

No. 704,800.

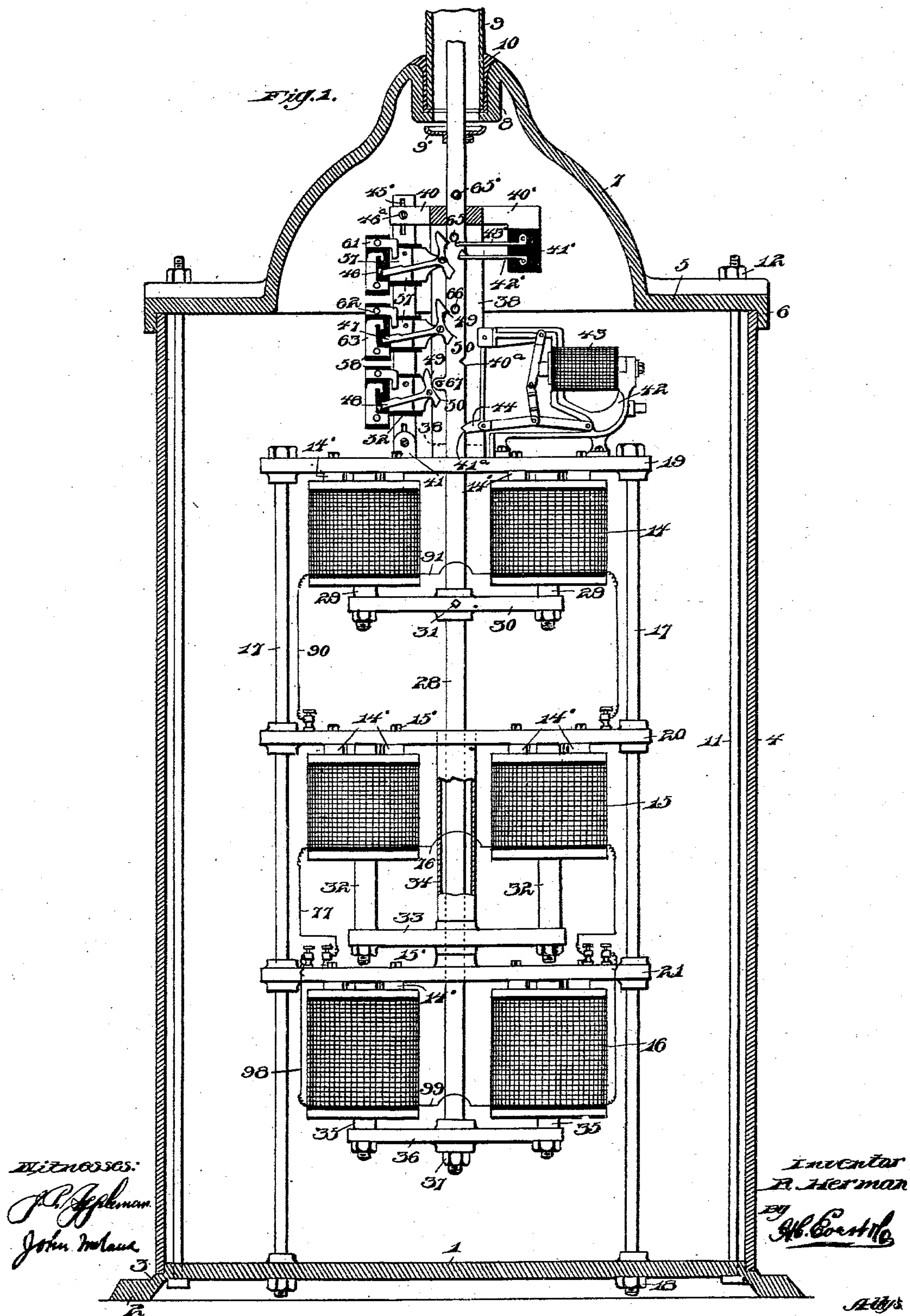
Patented July 15, 1902.

R. HERMAN.
SIGNAL.

(Application filed Oct. 11, 1901.)

(No Model.)

4 Sheets—Sheet 1.



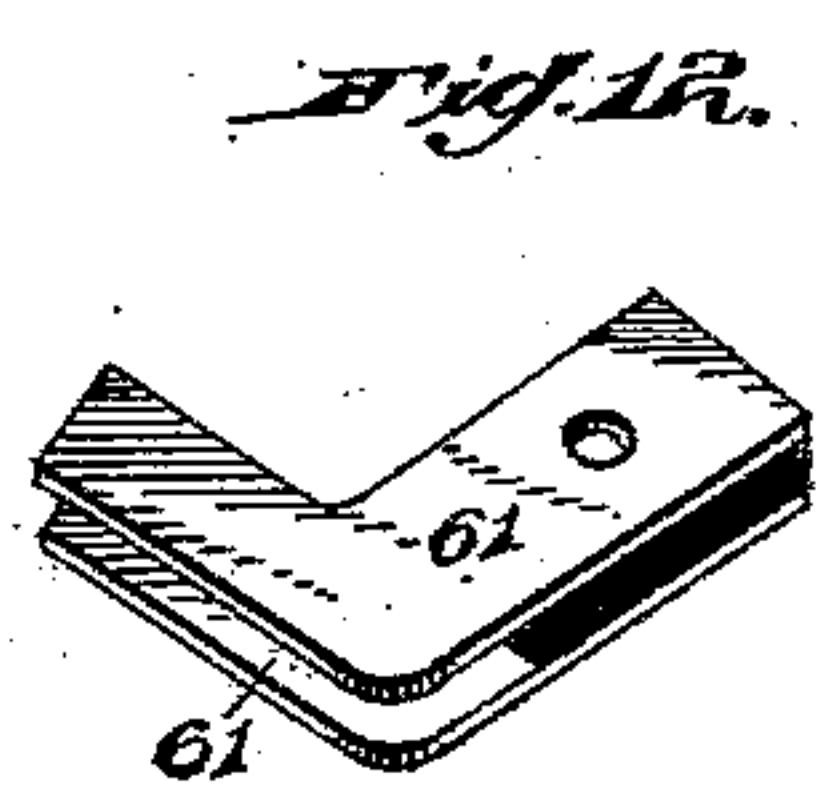
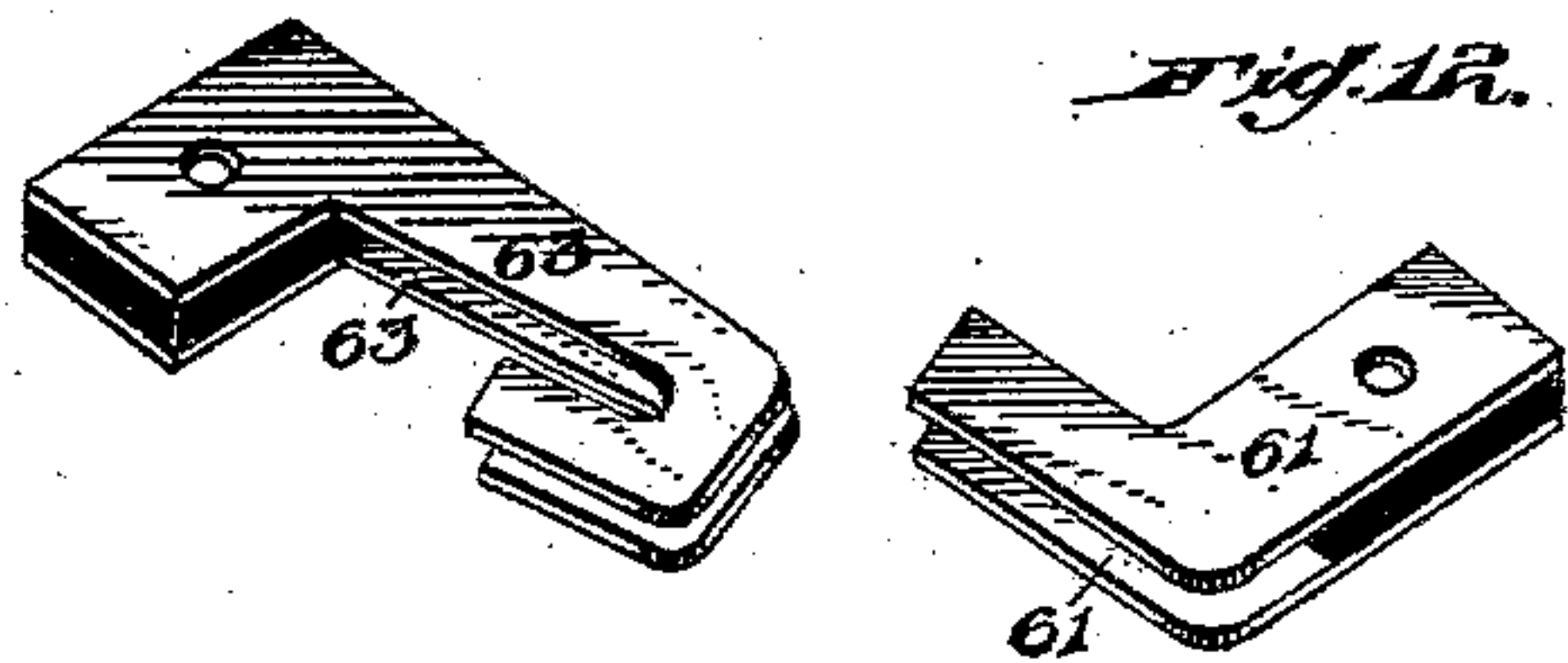
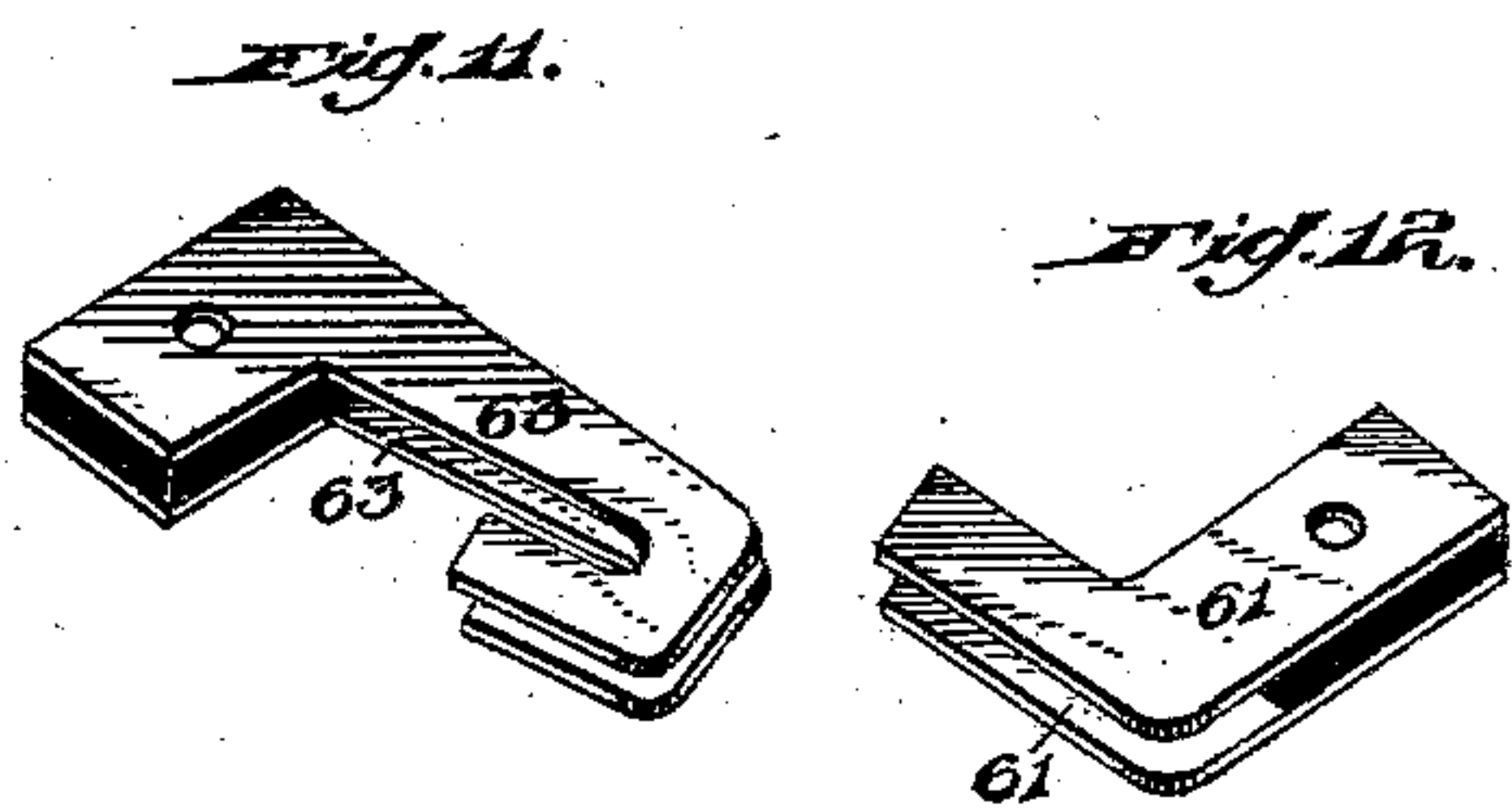
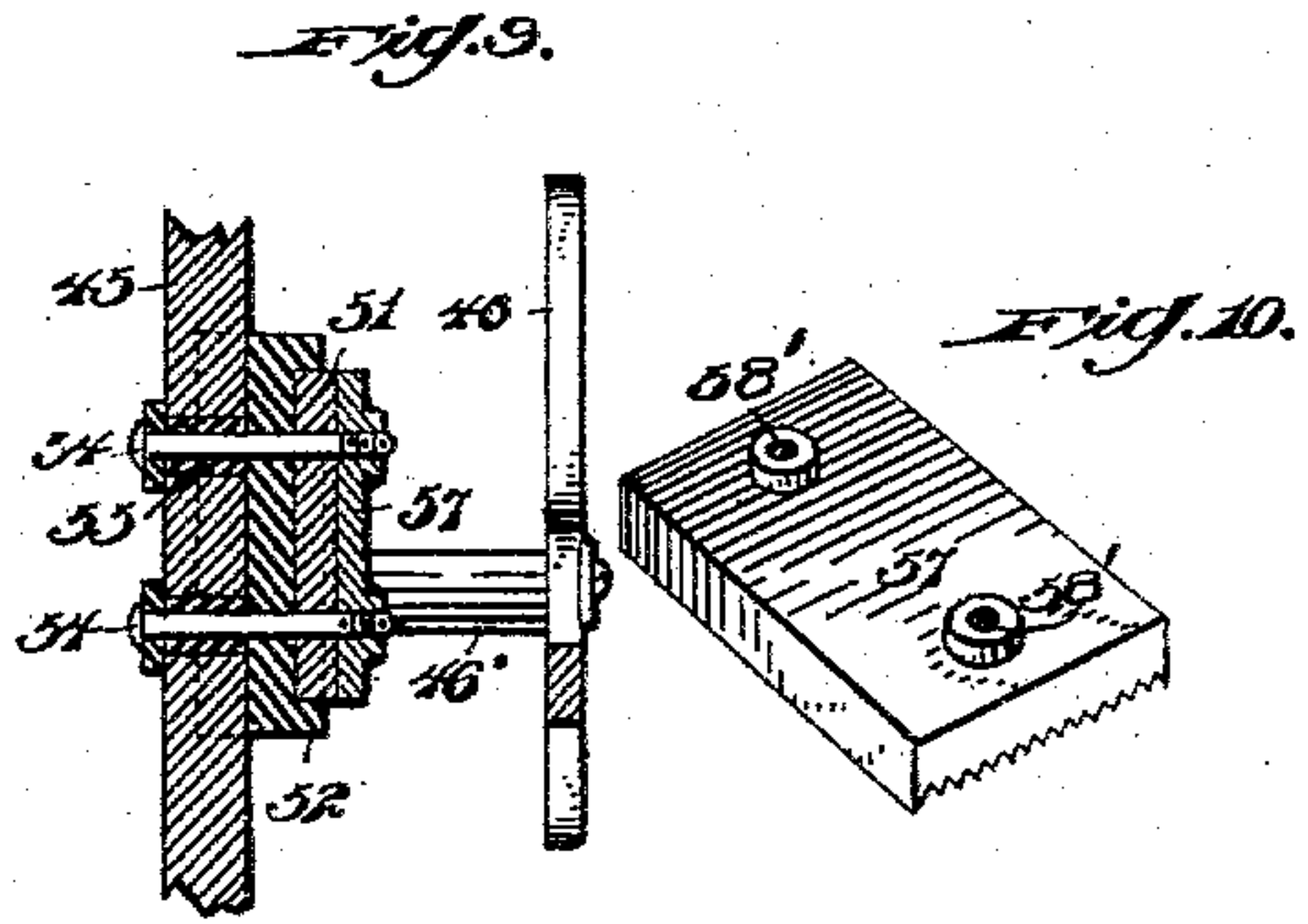
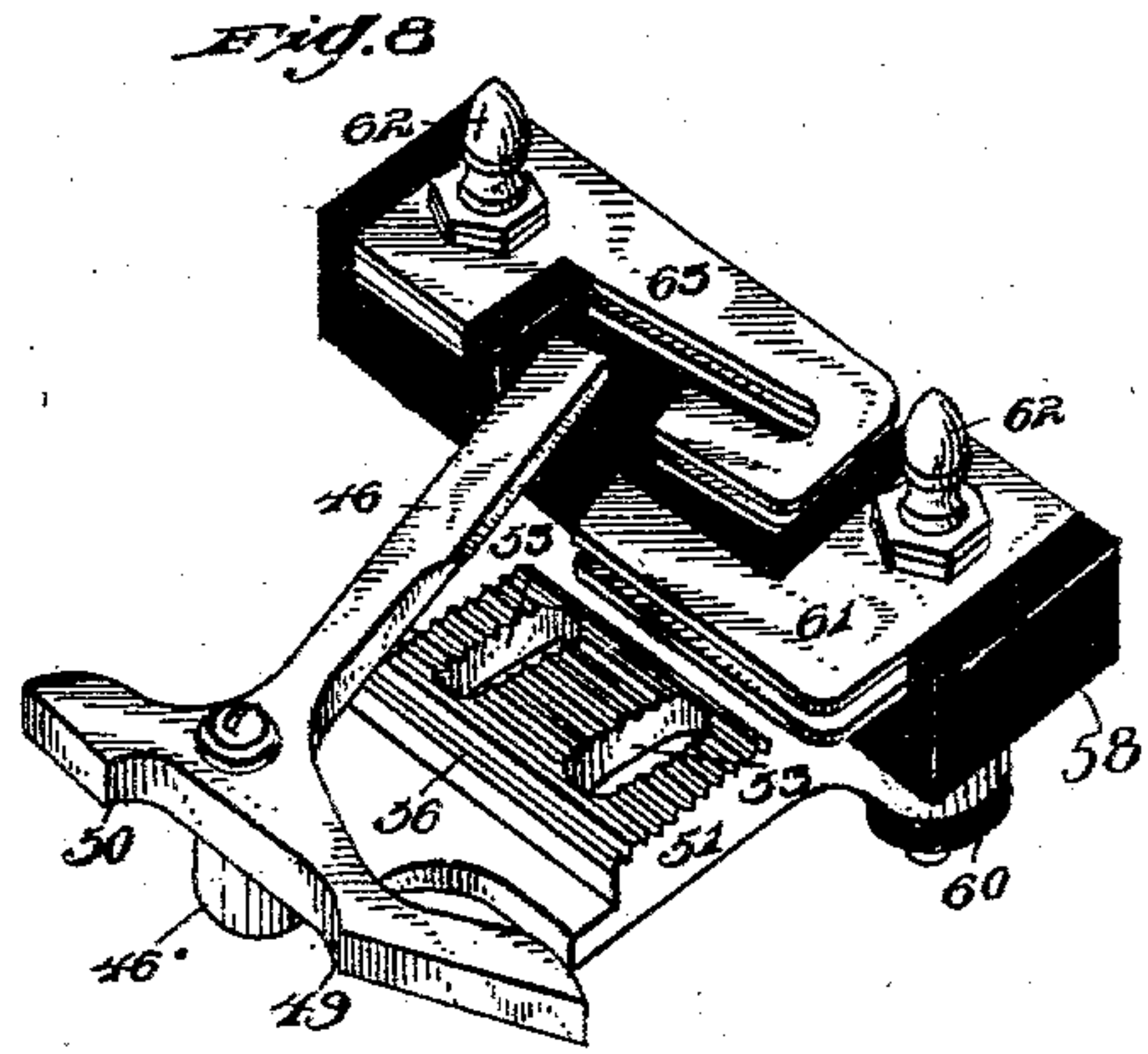
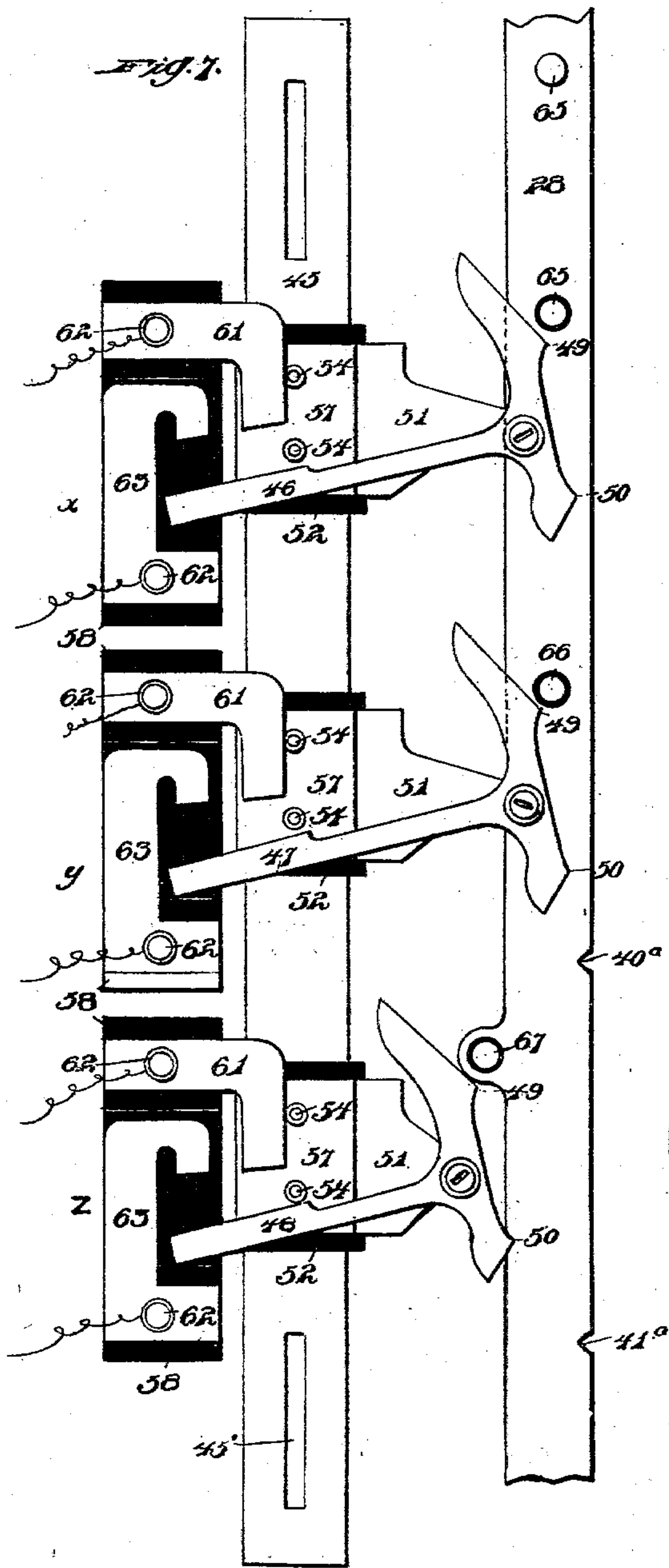
THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

R. HERMAN.
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(Application filed Oct. 11, 1901.)

(No Model.)

4 Sheets—Sheet 3.



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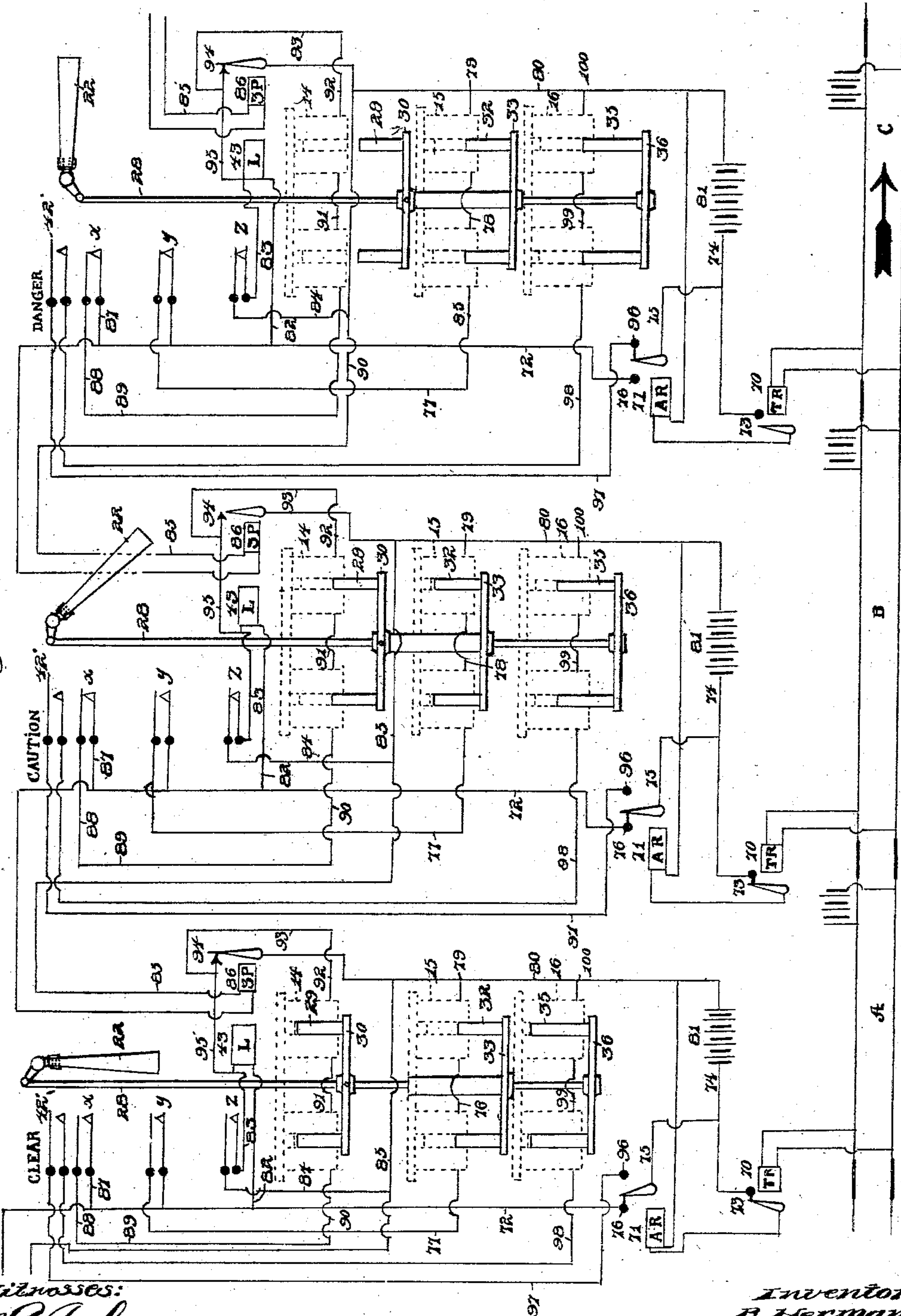
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(Application filed Oct. 11, 1901.)

(No Model.)

4 Sheets—Sheet 4.

Fig. 13.



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UNITED STATES PATENT OFFICE.

REINHOLD HERMAN, OF CRAFTON, PENNSYLVANIA.

SIGNAL.

SPECIFICATION forming part of Letters Patent No. 704,800, dated July 15, 1902.

Application filed October 11, 1901. Serial No. 78,301. (No model.)

To all whom it may concern:

Be it known that I, REINHOLD HERMAN, a citizen of the United States of America, residing at Crafton, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Signals, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in signals, and relates particularly to signals of the semaphore type, the main object of the invention being to operate the signal-arm solely by electromagnets and track-circuits controlled by train movements.

In the art of signaling by means of a semaphore-arm wherein the same signal is employed, as a "home" and "distant" signal, with the movements of the signal-arm from "clear" to "caution" and "danger" effected automatically, but controlled by train movements, it has generally been the practice to employ a signal-operating mechanism actuated by a motor or other suitable driving means. With such devices the signal-arm or semaphore is connected by a rod to the signal-operating mechanism, so that the latter when operated moves the signal into position. In this invention I dispense with all operating mechanism such as may require a motor or other driving means and employ a series of electromagnets of the solenoid type so arranged and connected to the signal or semaphore arm and with track-circuits so connected thereto that the entire operation of shifting the signal or semaphore arm is accomplished by the magnets.

Briefly described, my present invention consists in employing a signal or semaphore arm connecting the same to a series of electromagnets suitably mounted in the box or casing on which the signal or semaphore arm is supported, connecting these electromagnets to storage batteries or other source of electricity and to the track-circuits, and employing relays in said circuits, the different circuits being controlled and the cores of the magnets actuated to shift the signal or semaphore arm to different positions entirely by train movements.

In describing the invention in detail refer-

ence will be had to the accompanying drawings, forming a part of this specification, and wherein like numerals of reference will be employed to designate like parts throughout the several views, in which—

Figure 1 is a side elevation of the electromagnets, circuit-controller, and locking device, showing the inclosing box or casing in central vertical section. Fig. 2 is a detail side elevation showing the semaphore-arm in full lines in its clear position and in dotted lines in its caution and danger position, showing a part of the supporting-post and ladder. Fig. 3 is a central vertical sectional view of one of the magnets and a part of the support therefor. Fig. 4 is a top plan view of one of the solenoids of the magnets. Fig. 5 is a side elevation of the guiding-stirrup for the driving-rod, showing a part of the latter. Fig. 6 is a top plan view of the guiding-stirrup. Fig. 7 is a detail side elevation of the circuit-controller, showing the position of the contact-fingers when the semaphore-arm is locked in the clear position, also showing a part of the driving-rod. Fig. 8 is a detached detail perspective view of one of the contacts of the circuit-controller, the adjustable securing washer or block being removed. Fig. 9 is a cross-sectional view of a part of the circuit-controller, showing how the metal parts are insulated from the supporting-bar. Fig. 10 is a detached detail perspective view of the adjustable block or washer which holds the contacts of the circuit-controller to the supporting-bar. Figs. 11 and 12 are detached detail perspective views of the spring-clips employed in the circuit-controller. Fig. 13 is a diagrammatical view showing three blocks or sections of track with a signal for each block or section, the signals being shown in the respective three positions and the cores being shown in the respective positions they occupy.

In signals of the semaphore type employing a signal-operating mechanism the said mechanism is usually arranged within a box or casing suitably positioned at the side of the track. Where the signals are operated electrically, this box or casing also usually contains the motor. In my present invention I employ a box or casing for inclosing the electromagnets, the circuit-controller, the locks for holding the signal at the position to which

it has been moved, and for inclosing the relays employed in connection with the circuits. I have herein shown and will describe a practical form of this box or casing, which comprises a base 1, made with a downwardly-projecting flange 2, which rests on the support for the casing, the body of the base lying above the support, for a purpose as will presently appear. This base is formed with a ledge or shoulder 3 around its four sides to receive the side and end walls of the box or casing 4. Fitted on the upper ends of these side and end walls 4 is a cap-plate or crown 5, having depending flanges 6 to engage over the upper ends of the side and end walls of the box or casing. The cap-piece or crown 5 has an integral centrally-arranged cone 7, open at its apex and turned downwardly within the body of the cone to form a tubular extension or socket 8 to receive the supporting-post 9 for the signal or semaphore arm. This supporting-post 9 is preferably tubular in form, and it may be threaded into the socket 8 or otherwise suitably held, and when the same is not threaded into the socket it is preferable to "calk" the annular space around the support within the socket with a filling of lead 10 or other suitable material or substance in order to prevent the entrance of moisture. The cap-piece or crown 5 is securely fastened to the base 1, and thus binds the side and end walls of the casing firmly between the cap-piece and base by means of four bolts 11, passed through the base, one at each corner, and held by nuts 12, engaging the upper face of the cap-piece or crown. The base 1, being above its resting ledge or flange 2, the heads of these bolts 11 are thus free from engagement with the support for the casing.

Arranged within the box or casing is one or more sets of electromagnets of the solenoid type for controlling the shifting and holding of the signal or semaphore arm. I may employ a single set of magnets and by giving a longer or shorter throw to the rod connecting with the semaphore-arm and arranging the circuit-controller so as to cut out the circuit at predetermined times accomplish the same result as is accomplished by employing more than one set of magnets. However, I prefer to employ more than one set, as by so doing I am enabled to use shorter coils, which is preferable, and I am also enabled to use one of the magnets as a "choke" for the semaphore-arm in its movement to red or danger position, for the same purpose as a dash-pot is employed in connection with signal-operating mechanism—such, for instance, as is shown in my Patent No. 683,397. In this invention, like the patent above referred to, the signal or semaphore arm is automatically movable to and automatically held in the red or danger position and is held in the white or caution and green or caution positions by an electrically-operated lock. In the present illustration I have shown three sets of mag-

nets 14, 15, and 16, which are supported one above the other upon posts or uprights 17, in this instance consisting of bolts or rods passed through the base and secured by nuts 18. Mounted on these rods or bolts are three plates or cross-heads 19, 20, and 21, the plate or cross-head 19 supporting the magnets 14, the plate or cross-head 20 supporting the magnets 15, and the plate or cross-head 21 performing a like function for the magnets 16. A practical form of supporting the magnets is shown in Fig. 3, the solenoid being provided with segmental-shaped shoulders 14', having threaded openings to receive securing-screws 15', passed through the respective plates. The stationary cores or back straps 16' of the solenoids may be threaded into the plates 19, 20, and 21, as shown in detail in Fig. 3 for the plate 19. The signal or semaphore arm 22 is mounted in a spectacle-frame 23, which is pivotally secured to a rotatable head 24, mounted on the upper end of the tubular support 9, and since this rotatable head has been made the subject of a separate application for Letters Patent it is not shown or described in detail herein.

The spectacle-frame 23 in this invention, like that shown in my application Serial No. 70,957, is so constructed and mounted on the shaft 25 as to present the greatest amount of counterweight to the semaphore or signal arm when the latter is in the red or danger position. The head 24 carries the lamp 26, so that the latter will be adjusted as the head is rotated to adjust the semaphore or signal arm. The ladder 27 is also connected to the head, so that said ladder may be moved around the tubular support 9 as the head is rotated. Within the head 24 is a crank 24', (see dotted lines, Fig. 2,) which connects to the shaft 25, the other end of this crank having connected thereto the operating or driving rod 28, which extends downwardly through the tubular support 9 into the box or casing and through the three plates 19, 20, and 21. The armature-cores 29 of the solenoids for magnets 14 are connected together by a yoke 30, through which the rod 28 extends, this yoke being rigidly fastened to the operating-rod 28 by a set-screw 31. The armature-cores 32 of the solenoids for magnets 15 are likewise connected together by a yoke 33, which carries a tubular guide 34, which operates through the plate or cross-head 20, the rod 28 extending through this guide. The armature-cores 35 of the solenoids for magnets 16 are connected together by a yoke 36, which is fixed to the operating-rod by a nut 37 on the lower end of the rod. The rod 28 is guided in its vertical movement above the magnets by a stirrup 38, through which the rod operates. This stirrup has feet or lugs 39, which are securely bolted or otherwise suitably fastened to the plate or cross-piece 19, and this stirrup carries adjacent to its upper end a lug 40. A like lug 41 is mounted on the plate or cross-head 19, so as to be in

vertical alinement with the lug 40, and these two lugs support the circuit-controller, which will be hereinafter described.

The rod 28 is provided in a three-position signal with two notches 40^a 41^a, the notch 41^a (which is the lowermost notch) to receive the lock for holding the signal in the white or clear position and the notch 40^a to receive the lock in the same manner for holding the signal in the caution position. This lock in the present illustration is electrically operated and is supported on the plate or cross-head 19. It comprises a framework 42, which supports the lock-magnets 43 and a locking-link 44 for engagement with the notches in the rod, together with a particular construction and arrangement of toggle-links, and since this locking mechanism has been made the subject of a separate application for Letters Patent, Serial No. 76,856, and is fully described in detail therein I have not described the same in detail in this application.

The circuit-controller comprises a plate or bar 45, which is secured to the lugs 40 41 by the set-screws 46^a, and this bar 45 carries a series of pivoted contact-fingers 46 47 48, which are moved into engagement with spring-clips carried by the plate or bar 45 to complete a circuit, or moved out of engagement with the spring-clips to break the circuit by means of insulated studs, hereinafter referred to specifically, carried by the driving-rod 28. In a three-position signal such as herein shown three contact-fingers 46 47 48 are employed. These fingers are each substantially T-shaped, the head thereof having a curvilinear outer face to form heels 49 50 on each finger, which heels are in alinement with each other when the fingers are in a horizontal position, and the one or the other of which heels projects beyond the other when the finger has been operated so as to make contact with one or the other of the spring-clips. These fingers are pivotally supported on laterally-adjustable plates 51, mounted on the bar 45, with insulation 52 therebetween. The plate 51 has oblong openings 53 therein to receive the securing-bolts 54, which fasten the plate 51 to the bar 45. In order that these bolts may be insulated from the bar 45, I place insulated sleeves 55 in the bolt-openings in said bar 45. The outer face of each plate 51 is provided with teeth 56, and a toothed block or washer 57 is placed thereon and is provided with threaded openings 58' to receive the bolts 54. The meshing of teeth 56 and 57 serves to prevent any danger of lateral movement of the plate 51 after having been adjusted to position and secured by tightening of the bolts 54. The adjustability of the plate 51 not only permits the positioning of the fingers 46 47 48 so as to obtain the cut-out at any desired or predetermined time, but it also provides a means for taking up any wear upon the inclined faces of the fingers where they are engaged by the pins carried by the

driving-rods, since should the engaged faces become worn the plate 51 may be adjusted so as to move the finger closer to the driving-rod, and thereby present a new surface for engagement by the pins on the driving-rod without changing the time of the cut-out. It will be observed that when these bolts are slackened sufficiently to disengage the teeth of the block or washer 57 from the teeth 56 of the plate 51 the said plate may be moved laterally toward or away from the driving-rod 28, as may be desired, this movement being permitted by reason of the oblong openings 53 in the plate 51. The adjusting of the plates 51 moves the fingers 46 47 48 toward or away from the driving-rod 45, and thus varies the position in which the fingers are engaged and actuated by the said rod, this adjustment being provided so that the fingers may be actuated at any desired time during the movement of the driving-rod. Each of the plates 51 has bushings at the corners thereof, the bushing 46' at the end of the plate adjacent the driving-rod having the fingers 46 47 48 mounted thereon and the bushings at the two corners of the opposite end of the plate having a block of insulation 58 mounted thereon and in which the spring-clips are secured. The bolts 54, which bind the spring-clips in position in their insulated holding-block, are insulated from the plate 51 by washers 60. Each insulation-block 58 carries two pairs of spring-clips, one pair in each block being of a different form of construction than the other pair. These spring-clips I will designate generally in describing the operation as $x y z$, but in the detail description of the construction will refer to the same specifically. The upper pair 61 of each block are substantially L-shaped and fitted in a recess in the outer face of the block, with one leg depending downwardly. They are held by the bolts 59, which also act as binding-posts 62 for the reception of wires. The lower pair of spring-clips 63 on each block are hook-shaped, the free end thereof being in the same line as the free ends of the clips 61. These clips 63 are mounted in recesses in the blocks and held by the bolts 59, also acting as binding-posts 62. The contact-fingers 46 47 48 are actuated so as to be thrown into or moved out of engagement with their respective spring-clips $x y z$ by insulated studs 65 66 67, carried by the driving-rod 28 and placed thereon at such distance apart so as to engage with the heels 49 50 of the fingers to make and break the circuits at predetermined times. It will be observed that the circuit-controller is adjustable both vertically and laterally, the set-screws 46^a being secured through slots 45' near each end of the bar to permit the vertical adjustment and the lateral adjustment being accomplished by slackening up bolts 54, as afore described. The stirrup 38 is provided in the head thereof with an opening 38', conforming to the shape of

driving-rod 28 employed, and also has a registering opening 39' to permit the operation therethrough of the pins carried by the driving-rod. This stirrup also carries at the opposite side to the lug or bracket 40 an L-shaped bracket 40', on which is secured a block of insulation 41'. Secured upon this insulated block is a contact 42' and a spring contact-finger 43', the latter projecting in the path of travel of pin 65, carried by the driving-rod to be engaged thereby, and to also be engaged by an insulated pin 65', mounted on the driving-rod 28 above the pin 65. This contact 42' when closed completes a circuit through the magnets to cushion the movement of the cores to effect the same cushioning to the signal as is accomplished by a dash-pot employed with signal-mechanism devices.

In signals of the semaphore type such as shown in my Patent No. 683,397, wherein a motor-driven mechanical device is employed, the circuits for controlling the magnets are controlled in accordance with the movements of the mechanism and have circuit-breakers so arranged with reference to a movable part of the switch-operating mechanism or signal as to be opened and closed in a predetermined order. In my present invention I operate the semaphore-arm through a track-circuit and track-relay, which furnishes the current for the solenoids from storage-cells or other source of electrical energy, the movement of the semaphore being controlled by the automatic circuit-controller and third-position relay.

In describing the operation of the present invention reference will be had to Fig. 13 of the drawings, wherein is shown a diagrammatical view of three insulated blocks or sections of track with a signal for each block or section, the signal for block or section A of the track being shown in the clear or white position, that for block or section B in the green or caution position, and that for block or section C in the red or danger position. For the purpose of clearly illustrating the operation we will assume that the train has entered into block or section C, moving in the direction indicated by the arrow. The signal for block or section B will when the train occupies block or section C be at the caution or green position, as shown in this view, while the signal of block or section A will be at the white or clear position, provided, of course, that no train has followed into either block A or B. Referring to the signal for block or section C, shown in the danger or red position, it will be observed that the track-relay 70 is shunted out by the train entering this section, thereby cutting out the auxiliary relay 71 and opening up the main circuit 72 in block C, which also controls the lock-circuit, and the circuit for third-position relay in block or section B. When auxiliary relay 71 in block C opened main circuit, it released the lock 43 in this block and allowed sema-

phore to go to red or danger position, thereby closing contacts $x y z$ by reason of rod 28 moving downward, so as to cause pins 65, 66, and 67 to push contact-fingers 46, 47, and 48 into spring-clips 61 and 63 by engagement with heels 50 of the fingers. This signal of block or section C is automatically held in this danger position as long as the train remains in this block or section. When the last pair of wheels of the train passes out of block B into block C, the track-relay 70 of block B is energized, closing the contact 73, (of block B,) completing the circuit leading to the signal of said block B, and closing the circuit for auxiliary relay of said block, which auxiliary relay closes the main circuit in this block or section B. On the completion of this circuit in block or section B the signal in block or section B is shifted to the green or caution position, the circuit being closed in the contacts $x y z$ of block or section B, the circuit being completed from battery 81 (of block B) through wires 74 75, contact 76, wire 72, contact y , wire 77 into one solenoid 15, over connecting-wire 78 to the other solenoid 15, through short wire 79 to wire 80, and through said wire 80 back to battery 81. Simultaneously with the forming of the above circuit in block B there is also formed a circuit through contact z , from wire 72, over wire 82, through lock-magnet 43, over wire 83, contact-point z , over wires 84 85, back to battery 81, over wire 80, causing the signal in this block or section B to be shifted to the caution or green position. During the upward travel of rod 28 (of signal in block B) contact-point y in the automatic circuit-controller for the signal in this block B was opened and the rod locked up in notch 40^a, holding the signal of block B in the caution or green position so long as block or section C is occupied and providing, of course, that no train has entered into this block or section B. The signal at this time in block or section C (which block or section is occupied by the train) is at red or danger position, and the signal for block or section B is at green or caution position. The passing of the train, however, from block or section B into block or section C closed the three-position relay 86 of block or section A, completing a circuit (for signal in block A) over wire 72, (block B,) through three-position relay, (block A,) over wires 85 80, back to battery 81, closing the solenoids 14, (in block A,) from wire 72, over wire 87, contact-point x , wires 88 89 90 to one solenoid 14, over connecting-wire 91 to the other solenoid 14, over wires 92 93, contact-point 94, wire 80, to battery 81, and also closing the lock-circuit in this block or section A, from battery 81, over wires 74 75, contact 76, wires 72, over wire 82, lock-magnet 43, wire 95, contact 94, wire 80, back to battery 81, causing the signal to be shifted into clear or white position and locked in notch 41^a, in which position it is held by reason of

contacts x and z having been opened by the upward movement of rod 28, the contact y having previously been opened by the shifting of the signal from red or danger to green or caution position.

The signal of block or section A while the train is in block or section B would be at the green or caution position, and the passing of the train into block or section C allowed the signal in block or section A to go to white or clear position (the position shown for signal in block A) and be locked in that position, as described.

The solenoids 16 are provided with a winding suitable to act as a magnetic choke, proportioned to the load of rod 28 to be choked. This particular circuit is formed by contact 96, attached to auxiliary relay, thereby forming a circuit from battery 81, over wires 74 75, contact 96, wire 97, contact-point 42', wire 98 to one solenoid 16, over connecting-wire 99, short wire 100, and wire 80 to battery 81. The solenoids 16 are controlled by the two insulated pins 65 65', carried by rod 28, opening and closing contacts 42', predetermined by the movement of rod 28. The track-relay connections and batteries are of the same type as shown and described in Patent No. 683,397.

Although I have shown and described the solenoid type of magnet, yet it will be apparent that other forms of magnets which require a form of armature different from the core used in the solenoid type may be employed, and I therefore do not wish to limit myself to this specific form of magnet.

Instead of a locking device such as shown in Fig. 1 being employed the semaphore-signal may be held by a compound winding in the solenoids, the one winding being a coarse winding to do the work of moving semaphore, and the finer winding to hold it in the different positions. The circuit employed in this case would practically be the same, with the exception that the fine winding would be cut in the lock-circuit.

In order to catch any dust or dirt that may drop down the tubular support 9, I attach a dust-cup 9' onto the driving-rod 28 at a suitable point where it will not interfere with the vertical movement of said rod.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In signals, the combination with the signal-arm automatically held in the danger position, of electrically-actuated shifting means to shift the signal-arm to caution and danger, with track-circuits controlled by train movements, and a separate circuit also controlled by train movements to act as a choke for the signal when shifted to caution or danger position.

2. In signals, the combination with the signal-arm automatically held in the danger position, of electrically-operated shifting means

to shift the signal to caution and clear positions, with track-circuits controlled by train movements, with a circuit connected to the shifting means to act as a choke for the movement of the signal to certain positions.

3. In signals, the combination with the signal-arm movable to different positions, of electrically-operated shifting means with circuits connected thereto and controlled by train movements, a circuit-controller in said circuits, with a choke-circuit closed by the signal in its movement to certain positions.

4. In signals, the combination with the semaphore-arm, of electrically-operated shifting means with circuits controlled by train movements, and a circuit-controller in the circuit, said controller including spring-clips and contact-fingers which are moved into and out of engagement with said clips during the shifting of the signal to make and break the circuit.

5. In electrically-operated signals, a circuit-controller in the operating circuits and comprising spring-clips and contact-fingers which latter are movable into and out of engagement with the clips to make and break the circuit at predetermined times.

6. In signals, the combination with the signal-arm, of electrically-operated means for shifting the signal, a driving-rod connecting the signal-arm to the shifting means, a circuit-controller included in the circuit of the shifting means, and pins carried by the driving-rod to make and break the circuit in the circuit-controller at predetermined times.

7. In a signal, the combination of a signal-arm automatically held in the danger position, of electrically-operated shifting means controlled by train movements for shifting the signal to different positions, a driving-rod connecting the signal-arm to the shifting means, a circuit-controller in the circuit of the shifting means, means carried by the driving-rod for engagement with the circuit-controller to make and break the circuit at predetermined times, and an electric lock for holding the signal after the same is shifted into position.

8. In signals, the combination with the signal-arm automatically held in the danger position, of a series of electromagnets connected to the arm and constituting a means for operating the signal by the aid of circuits controlled by train movements, and a choke-circuit controlled by an auxiliary relay for cushioning the signal when shifted to different positions.

9. In electrically-operated signals, a circuit-controller in the operating-circuits and comprising spring-clips and pivotal contact-fingers which latter are movable into and out of engagement with the spring-clips to make and break the circuit at predetermined times.

10. In signals, the combination with a signal, and electrically-operated shifting means therefor, of a box or casing for inclosing the

- shifting means, said box or casing comprising a base having a ledge with side and end walls fitted thereon, a cap-piece fitted on the side and end walls, a hollow cone carried by said cap-piece and provided with a downwardly-projecting tubular extension to receive the support for the signal-arm, and tie-bolts connecting the cap-piece and base, substantially as described.
11. The combination of a signal-arm, a driving-rod connected thereto, suitably-supported electromagnets having their cores connected to said driving-rod, with track-circuits connected to a track-relay and controlled by train movements, a circuit-controller connected to the circuits, and insulated pins carried by the drive-shaft to operate the circuit-controller to make and break the circuit at predetermined times, substantially as described.
12. In signals, the combination with the signal-arm, and the driving-rod connected thereto, of electrically-operated means for shifting the signal, a circuit-controller included in the circuit of the shifting means, and insulated pins carried by the driving-rod to actuate the circuit-controller to make and break the circuit at predetermined times.
13. In signals, the combination with the signal-arm, of electrically-operated means for shifting the signal, a driving-rod connecting the signal-arm to the shifting means, a circuit-controller in the circuit of the shifting means, and including spring-clips and pivoted contact-fingers, and means carried by the driving-rod to actuate said fingers to make and break the circuit in the controller at predetermined times.
14. In signals, the combination with the signal-arm, of electrically-operated means for shifting the signal, a driving-rod connecting the signal-arm to the shifting means, a circuit-controller included in the circuit of the shifting means, means carried by the driving-rod to make and break the circuit in the circuit-controller at predetermined times, and means for locking the signal after the same is shifted into position.
15. In signals, the combination with the signal-arm automatically held in the danger position and movable to caution and clear positions, of a series of electromagnets arranged in pairs and constituting the operating mechanism for shifting the signal to caution and clear positions, said magnets having their cores attached to the driving-rod of the signal, one pair of said magnets acting as the shifting means for the signal to the caution position and another pair of said magnets acting as the shifting means for the signal to the clear position.
16. In signals, the combination with the signal-arm automatically held in the danger position and movable to caution and clear positions, of a series of electromagnets arranged in pairs and constituting the operating mechanism for shifting the signal to caution and clear positions through track-circuits controlled by train movements, the cores of the said magnets attached to the driving-rod of the signal, one pair of said magnets acting as the shifting means for the signal to caution position and another pair of said magnets acting to shift the signal to the clear position.
17. In signals, the combination with a signal-arm automatically held in the danger position and movable to caution and clear positions, of a series of electromagnets arranged in pairs and constituting means for shifting the signal to caution and clear positions through track-circuits controlled by train movements, one pair of said magnets acting as the means for shifting the signal to caution position, another pair of said magnets acting to shift the signal to the clear position, an auxiliary cut-out for said magnets, and an automatic lock for holding the signal at the caution and clear positions.
18. In an electric signal system for railroads, the combination with a signal-arm automatically held in the danger and caution positions, of electromagnets connected to a source of electric supply and constituting means for shifting the signal-arm in one direction to caution and clear positions, an auxiliary relay in the circuit with said electromagnets, a track-relay controlling the circuit of the auxiliary relay, said track-relay in circuit with track-circuits controlled by train movements in opposite running directions.
19. In signals, the combination with a signal-arm automatically held in the danger position and movable to caution and clear positions, of a series of electromagnets constituting the operating means for shifting the signal in one direction to caution and clear positions, a source of electric energy connected to said magnets through an auxiliary relay, and automatic cut-outs controlled through the track-relay connected to track-circuits, said track-circuits controlled by train movements in both running directions.
20. In an electric signal system for railroads, the combination of a signal-arm automatically held in the danger and caution positions and movable to caution and clear positions, and means for holding the signal-arm at caution and clear positions, said means operated through track-circuits controlled by train movements in opposite running directions.
21. In signals, the combination with the signal-arm automatically held in the danger position and electrically movable to caution and clear positions, and the driving-rod connected to said arm, of a series of cores attached to the driving-rod of the signal-arm, electromagnets arranged to energize said cores through circuits at predetermined times, substantially as and for the purpose set forth.
22. In signals, the combination with the signal-arm automatically held in the danger position and electrically movable to caution and

clear positions, and a driving-rod connected
to said signal-arm, of a series of armatures at-
tached to said driving-rod, electromagnets ar-
ranged to energize said armatures through
5 circuits at predetermined times, and track-
circuits controlled by train movements in both
running directions.

In testimony whereof I affix my signature
in the presence of two witnesses.

REINHOLD HERMAN.

Witnesses:

JOHN NOLAND,
A. M. WILSON.