to normal position when the car leaves said block or signal section, substantially as described.

6. In combination with an electric signal system for railways, a circuit-interrupting device, comprising in combination with a suitable support or casing therefor, a pair of contact members, a connecting member mounted to be moved into and out of connecting engagement with said contact members, a guide-frame for said connecting member an actuating member movably mounted and adapted to be engaged and actuated by a passing car, and mechanism operatively connecting said actuating member and said connecting member, for the purpose described.

7. A circuit-interrupter for railway-signals, comprising in combination with a suitable support or casing therefor, a pair of contact members connected in circuit, a spring-restored connecting member mounted to be moved into and out of connecting engagement with said contact members, an actuating-shoe mounted adjacent the rail and adapted to be engaged by a passing car-wheel, and mechanism operatively connecting said actuating-shoe with said connecting member, for the purpose described.

8. A circuit-interrupter for a railway-signal system comprising in combination with the rails thereof, a suitable support or casing therefor, a pair of contact members mounted therein and forming circuit-terminals, a spring-restored connecting member movably mounted between and in engagement with said contact members, guide members for said connecting member, an actuating-shoe mounted adjacent one of the rails and adapted to be mechanically engaged by a passing car-wheel, and an actuating-lever yieldingly connecting said shoe and said connecting member, whereby a passing car momentarily interrupts said circuit, substantially as described.

9. A circuit-controller for railway-signal systems, comprising in combination with an electric circuit, a solenoid-coil, an armature coöperating therewith, relatively fixed and movable contact devices, the latter moving with said armature, and adapted to be moved into and out of engagement with each other, an actuating member adapted to be mechanically engaged and operated by a passing car, mechanism connecting said actuating member with said armature, whereby the latter is mechanically moved and electrically held in a given position, for the purpose described.

10. In a circuit-controller for railway-signal systems, the combination with an electric circuit, of a magnet, an armature therefor, relatively fixed and movable contact devices, the latter moving with said armature and adapted to be moved into and out of engagement with the former, and means for mechanically moving said armature into contact with the magnet to be electrically held thereby.

11. A circuit-controlling device for railway-signal systems, comprising in combination with an electric circuit, a solenoid, an armature mounted to reciprocate axially within said solenoid, contact members upon said solenoid and upon said armature and arranged to be moved into and out of engagement with each other, an actuating member arranged to be mechanically engaged and operated by a passing car, mechanism connecting said actuating member with said armature, whereby the latter is mechanically moved and electrically held in a given position, for the purpose described.

12. In an electric signal system for railways, the combination with an electric circuit, of a solenoid, an automatically-returning armature coöperating therewith, contact members upon said armature and said solenoid, said contact members being connected in circuit and adapted to be moved into engagement with each other mechanically to make said circuit, an actuating member mounted adjacent the railway-track and adapted to be mechanically engaged and operated by a passing car, mechanism connecting said actuating member with said armature, whereby said armature is mechanically moved and electrically held in a given position, and a circuit-interrupter for momentarily opening said circuit to permit the automatic return of said armature to normal position, substantially as and for the purpose described.

13. In an electric signal system for railways, the combination with an electric circuit, of a

solenoid connected therein, a gravity-returned armature coöperating with said solenoid, electric contact members mounted upon said solenoid and upon said armature and adapted to be moved into and out of engagement with each other, an electrically-operated signal connected in said circuit, an actuating member mounted to be mechanically engaged and operated by a passing car, mechanism connecting said actuating member with said armature, whereby said armature is mechanically moved and electrically held in a given position, and a circuit-interrupting device adapted to be mechanically operated by said passing car to momentarily interrupt said circuit to permit the return of said armature to normal position, substantially as and for the purpose described.

14. In an electric signal system, the combination with a block or signal section of a railway system, of an electrically-operated signal, an electric circuit including said signal, a switch mechanism for said railway-track connected in said circuit, whereby to interrupt said circuit when said switch is in one of two positions, circuit-controlling and circuit-interrupting devices connected in said circuit and adapted to be mechanically engaged and operated by a passing car, whereby to set said signal when entering said block and to restore said signal to normal position when leaving said block, substantially as and for the purpose described.

15. In an electric signal system, the combination with a block or signal section of a railway system, of an electrically-operated signal, a main circuit, a shunt-circuit including said signal, a rail-switch mechanism connected in said shunt-circuit, whereby to interrupt said shunt-circuit and set said signal when said switch is in one of two positions, circuit-controlling and circuit-interrupting devices connected in said circuits, said devices being adapted to be mechanically engaged and operated by a passing car, whereby to set said signal upon entering said block or signal section and to restore said signal to normal position when leaving said block or signal section, substantially as described.

16. In a signal system of the general character described, a semaphore comprising a suitable casing with target and bull's-eye openings therein, a collapsible screen controlling the target, a second screen controlling the bull's-eye opening, a solenoid and operative connections between the core of the solenoid and the two screens, whereby the target and bull's-eye openings are opened and closed together.

17. In a signal system of the general character described, the combination with a suitable semaphore-casing, target and bull's-eye openings therein arranged in superposed relation, a vertically-reciprocatory screen arranged to control said target-opening, a rocking lever carrying a bull's-eye screen arranged to control said bull's-eye opening, a solenoid mounted within said casing with its axis disposed vertically, direct connections between the target-screen and armature of the solenoid, and a link connection between said armature and the rocking lever, substantially as described.

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