

(No Model.)

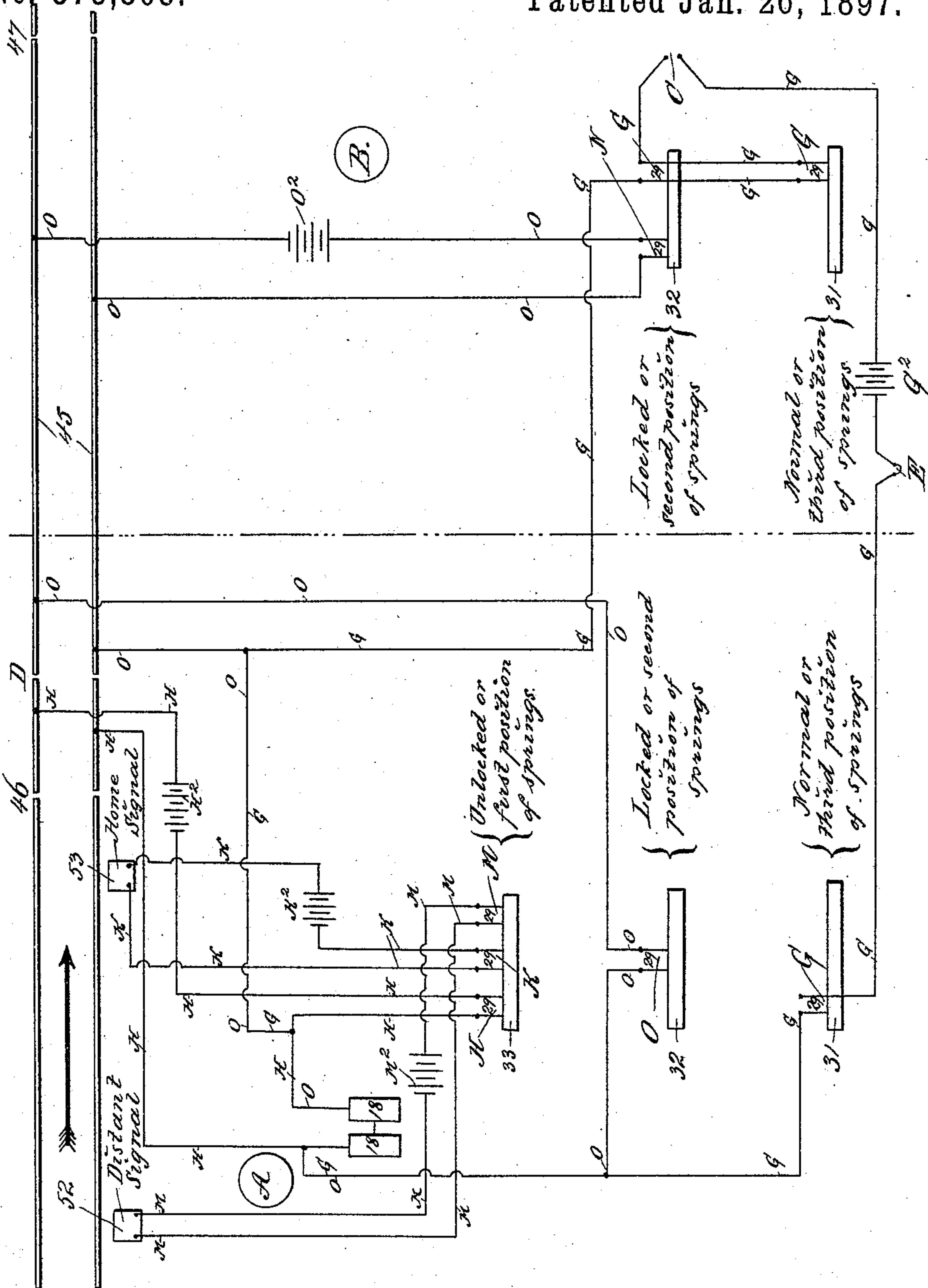
3 Sheets—Sheet 1.

P. FREEMAN & R. E. SLATER.
ELECTRICAL SIGNAL SYSTEM.

No. 575,805.

Patented Jan. 26, 1897.

Fig. 1.



WITNESSES

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3 Sheets—Sheet 2.

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Fig. 2.

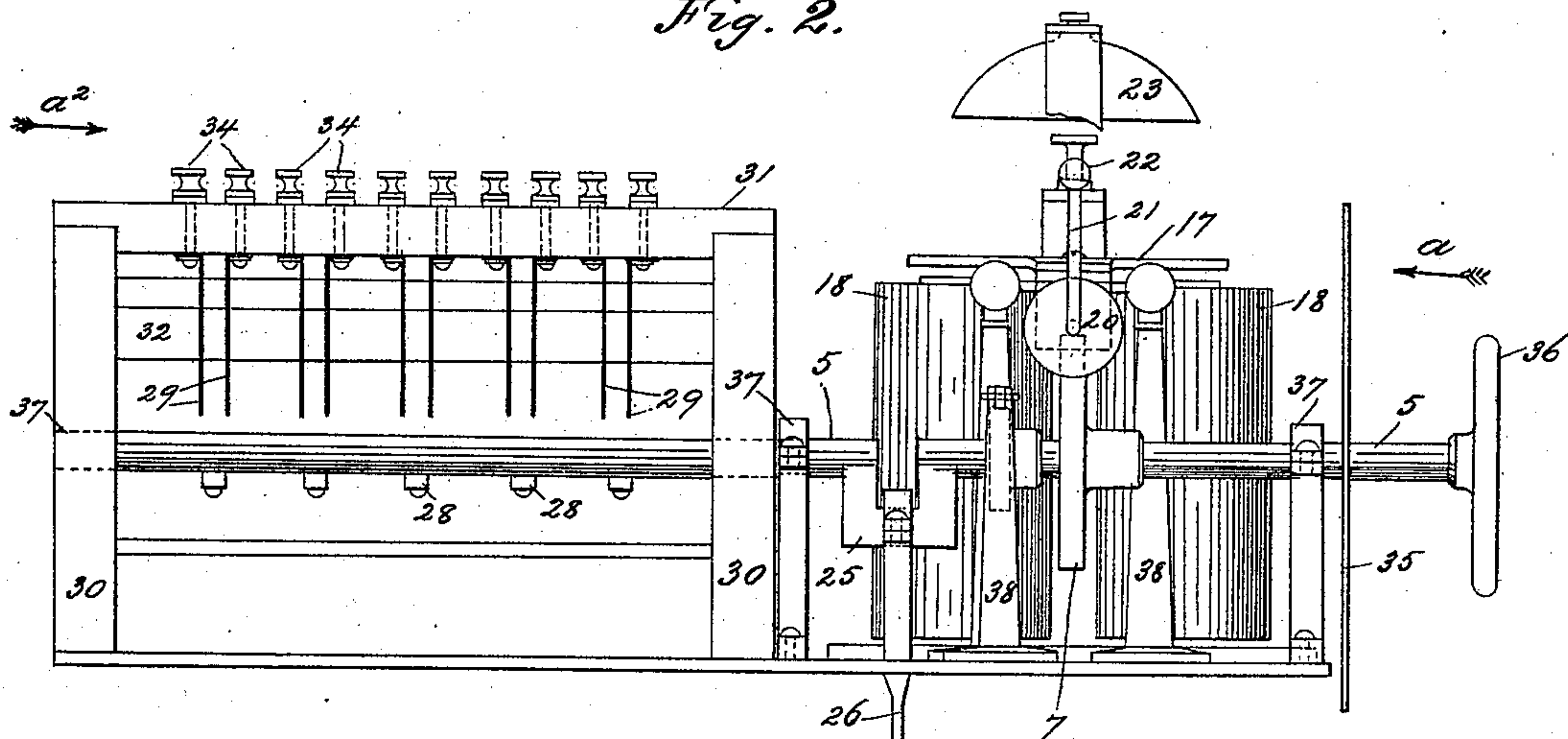


Fig. 3.

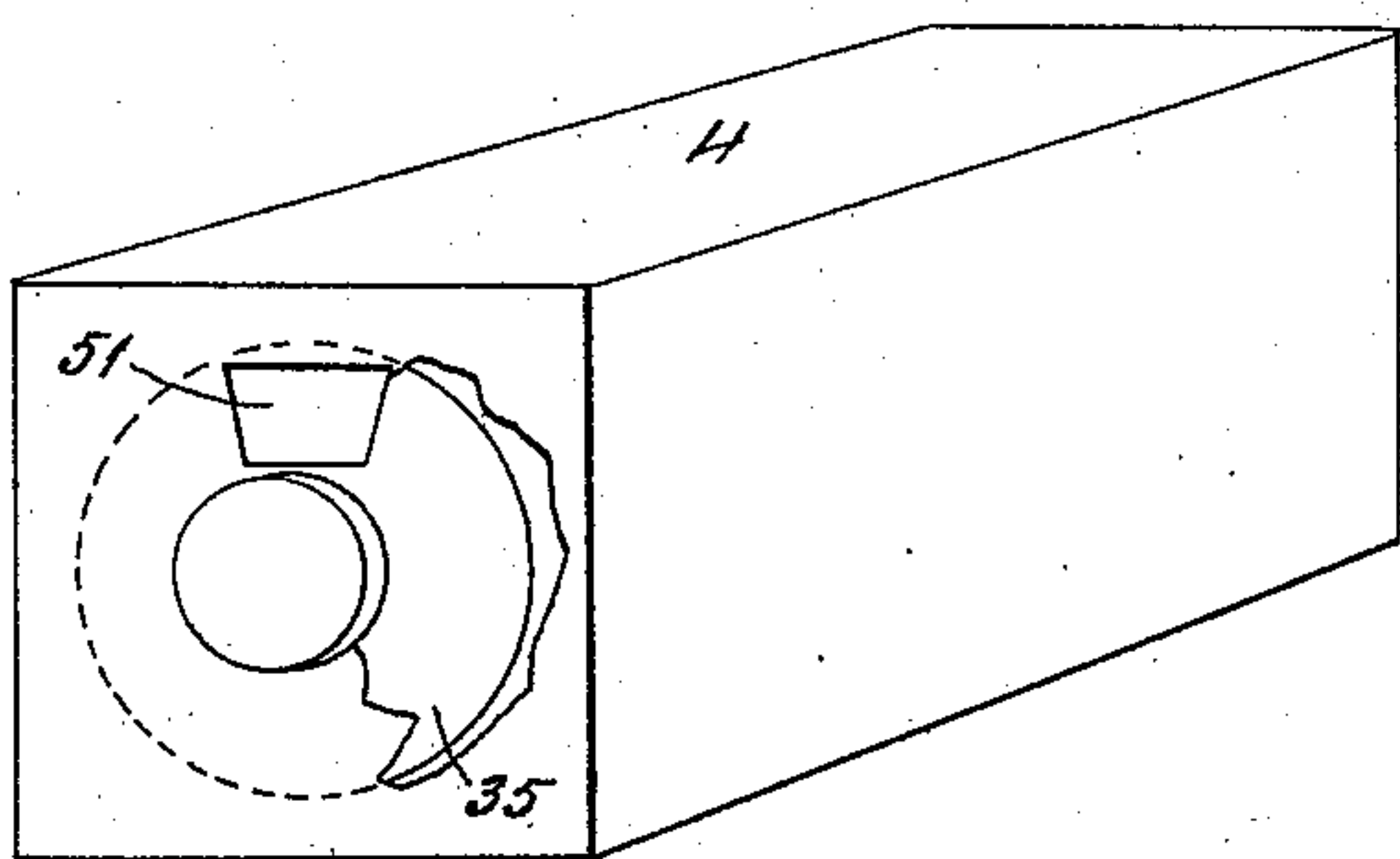


Fig. 6.

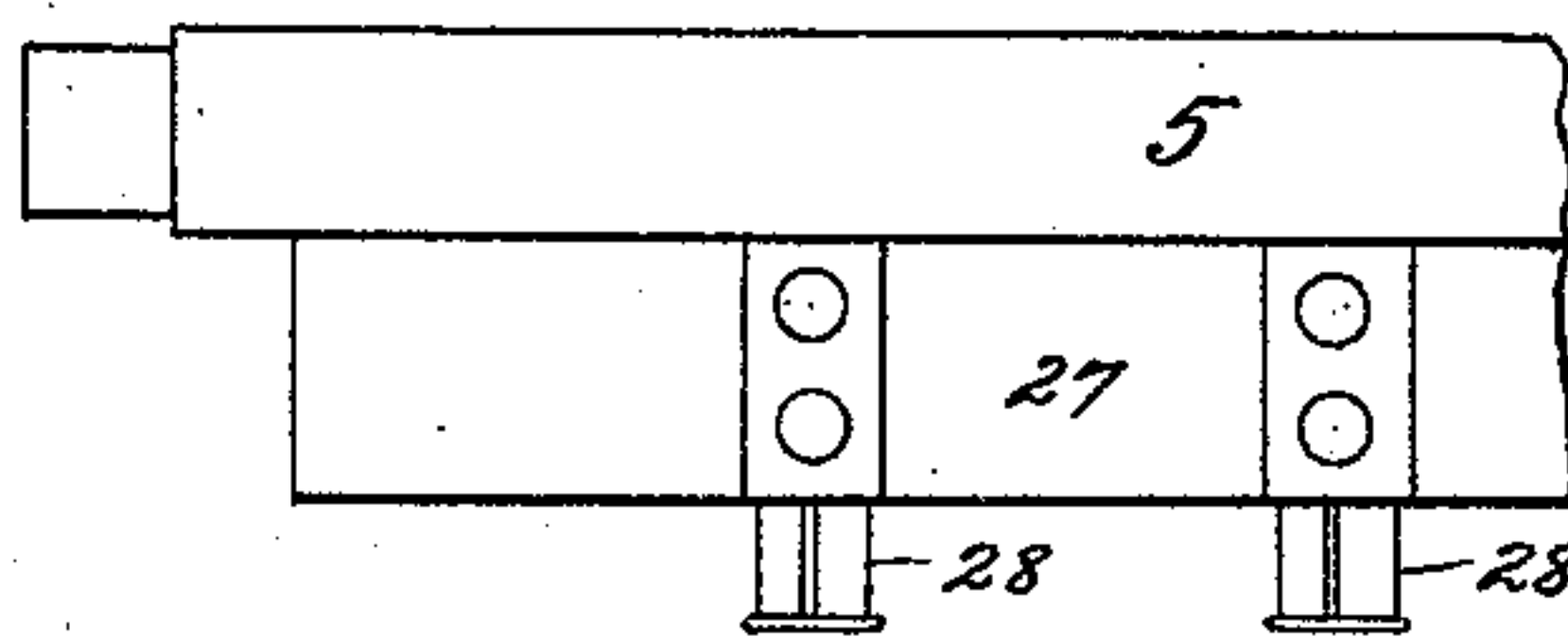
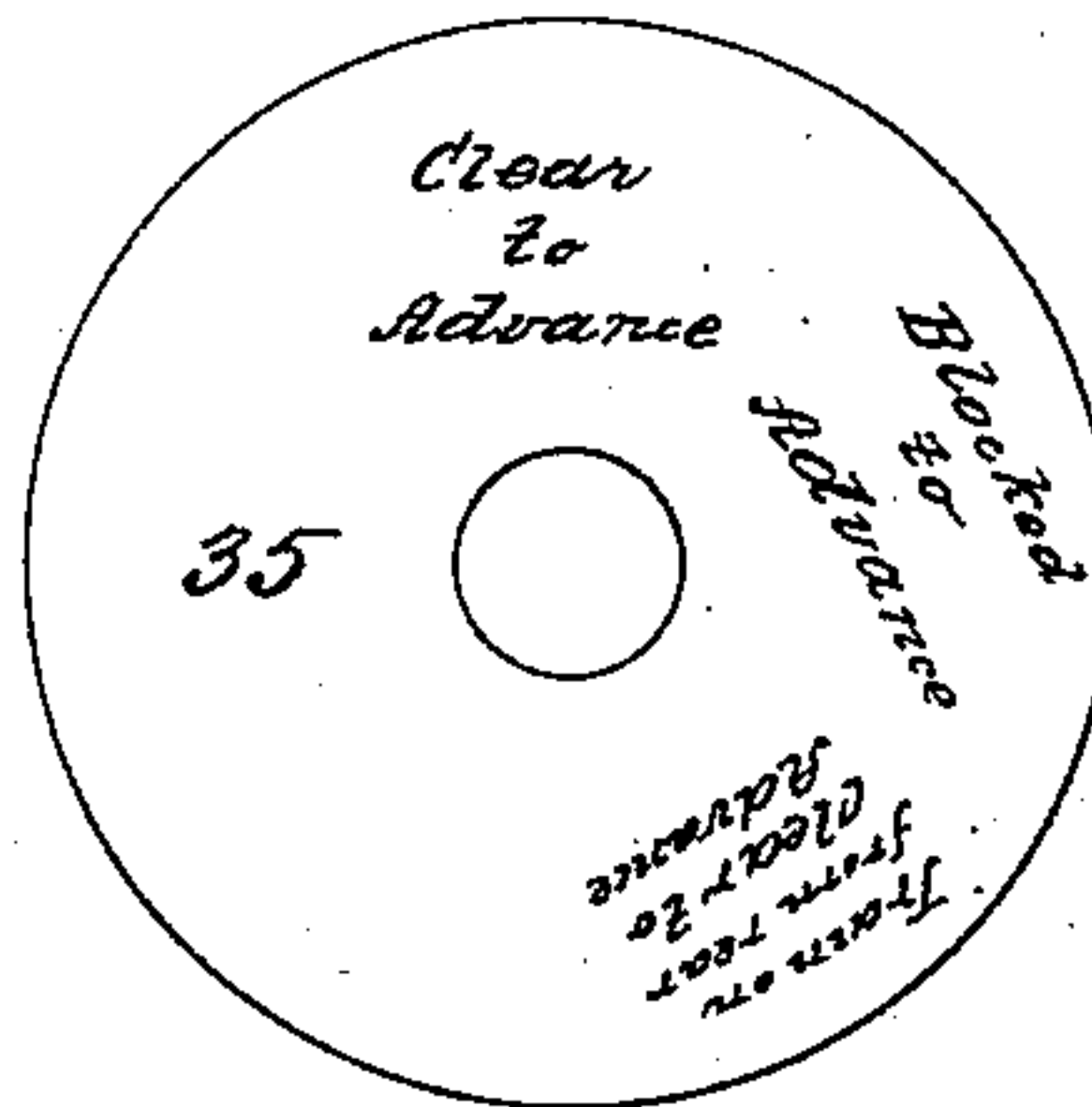


Fig. 7.



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Fig. 4.

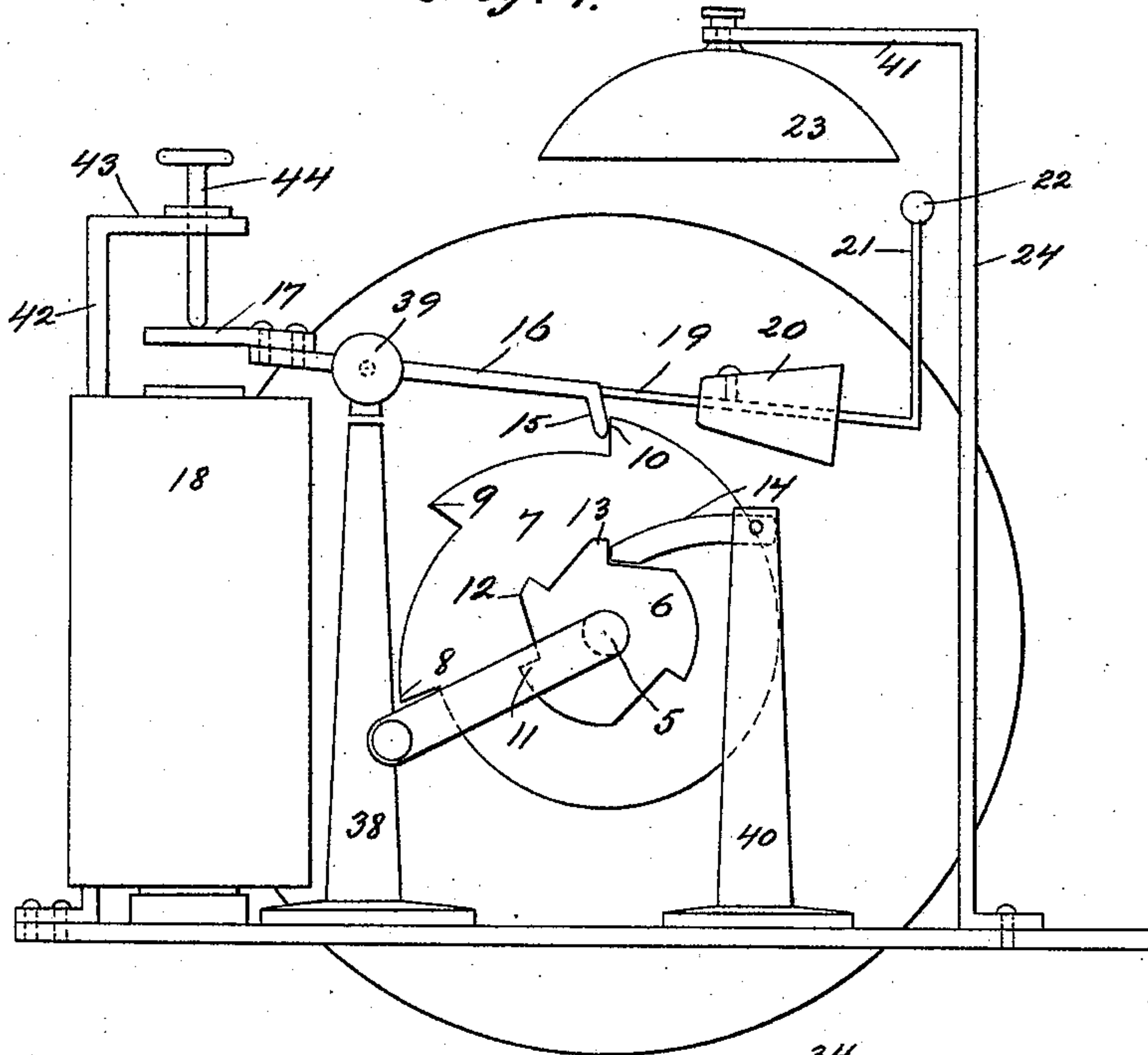
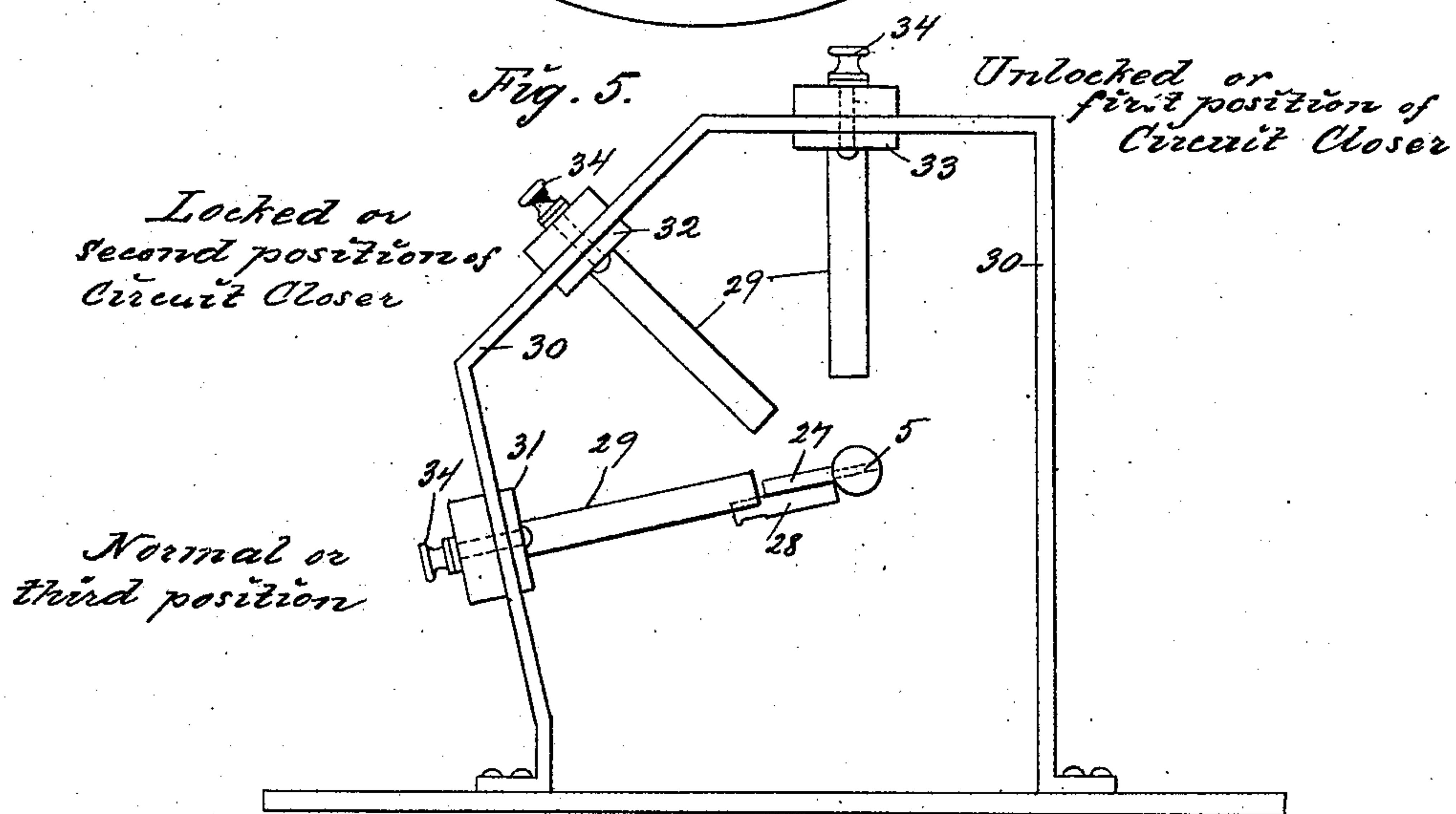


Fig. 5.



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UNITED STATES PATENT OFFICE.

PAUL FREEMAN, OF NEW YORK, AND RICHARD E. SLATER, OF MONTROSE,
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ELECTRICAL SIGNAL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 575,805, dated January 26, 1897.

Application filed May 25, 1896. Serial No. 593,047. (No model.)

To all whom it may concern:

Be it known that we, PAUL FREEMAN, a resident of New York, in the county of New York, and RICHARD E. SLATER, a resident of Montrose, in the county of Westchester, State of New York, citizens of the United States, have invented certain new and useful Improvements in Electrical Signal Systems for Railways, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof, in which similar letters and numerals of reference indicate corresponding parts.

This invention relates to electric railway signal apparatus; and the object thereof is to provide an improved apparatus of this class which works upon the block system and by means of which a train may be absolutely prevented from entering upon a given block until said block is clear throughout its length and whereby it will be impossible for a single operator to place two trains on the same block or section at the same time.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which—

Figure 1 is a diagrammatic view of our improved railway signal apparatus; Fig. 2, a side view of a part of the mechanism which we employ; Fig. 3, a perspective view of a box in which said mechanism is placed; Fig. 4, an end view of said mechanism, looking in the direction of the arrow *a* in Fig. 2; Fig. 5, an end view of said mechanism, looking in the direction of the arrow *a*² in Fig. 2; and Figs. 6 and 7 represent a detail of the construction.

In the practice of our invention we provide a box 4, which is shown in Fig. 3 and which is oblong in form and which is preferably rectangular in cross-section, but which may be of any desired shape and composed of any desired material, and mounted longitudinally of the box 4 and centrally thereof and passing therethrough is a revoluble crank-shaft 5, upon which are mounted two ratchet-wheels 6 and 7, as shown in Fig. 4, the first of which is much smaller than the last, and the ratchet-wheel 7 is provided with teeth 8, 9, and 10, which are cut at a predetermined distance apart on one side thereof, and the ratchet-wheel 6 is provided with three teeth 11, 12, and 13,

which are similarly arranged, and the smaller ratchet-wheel 6 is also provided with and controlled by a pivoted dog 14, whereby it is rendered impossible at any time to turn the shaft in a backward direction, and the larger wheel 7 is controlled by a dog 15, secured to or formed on an armature-lever 16, provided with an armature 17, and which is so arranged that when no current is applied to the magnets 18 it will drop down by gravity at any point and prevent further movement of the shaft in either direction until the current is applied to the magnets, either by means of a train, as hereinafter described, or by an operator.

The lever 16 is provided with an extension 19, on which is mounted a weight 20, and the outer end of said extension 19 is provided with an upwardly-directed arm 21, the upper end of which is provided with a knob or clapper 22, which is adapted to operate in connection with a bell or gong 23, which is mounted on a standard 24 and which is adapted to sound an alarm, as hereinafter described.

The shaft 5 is provided with a crank 25, on which is mounted a locking-rod 26 and which is adapted to lock and unlock the levers for the signals, which are not shown, but which are of the usual construction, and a wing or plate 27 is attached to or formed on the shaft 5, to which are secured or on which are mounted insulated wedges 28, said wedges being adapted to enter between springs 29, any desired number of which may be employed at various positions of the shaft, thus closing the circuits at one point and leaving all the circuits open at the other points.

It will be observed that the shaft 5 passes through a suitable frame composed of end pieces 30, which are suitably supported and connected, and that these end pieces 30 are provided at one side and at the top with three longitudinal bars 31, 32, and 33, which serve as supports for the springs 29, and said springs are arranged in pairs and connected with the bars 31, 32, and 33 by binding-posts 34, and each row of the springs 29 extends inwardly in the direction of the shaft 5, and a disk 35 is mounted on said shaft adjacent to one end thereof, on which are printed different indi-

cations, which appear and disappear from view as said disk revolves from one position to another, and said shaft is provided with a ring or handle 36, which is outside of the box or cabinet 4, whereby the operator is enabled to turn said shaft and its attachments from the normal or third position, in which the wedges 28 connect with the springs 29, which are secured to the bar 31, to the unlocked or first position, in which the wedges 28 connect with the springs 29, secured to the bar 33, or said shaft can be turned from the normal or third position to the unlocked or first position by attaching said shaft to a motor and applying power to the motor, and this covers all the attachments or appliances connected with said shaft and operating in connection therewith, and said shaft is mounted in suitable journals, as shown at 37, and the stationary parts of the apparatus connected with said frame are as follows:

Two posts or standards 38 are mounted in front of the magnets 18, by means of which the armature-lever 16 is pivotally supported, said posts or standards being provided with a cross-rod 39, which passes through said lever, and a similar post 40 is also provided, to which the dog 14, which controls the wheel 6, is pivotally secured, and the post or standard 24, which is provided with an arm 41, with which the gong or bell 23 is connected and which is so arranged that when the outer end of the armature-lever is thrown upwardly the clapper or knob 22 will strike the bell or gong and indicate by audible signals to the operator that the dog 15 has been raised and the ratchet-wheel 7 released, so that said ratchet-wheel can revolve from one position to the next, and a standard 42 is also provided, having an inwardly-directed arm 43, through which passes a set-screw 44, which is adapted to limit the movement of the armature 17 and the armature-lever 16 and by means of which the movement of said armature may be adjusted, together with the movement of the dog 15 on the armature-lever.

The bars 31, 32, and 33 are also insulated and secured to the frame hereinbefore referred to, of which the end pieces 30 form a part, and said bars are composed of a strip of wood or similar material, which are suitably insulated and to which the springs 29 are attached, and the binding-posts 34, by means of which electrical connection with said springs is made, pass through said bars, and said bars are also so arranged that when the wedges 28 on the shaft 5, or the plate or wing 27, connected therewith, revolve from point to point they open and close different electrical circuits.

In Fig. 1 we have shown by diagram the method of putting a train through a section or block, and in this view the rails of the track are shown at 45, and for the purposes of this description we have shown one entire block or section and a portion of two others, one in the rear and one in advance of the entire

block or section, which is shown in full beginning at 46 and ending at 47, and the one in advance beginning at 47.

In practice one of the machines or boxes or cabinets 4, with the apparatus connected therewith, is employed at each end of a section or block, and for the purposes of convenience we will designate the signal-tower which is not shown at the entrance of the full section as A and the signal-tower at the opposite end as B, and as a train approaches the signal-tower at A in the direction of the track arrow, the section between A and B being clear, the apparatus at A will stand in the normal or third position in which the wedges 28, which are connected with the shaft 5, will connect with the springs 29, which are secured to the bar 31, and with which the wires G of the main locking or unlocking circuit from B connect, thereby closing the circuit at this position, the wedges 28 having entered between the separate pairs of springs 29 at this point, thus leaving all the other circuits at the other positions open.

The apparatus at B is standing at second or locked position, in which the wedges 28 will contact with the springs 29, secured to the bar 32, or at the third or normal position, either of said positions serving to close the gap in the locking and unlocking circuit G back to A, and this position leaves the locking and unlocking circuit from B to A open in one place, namely, at the "circuit-closer" at C, it being understood that the operator at B has his signal-lever at "danger" position, which closes the circuit G at E, which is a circuit-closer attached to said lever, which is so arranged that the circuit G is open at this point when lever B is at the "clear" position, and closed when said lever is at "danger," and when the operator at A asks the operator at B to unlock his apparatus at A the operator at B closes the circuit at C, which is at all times under his control, thereby putting the battery G² of the circuit G onto the controller-magnets 18 at A, thus causing the armature 17 at A to operate the dog 15 and the armature-lever 16 to be disconnected from the tooth 10 of the ratchet-wheel 7, thus allowing the operator at A to turn the shaft from the third or normal position up to the first or unlocked position, as indicated by the tooth 8.

The instant that the operator at A starts to revolve the shaft 5 the wedges 28 are disconnected from the springs 29, and thus opens the circuit G at that point which the operator at B has closed at C and thus allows the armature 17 at A to be disconnected from the magnets and the dog 15 to drop by gravity, and the operator at A cannot turn the shaft 5 beyond the next tooth, which is 8, on the ratchet-wheel 7. As the operator at A turns the shaft 5 from third or normal position to first or unlocked position he lifts the locking-rod 26, which is connected with the crank 25 on the shaft 5, thereby unlocking the latches

of the levers by which the signals are operated at this point, and which are not shown, so that said levers may be pulled to the "clear" position, and when the wedges 28 reach the unlocked or first position they enter the springs 29, which close the signal-circuits K and M and the controller-circuits H to a short insulated section of track which extends from D to 46, one of these short sections of insulated track being provided at the beginning of each of the main blocks or sections, and the operator at A now has his signals clear and ready for a train to pass in the section between A and B or the section between 46 and 47. In this position of the signals the train enters the block between A and B, and as soon as it strikes the insulated section between 46 and D it puts the battery H^2 onto the controller-magnets at A through the wheels and axle of a car, and this raises the dog 15 on the armature-lever 16, and the crank 25 on the shaft 5 with which the locking-rod 26 is connected, having been allowed to pass a little beyond the vertical center, acts as a weight to turn the shaft from unlocked or first position to locked or second position, and when said shaft turns from the unlocked or first position to the locked or second position the wedges 28 leave the circuits H, K, and M open at the first position, thereby opening the battery H^2 to the controller-magnets 18, the battery K^2 to the home signal, and the battery M^2 to the distant signal and closes the circuits O at locked or second position. As the crank-shaft 5 is thus operated or as the crank drops by gravity from the first to the second position the locking-rod 26 drops downwardly the full distance through a slotted rod 48, with which it is connected, the lower part of which now rests against the locking-tappets, (not shown,) which in operation are connected with the lower end of the slotted rod 48 by means of jaws 49, secured to or formed on arms 50, which are connected with said rod 48, and the lower parts of the arms 50 of the rod 48 rest upon the locking-tappets.

As soon as the lever which controls the signals, and which is not shown, is put to the "danger" position the tappets, which are not shown but connection with which is made by the arms 50 of the rod 48 by means of the jaw 49, drop in place by gravity and lock the signal-levers, which are not shown, so that said levers cannot be pulled to the clear position until the train has passed B and the operator there has again unlocked the apparatus at A.

When the train reaches B, the shaft 5 of the apparatus at this point revolves from unlocked or first position, which in Fig. 4 is represented by the tooth 8 of the wheel 7, to the second or locked position, as indicated by the tooth 9 in said figure. The circuit O to the controller-magnets at A is now closed at station B in the second or locked position, and as soon as the last portion of the train passes the insulation at 47 at B, the circuit O being

closed at A and B, the current will pass through the track to A and put the battery O^2 at B on the controller-magnets 18 at A and attract the armature 17 at this point, thereby releasing the dog 15 on the armature-lever 16 and allowing the shaft 5 at A to revolve from the locked or second position to the normal or third position, thus opening circuit O at A and closing circuit G at A, and the operator at A is now ready for the operator at B to unlock his apparatus again, A's machine having made a complete revolution.

When the apparatus at A revolves from the second to the third position, the lost motion in the locking-rod 26 is provided for by means of the slotted rod 48, with which the rod 26 is connected, and it will be understood that the lower end of the rod 26 is free to slide in the rod 48 without being disconnected therefrom. It will also be seen by the circuits that while a train is between the points A and B it will be impossible for the operator at B to unlock the apparatus at A, as the locking and unlocking circuit G would be open in the springs 29 at A in the third or normal position, and therefore until the entire train has passed the station at B the apparatus at A will be in the second or locked position, and the shaft 5 at this point cannot be moved either way, though the operator at A were to attempt to do so; and it will be seen that while the operator at B has his signal-levers at the "clear" position he cannot unlock the apparatus at A, as the circuit G would be open at B in locked or secured position and normal or third position, and until he has put his signal-levers at the "danger" position, which closes the circuit at E.

The revolving disk 35, which is mounted on the shaft 5, is intended to serve as an indicator and to operate in the following manner: An opening 51 is formed in the end of the cabinet or box 4 and preferably provided with a glass cover, and the disk 35 revolves just behind said opening, and printed or otherwise placed on said disk so as to be clearly seen through said opening when the shaft is at normal or third position are the words "Clear to advance," indicating that the section from A to B is clear of trains. When the operator at B unlocks the apparatus at A and the operator at A turns the shaft from third or normal position to first or unlocked position, the indication "Clear to advance" revolves out of sight, and there appears through said opening the words "Train on from rear, clear to advance," thus indicating that a train is approaching the station at A and that the signals are clear for it to advance onto the block or section between A and B, it being understood that the operator at A after his apparatus has been unlocked has operated or turned his signals to the "clear" position.

When the train passes the station at A and the shaft 5 revolves from first or unlocked position to the second or locked position, the

indication "Train on from rear, clear to advance" passes from view, and there comes into sight the indication "Blocked to advance," thus indicating that there is a train in the section or block between A and B, and when the entire train has passed the station at B the shaft 5 of the apparatus at A will turn from the second or locked position to the third or normal position, and the indication "Clear to advance" will again appear through the opening 51. We also provide at 52 and 53 a distant signal and a home signal, respectively, which are in connection with the circuits at the first or unlocked position and the object of which is to provide means whereby even though the operator would pull the signal-levers which are to clear the signals said levers would not operate the signals unless the circuits were closed at said first or unlocked position.

The advantages of our improved signal system over those now in use are found in the fact that it entirely abandons the use of all relays and track-indicators, only one set of eight or twelve ohm magnets being necessary to control the system for one track. It is also a gravity-lock, thus making it an impossibility for the operator to leave the levers unlocked and pull them at any time. The instant he restores the levers to the "danger" position they are locked by gravity, and he cannot in any way release them until the section or block under his control is clear and the operator in advance again unlocks his apparatus. It is far simpler than any apparatus now employed for this purpose, and the batteries used are open-circuit batteries and are closed but the fraction of a second, thereby extending the life of the batteries. It is also an impossibility for any two operators to enter into any agreement or collusion, so as to overcome the apparatus or to interfere with the operation thereof and thus place two trains in or upon the same block or section at the same time, it being understood that the machine or apparatus locks itself when the train enters the block, the operator at the station which the train passes receiving only an unlock from the operator in advance; and it will also be understood that the idea of employing a shaft for the attachments herein described and the method herein described to open and close a number of electric circuits at various points is original and of our invention; and in our improved signal apparatus no circuit is less than twice broken, and some of them three times broken, and that it is impossible to make any combination or crosses in the circuits to effect the working of the machine, so that the operator at any particular point, as at A, could by any means or accident have his apparatus unlocked, and thus be enabled to put two trains upon the same block or section.

It is evident that changes in and modifications of the construction herein described may be made without departing from the

spirit of our invention or sacrificing its advantages, and we reserve the right to make all such alterations therein and modifications of said construction as fairly come within the scope of the invention.

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

1. In an electrical railway signal system, adapted for use in connection with a railway-track, which is divided into blocks or sections, the rails of which are insulated at the ends of said blocks or sections, the combination therewith, of a signal apparatus, one of which is located at the beginning of each block or section, said apparatus being provided with a plurality of longitudinal rows of springs which are arranged in pairs, and a shaft provided with wedges by which connection is made between the springs of each pair, said wedges and said springs being also insulated from each other and the springs of each pair being also provided with binding-posts, and magnets suitably mounted, and provided with an armature, which is connected with a lever, which is adapted to operate in connection with said shaft, or a ratchet-wheel mounted thereon, and means connected with said shaft for releasing or locking, locking-tappets, or similar devices which control the signal-levers, substantially as shown and described.

2. In an electrical railway signal system, adapted for use in connection with a railway-track, which is divided into blocks or sections, the rails of which are insulated at the ends of said blocks or sections, the combination therewith, of a signal apparatus, one of which is located at the beginning of each block or section, said apparatus being provided with a plurality of longitudinal rows of springs which are arranged in pairs, and a shaft provided with wedges by which connection is made between the springs of each pair, said wedges and said springs being also insulated from each other, and the springs of each pair being also provided with binding-posts, and magnets suitably mounted, and provided with an armature, which is connected with a lever, which is adapted to operate in connection with said shaft, or a ratchet-wheel mounted thereon, and means connected with said shaft for releasing or locking, locking-tappets or similar devices which control the signal-levers, said springs which are arranged in pairs being connected by suitable circuits, with batteries, and the apparatus at each block or section of the road being under the control of separate operators, substantially as shown and described.

3. In an electrical railway signal system, the combination with the rails of a track, which are divided into blocks or sections, the rails of each block or section being insulated from those of the adjoining blocks or sections, and each block or section being also provided with a short insulated section at the beginning

thereof, of a signal apparatus which is placed adjacent to the signal-towers, one of which is arranged adjacent to the end of each block or section, each of said signal apparatus being the same in construction, and each being provided with a revoluble shaft, which can turn in but one direction, each being also provided with a set of controller-magnets, and with a plurality of rows of springs, which are arranged in pairs, and insulated from their supports, each spring being also provided with a binding-post, and said shafts being provided with wedges, which are adapted to connect the springs of each pair, and said magnets being also provided with an armature, which is provided with a dog, which operates in connection with a wheel mounted on said shaft, and provided with teeth which correspond in number with the rows of springs, and said binding-posts of the separate apparatus being connected by suitable conductors, and being also in connection with the rails of the main blocks or sections, and with the short insulated blocks or sections, substantially as shown and described.

4. In an electrical railway signal system the combination with the rails of a track, which are divided into blocks or sections, the rails of each block or section being insulated from those of the adjoining blocks or sections, and each block or section being also provided with a short insulated section at the beginning thereof, of a signal apparatus which is placed adjacent to the signal-towers, one of which is arranged adjacent to the end of each block or section, each of said signal apparatus being the same in construction, and each being provided with a revoluble shaft, which can turn in but one direction and being also provided with a set of controller-magnets, and with a plurality of rows of springs which are arranged in pairs, and insulated from their supports, each spring being also provided with a binding-post, and said shafts being provided with wedges, which are adapted to connect the springs of each pair, and said magnets being also provided with an armature which is provided with a dog, which operates in connection with a wheel mounted on said shaft, and provided with teeth which correspond in number with the rows of springs, and said binding-posts of the separate apparatus being connected by suitable conductors, and being also in connection with the rails of the main blocks or sections, and with the short insulated blocks or sections, and said apparatus being each also in connection with home and distant signals, substantially as shown and described.

5. In an electrical railway signal apparatus, the combination with a suitable frame, of a shaft passing therethrough, and revolving in one direction, a plurality of suitably-supported insulated bars mounted parallel with said shaft, a plurality of pairs of springs, connected with said bars, and pointing in the direction of said shaft, suitably-insulated

wedges connected with said shaft, and adapted to contact with said pairs of springs, binding-posts connected with each of said springs, said shaft being also provided with a crank, and a locking-rod connected therewith, said locking-rod being composed of sections, which are adapted to slide one upon the other, and one of said sections being adapted to be connected with the signal devices, substantially as shown and described.

6. In an electrical railway signal apparatus, the combination with a suitable frame, of a shaft passing therethrough, and revolving in one direction, a plurality of suitably-supported insulated bars mounted parallel with said shaft, a plurality of pairs of springs, connected with said bars, and pointing in the direction of said shaft, suitably-insulated wedges connected with said shaft, and adapted to contact with said pairs of springs, binding-posts connected with each of said springs, said shaft being also provided with a crank, and a locking-rod connected therewith, said locking-rod being composed of sections, which are adapted to slide one upon the other, and one of said sections being adapted to be connected with the signal devices, said frame being also provided with magnets, and a suitably-supported lever, on one end of which is mounted an armature, adapted to operate in connection with said magnets, said lever being provided with a dog which is adapted to operate in connection with a number of teeth formed on a wheel mounted on said shaft, substantially as shown and described.

7. In an electrical railway signal apparatus, the combination with a suitable frame, of a shaft passing therethrough, and revolving in one direction, a plurality of suitably-supported insulated bars mounted parallel with said shaft, a plurality of pairs of springs, connected with said bars, and pointing in the direction of said shaft, insulated wedges connected with said shaft and adapted to contact with said pairs of springs, binding-posts connected with each of said springs, said shaft being also provided with a crank, and a locking-rod connected therewith, said locking-rod being composed of sections, which are adapted to slide one upon the other, and one of said sections being adapted to be connected with signal devices, said frame being also provided with magnets, and a suitably-supported lever, on one end of which is mounted an armature, adapted to operate in connection with said magnets, said lever being provided with a dog which is adapted to operate in connection with a number of teeth formed on a wheel mounted on the shaft, and said lever being also weighted at the end opposite the armature and provided with an arm having a clapper or knocker mounted thereon, which is adapted to operate in connection with a bell or gong, substantially as shown and described.

8. In an electrical railway signal apparatus, the combination with a suitable frame, of a shaft passing therethrough, and revolving in

one direction, a plurality of suitably-supported insulated bars, mounted parallel with said shaft, a plurality of pairs of springs connected with said bars, and pointing in the direction
5 of said shaft; suitably-insulated wedges, connected with said shaft, and adapted to contact with said pairs of springs, binding-posts connected with each of said springs, said shaft
10 being also provided with a crank, and a locking-rod connected therewith, and said locking-rod being adapted to be connected with the signal device, and an indicator connected with said shaft which is designed to indicate the position of the blocks or section, substantially as shown and described.
15

9. In an electrical railway signal apparatus, the combination with a suitable frame, of a shaft passing therethrough, and revolving in one direction, a plurality of suitably-supported insulated bars mounted parallel with said
20 shaft, a pair or pairs of springs connected with said bars, and pointing in the direction of said

shaft, suitably-insulated wedges connected with said shaft, and adapted to contact with said pairs of springs, binding-posts connected
25 with each of said springs, said shaft being also provided with a crank, and a locking-rod connected therewith, and adapted to operate signal devices, said locking-rod being composed of separate sections, and adapted to
30 operate by gravity, and said shaft being also provided with an indicator, which is designed to indicate the condition of the blocks or sections of the track, substantially as shown and described.
35

In testimony that we claim the foregoing as our invention we have signed our names, in presence of the subscribing witnesses, this 22d day of May, 1896.

PAUL FREEMAN.

RICHARD E. SLATER.

Witnesses:

CHARLES S. ROGERS,
C. GERST.