No. 869,467. PATENTED OCT. 29, 1907.

C. W. S. TURNER.

RAILWAY SIGNAL.

APPLICATION FILED FEB. 1, 1907.

6 SHEETS—SHEET 1.

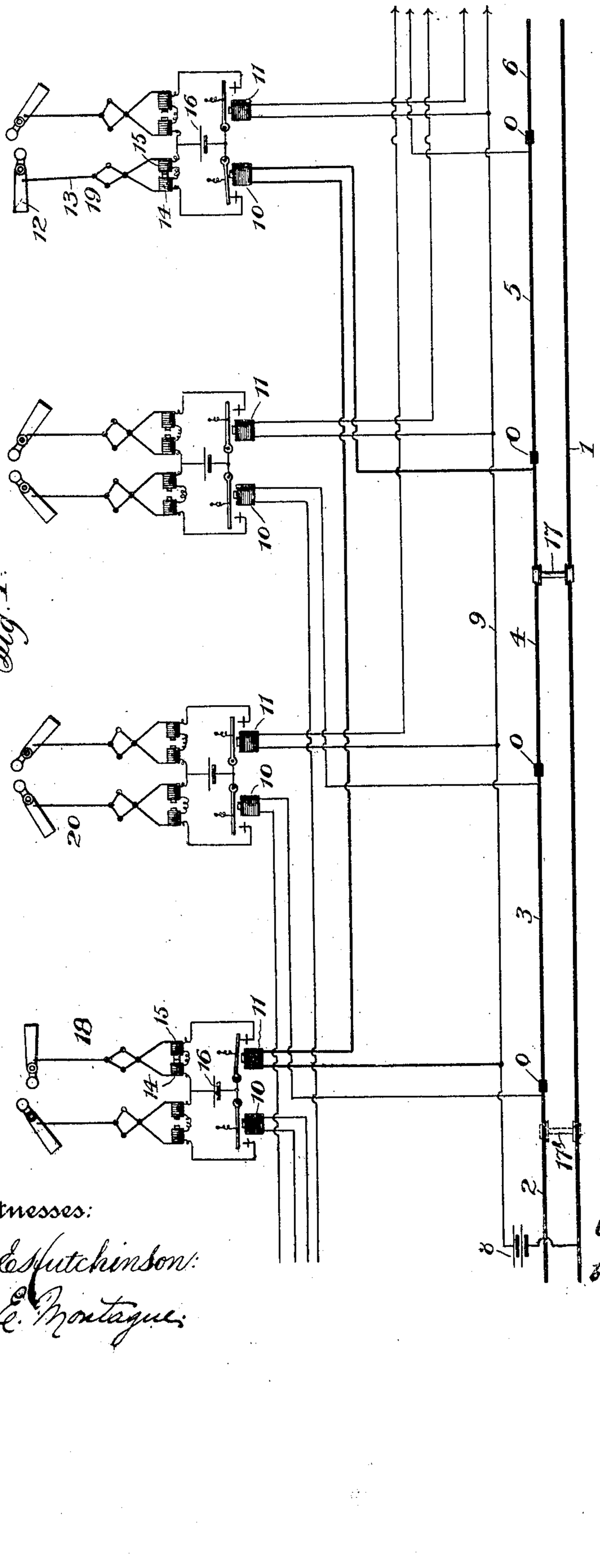

Fig. 1.

Witnesses:

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K. E. Montague.

Inventor:

C. W. S. Turner

by John S. Holk

his Attorney.

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6 SHEETS—SHEET 2.

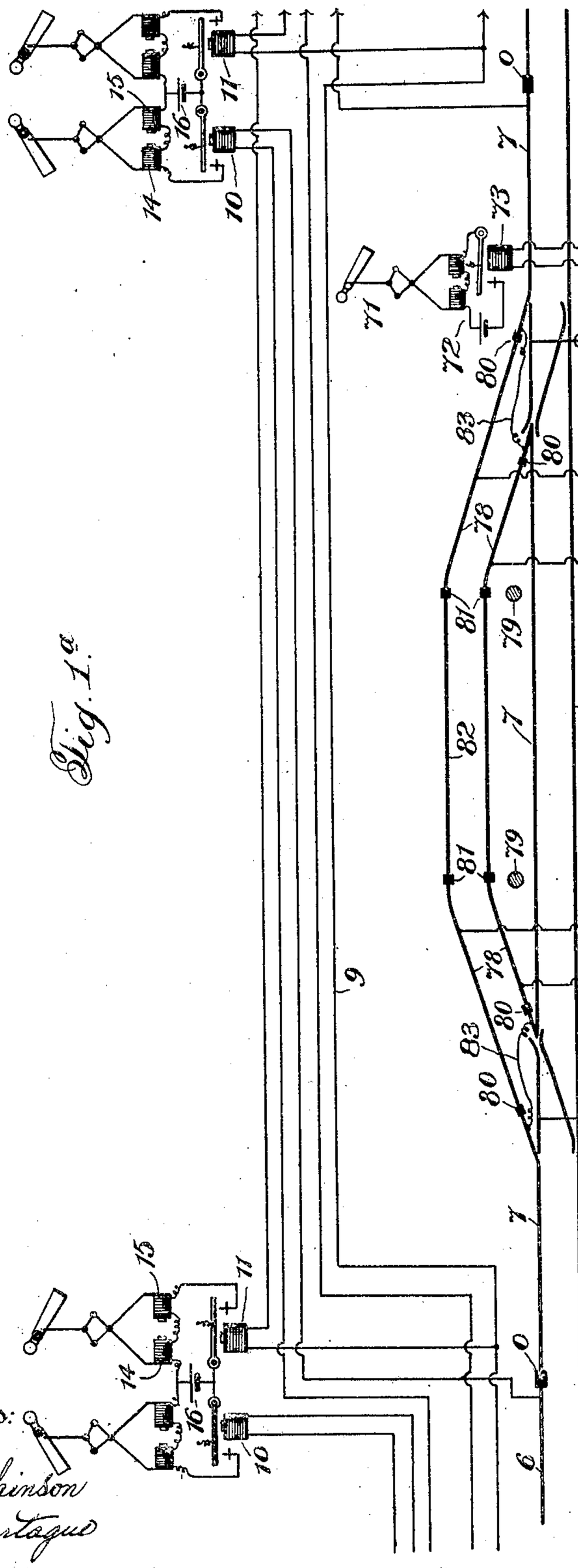

Fig. 1.

Witnesses:

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6 SHEETS—SHEET 3.

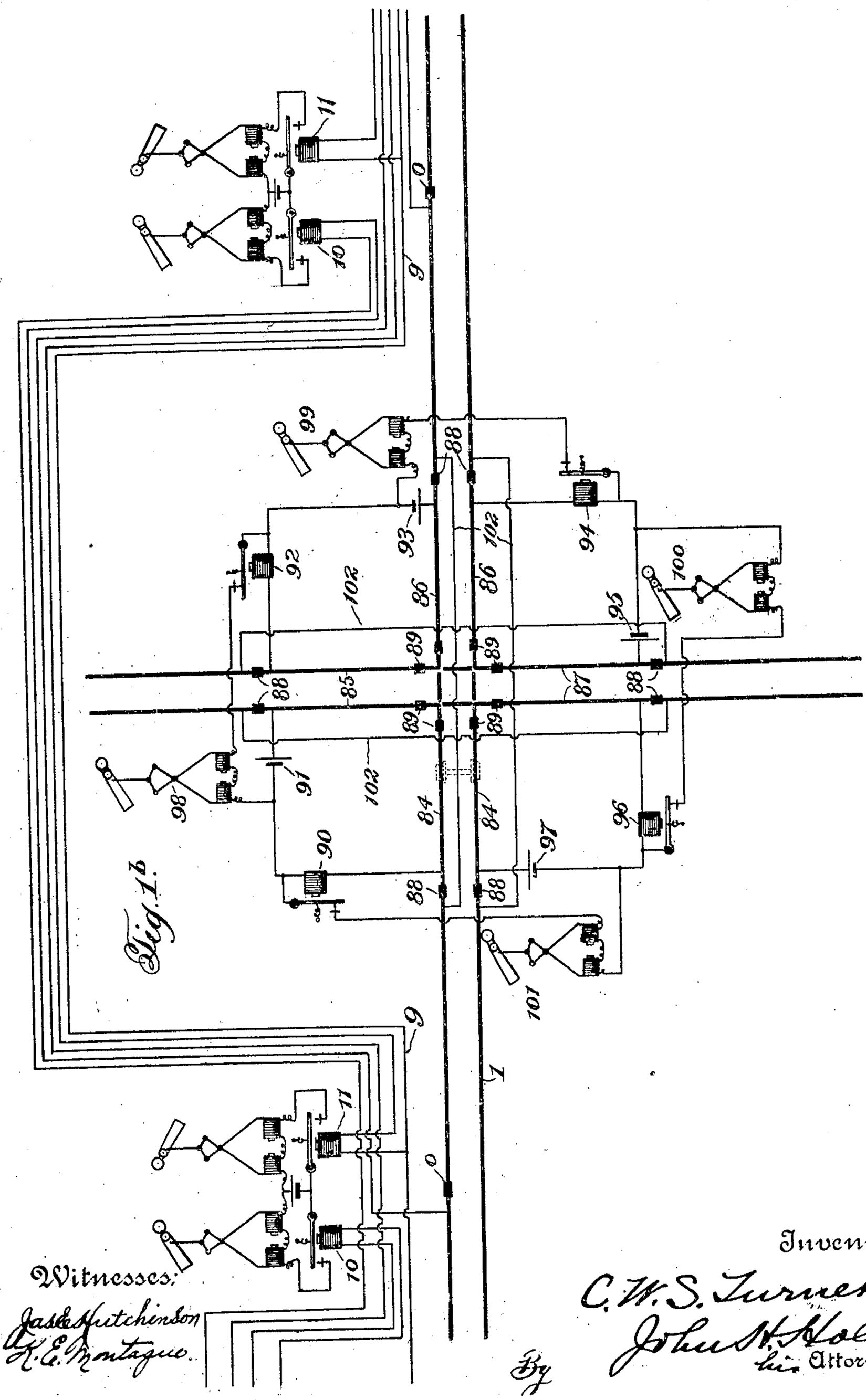

Fig. 1.b

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6 SHEETS—SHEET 4.

Fig. 2.

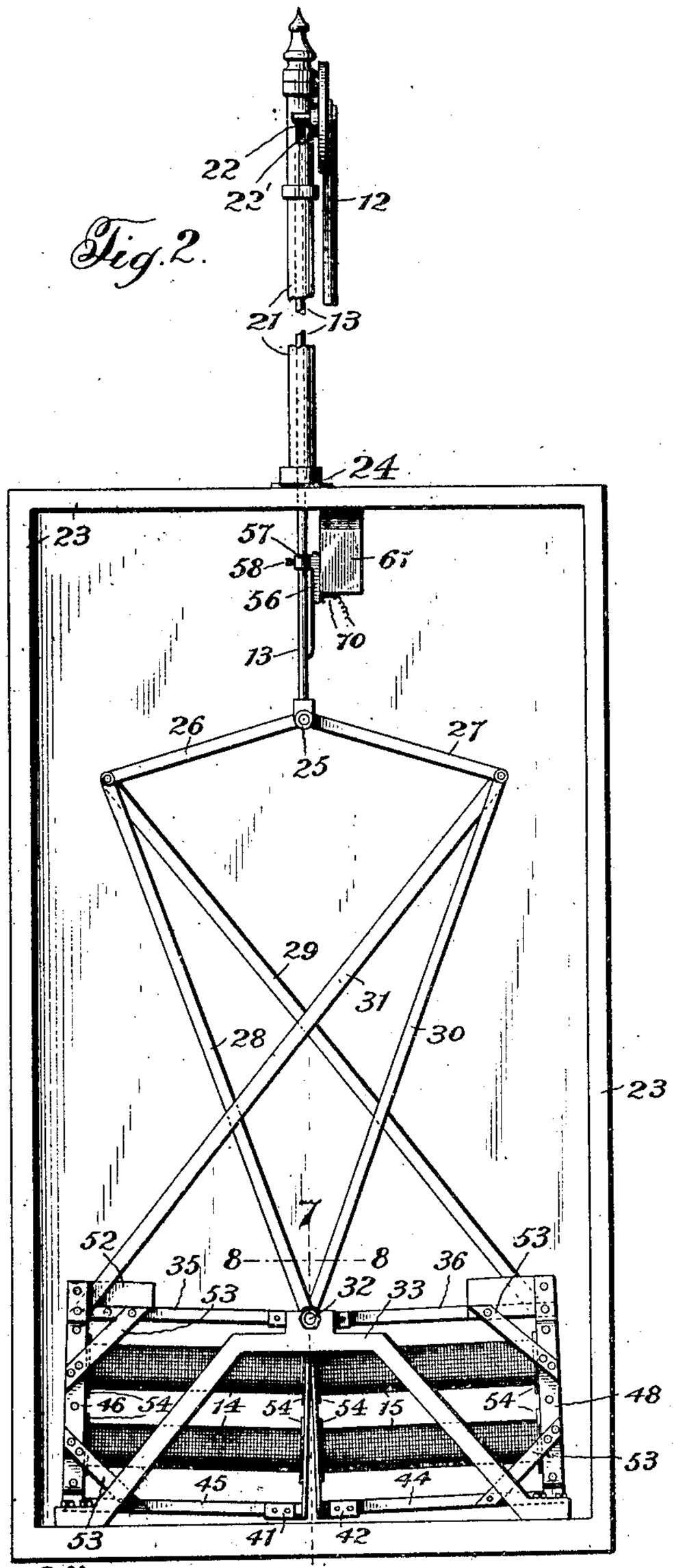
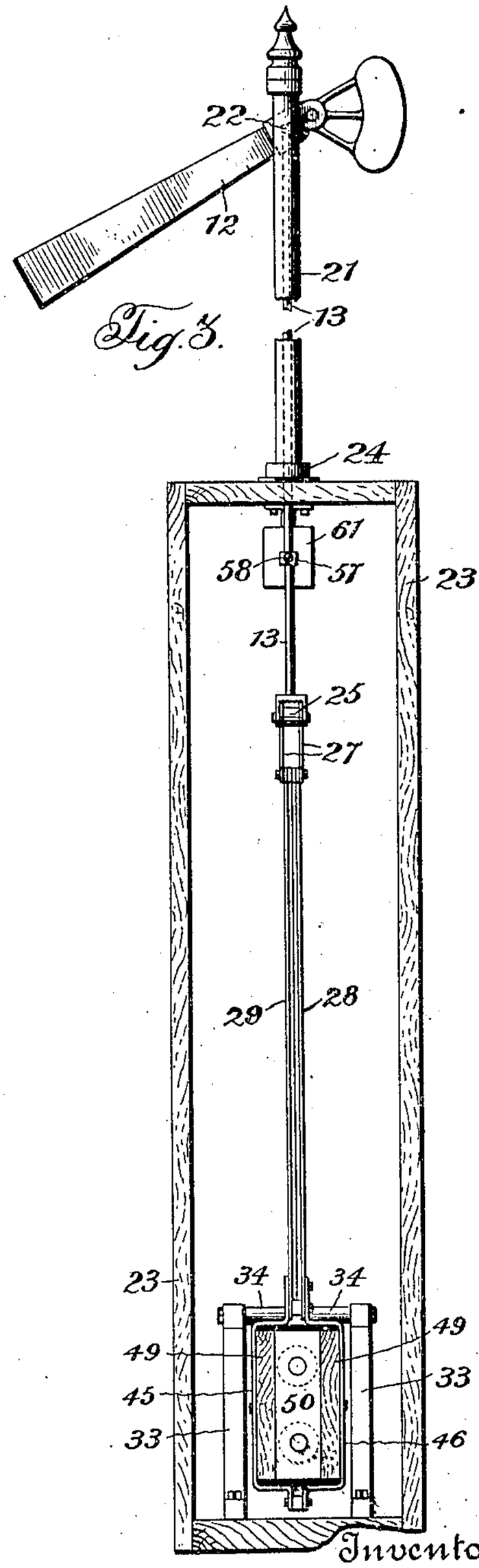


Fig. 3.



Witnesses:

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APPLICATION FILED FEB. 1, 1907.

6 SHEETS—SHEET 5.

Fig. 4.

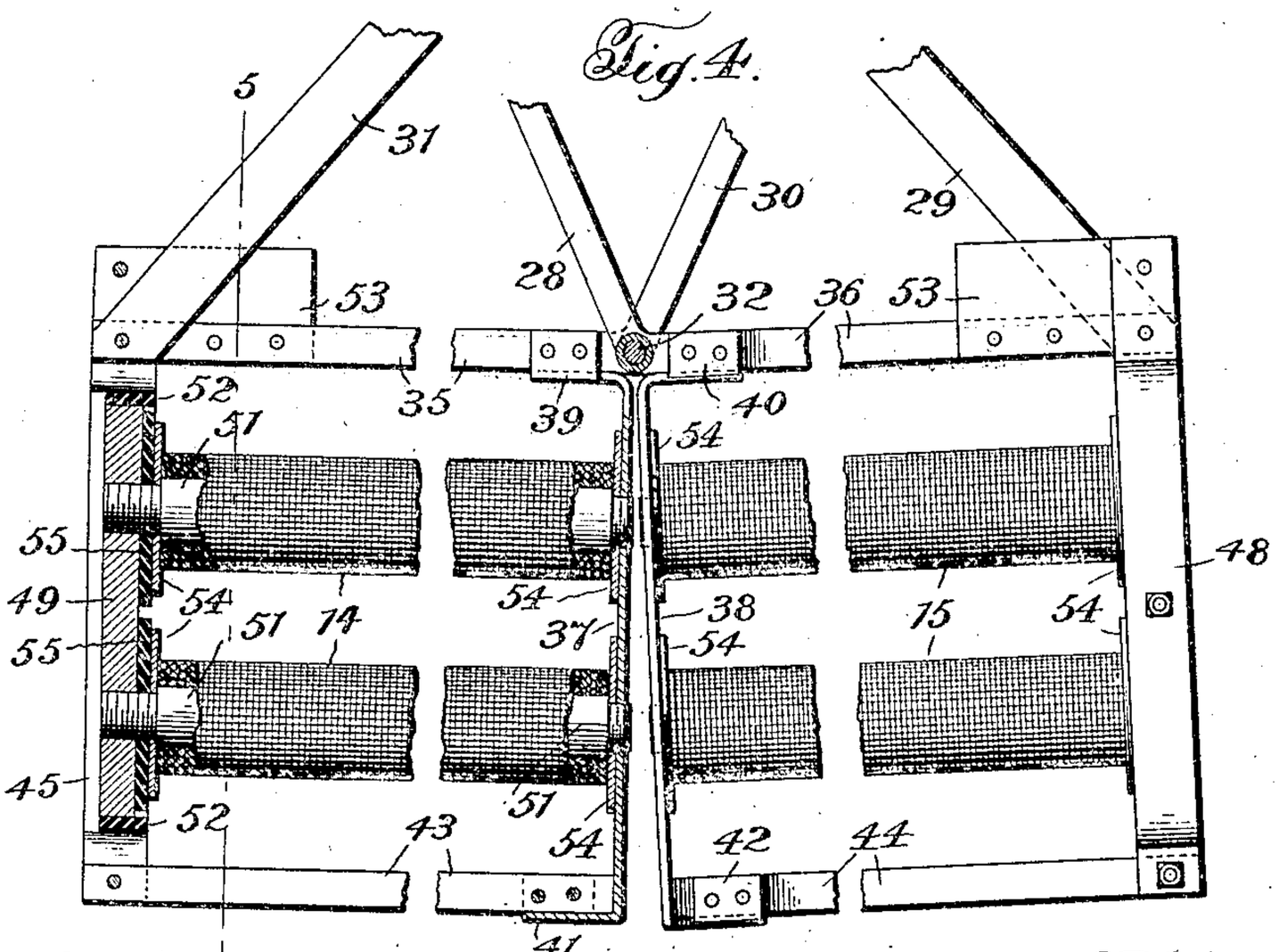


Fig. 5.

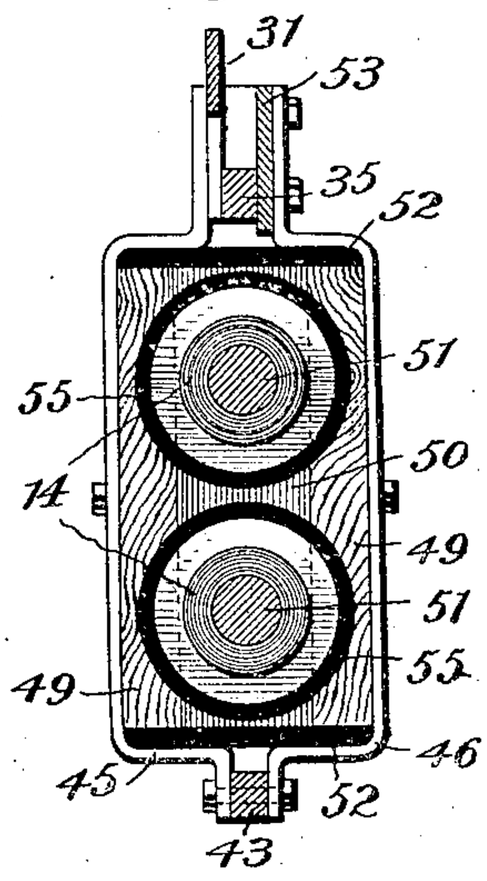


Fig. 6.

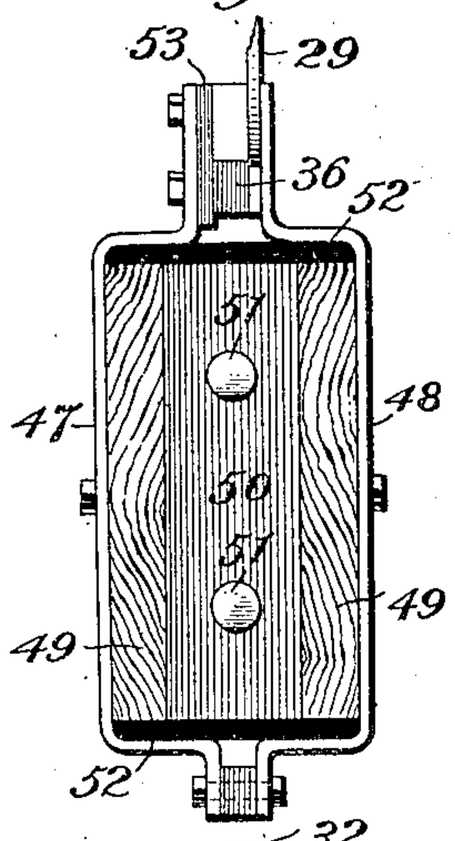


Fig. 7.

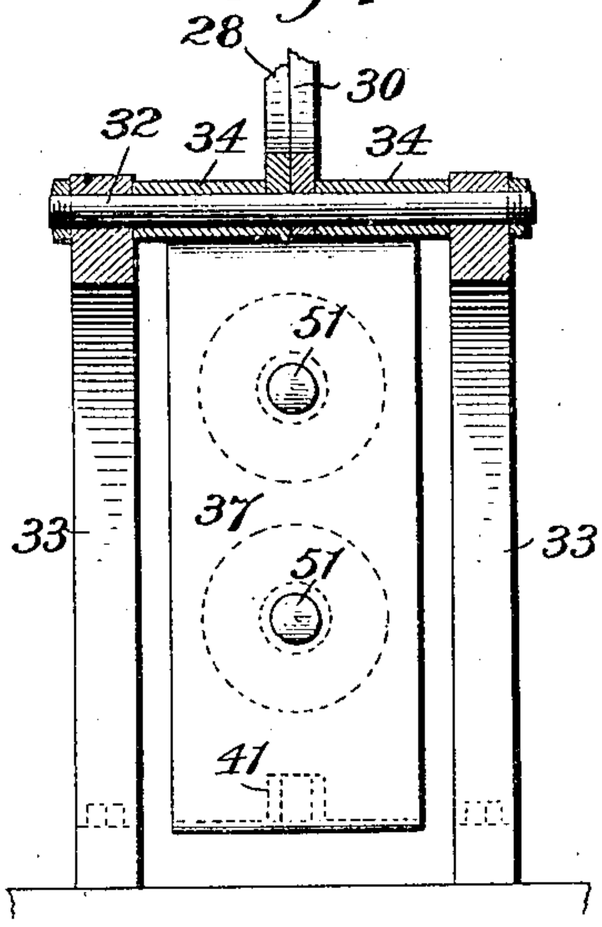


Fig. 7.a.

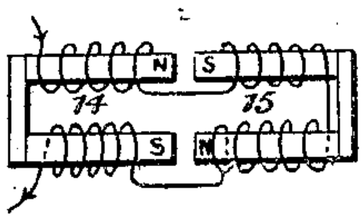
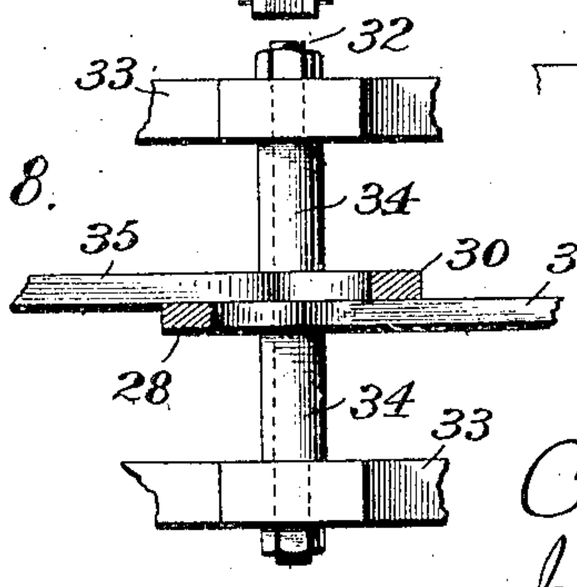


Fig. 8.



Witnesses:

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Its Attorney:

No. 869,467. PATENTED OCT. 29, 1907.

C. W. S. TURNER.

RAILWAY SIGNAL.

APPLICATION FILED FEB. 1, 1907.

6 SHEETS—SHEET 6.

Fig. 9.

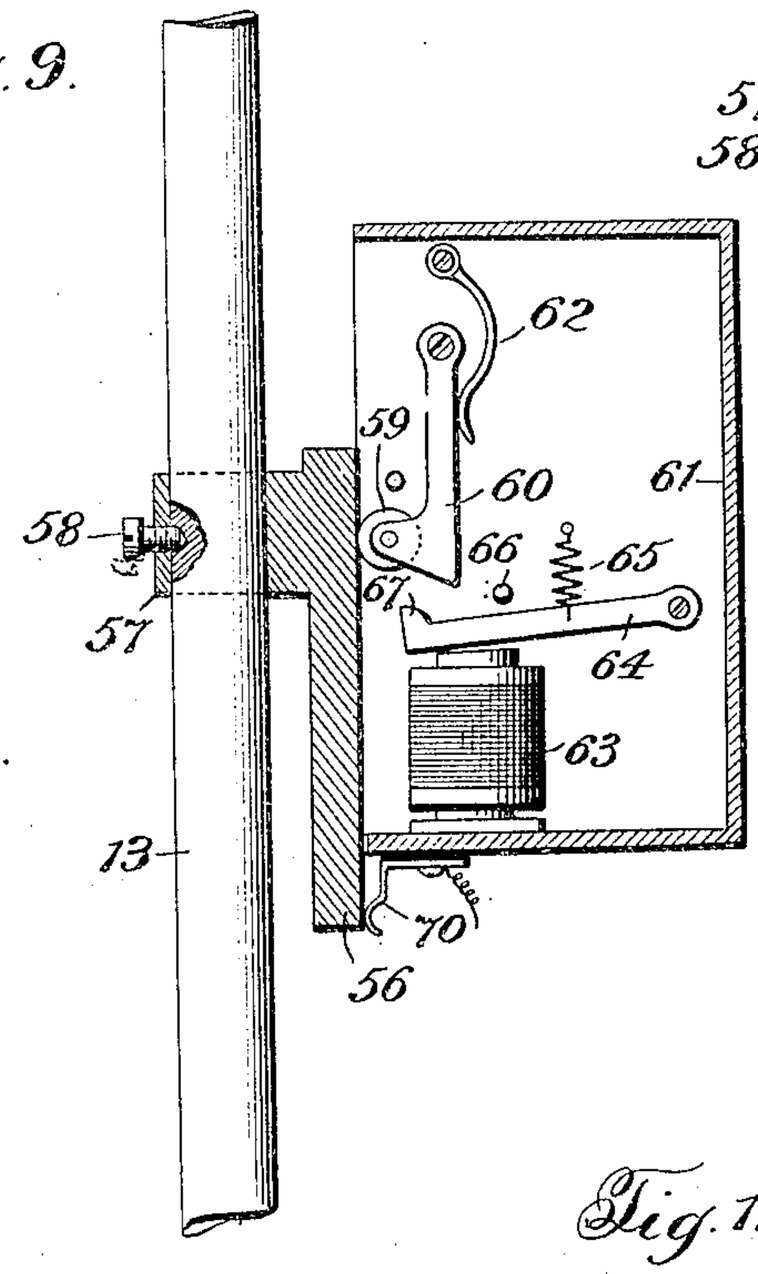


Fig. 10.

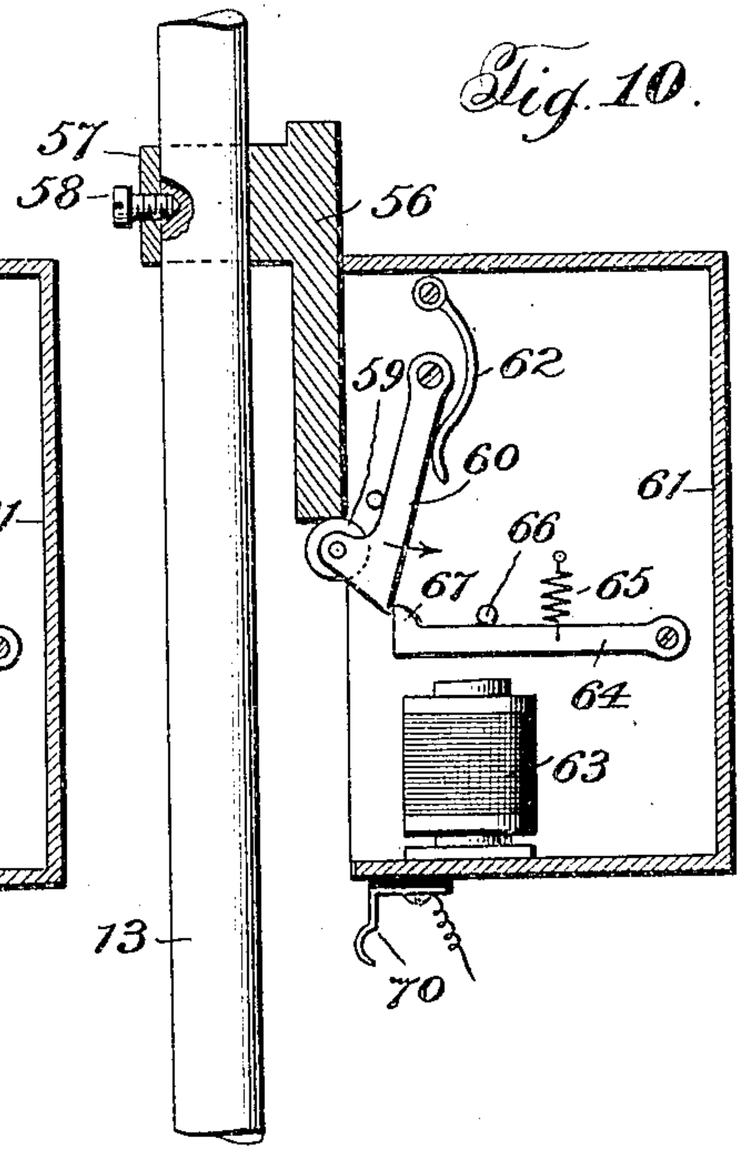
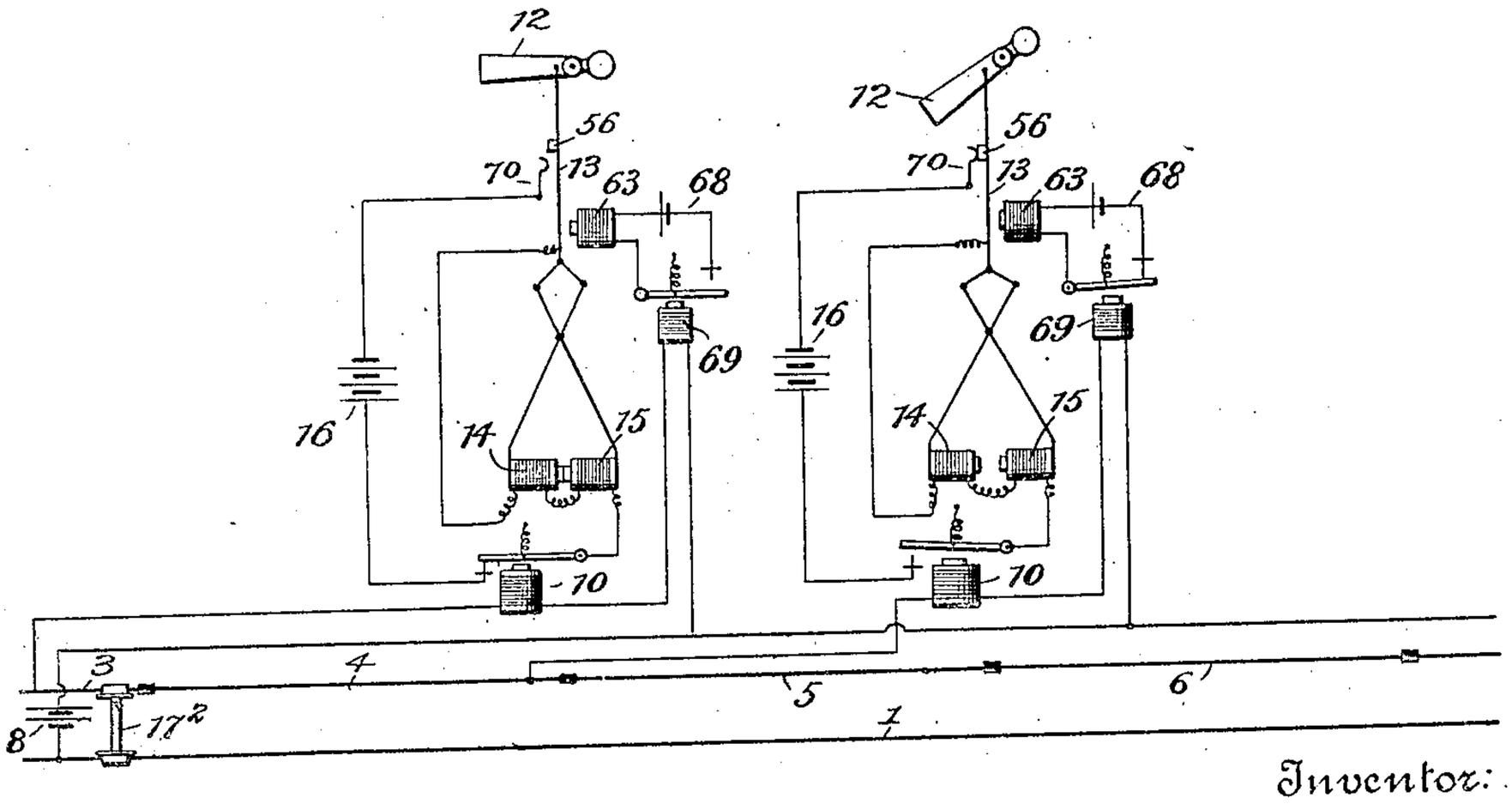


Fig. 11.



Witnesses:

Jas. E. Hutchinson.

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Attorney:

UNITED STATES PATENT OFFICE.

CHARLES W. S. TURNER, OF MOUNTVILLE, VIRGINIA.

RAILWAY-SIGNAL.

No. 869,467. Specification of Letters Patent. Patented Oct. 29, 1907.

Application filed February 1, 1907. Serial No. 355,313.

To all whom it may concern:

Be it known that I, CHARLES W. S. TURNER, a citizen of the United States, residing at Mountville, in the county of Loudoun and State of Virginia, have invented certain new and useful Improvements in Railway-Signals, of which the following is a specification.

This invention relates primarily to that class of railway signals known as block signals, the object of which is to prevent railway collisions by keeping each train in a prescribed zone of isolation from any other train. This zone is a certain length of track known as a "block" into which but one train at a time is theoretically permitted to enter. In the operation of such systems, as at present generally practiced, it is not permissible for but one train at a time to occupy a given "block"; but the operation of such systems does permit a train to enter either or both of the blocks adjacent to said occupied "block". The result of such operation and the employment of apparatus which will permit of such operation is, that if a train, due to a mistake, or to carelessness on the part of one who is responsible for the observance of the block signals, or to the failure of a signal to operate, or to other causes, runs past a signal which is or should be set at danger, it immediately runs into an occupied "block".

One of the primary objects of this invention is to prevent such operation, and to this end I provide an arrangement designed to maintain unoccupied both the block next in advance and the one next in the rear of a train in an occupied block, so that there will always be a neutral block between trains. I use the term "neutral block" as meaning an unoccupied block into which trains are not permitted to enter. In order for two trains to get into this neutral block, each has to pass a danger signal.

My invention has for its object also the simplifying of the circuits and apparatus for the operation of such a system and the rendering of such operation positive and certain.

A further object of my invention is to improve the actuating mechanism for the semaphores to render their operation quick and positive, and by a small expenditure of power.

Further objects of my invention are to provide improved arrangements for the operation of turnout and crossing signals, all of which will be more fully described and particularly pointed out in the claims.

In order to more fully describe my said invention reference will be had to the accompanying drawings, wherein,

Figure 1, is a diagram representing a stretch of railway track embracing several blocks arranged and equipped with circuits and signaling apparatus according to my invention; Fig. 1ª, is a diagram forming a continuation of Fig. 1, and showing my invention as applied to a turnout or siding; Fig. 1ᵇ, a diagram also forming a continuation of Fig. 1 and showing my invention as applied to a crossing; Fig. 2, a front elevation of a semaphore provided with a form of my improved semaphore actuating mechanism, the front of the box inclosing said mechanism being removed; Fig. 3, a side elevation thereof with one of the sides of said box removed; Fig. 4, a detail fragmentary view partly in section of the magnets of said semaphore mechanism and the supporting frame work for said magnets; Fig. 5, a section along the line 5—5, Fig. 4, looking to the left; Fig. 6, an elevation of the outside end of one of the swinging frame members shown in Fig. 4; Fig. 7, an enlarged sectional view taken on line 7—7, Fig. 2, and showing the toggle-operating levers broken off; Fig. 7ª, a diagram of winding of the semaphore magnets; Fig. 8, an enlarged fragmentary view partly in elevation and partly in section along the line 8—8, Fig. 2, looking down on top of the supporting fulcrum for the swinging frame, and toggle operating levers; Fig. 9, a detail view partly in section and partly in elevation of the semaphore rod-locking mechanism, showing the parts in the positions which they occupy when the semaphore-actuating-rod is in its down or normal position; Fig. 10, a similar view showing said parts in the position which they occupy when the said rod is in the up or actuated position; and Fig. 11, a diagram illustrating the operation of the semaphore mechanism and the electric circuits thereof.

In carrying out that portion of my invention which relates to the straightway track, that is, not considering sidings and crossings *per se*, the rails on one side of the track are made electrically continuous as indicated conveniently by the line 1, Fig. 1; while the rails on the other side of the track are electrically continuous in sections such as sections 2, 3, 4, 5 and 6, each of which sections extends over the length of one block and each section is separated from its adjacent section by any suitable insulation, indicated conveniently at O. These block sections may of course be of any desired length.

The continuous conductor rails 1 are normally in electrical connection through any suitable source of electrical energy 8, with a feed wire 9 which extends along the line of the track.

Each conductor section between the insulations O forms a part of a normally open circuit, each of which circuits includes the conductor section, the winding of two relays 10 and 11 or other translating devices, the feed wire 9 and source of electrical energy 8. The return side of the circuit extends from the continuous conductor rails 1 to the said source of energy. These relays 10 and 11 control the operation respectively of signal apparatus located at the distant end of each block adjacent to the one containing the conductor section to which said relays are electrically connected. In the drawings I have represented these signaling

devices as electrically operated semaphores of a type which will be hereinafter more fully described, but I do not limit myself to any particular type of semaphore. The one which I have represented consists essentially of a pivoted semaphore paddle or arm 12, an actuating rod 13, a pair of magnets 14—15 and a system of levers operative by said magnets to actuate said semaphore rod, all described in greater detail later on in this specification. The relays 10, 11 control each a circuit which includes the winding of magnets 14—15 of a semaphore, a source of current 16 and the tongue and forward contact of the relay.

Of course whether the semaphores are normally set to "danger" or "safety" is a matter of choice, but in the present system I prefer that normally the semaphores shall be set to "safety" and shall be automatically set to "danger" at the distant ends of the two blocks next adjacent to an occupied block. This being the case the semaphores all stand normally down and are raised to the horizontal position to indicate danger when actuated. As long therefore as no trains are on any of the blocks the circuits of all of the relay magnets 10, 11 will be open, with the result that none of said relays will attract its tongue. Hence the operating circuits of the semaphore magnets will be broken and said magnets will swing apart pulling the rod 13 down and with it the semaphore arm. When, however, there is a train in a block, as, for example, in the center block 4, Fig. 1, where the train is indicated conventionally at 17, the normally open circuit of that block will be completed as follows: from source of current 8, through feed wire 9, winding of relay 11 at the distant (left hand) end of block section 3, winding of relay 10 at the distant (right hand) end of block section 5, insulated rails 4, train wheels 17, continuous conductor side 1, of track, back to source 8. The passage of current in this circuit energizes magnets of relays 10 and 11 therein, and causes them to attract their tongues and close their respective semaphore-operating circuits including the magnets 14 and 15. These semaphore magnets becoming energized are drawn together, and this movement acting through the system of levers hereinafter more fully described connecting said magnets with the semaphore rods, lifts said rods and raises the semaphore arms to danger as shown in Fig. 1. This then places a danger signal (actuated semaphores 18 and 19) at the entrance to each block adjacent to the occupied block thus maintaining a neutral or empty block both ahead and in the rear of the one occupied. The circuit shown in heavy lines in Fig. 1 for the protection of block 4, is simply duplicated for each other block section.

If two trains are in blocks, between which blocks there is but one empty block, both trains will have to pass danger signals before they can get into the same block. To illustrate: Suppose while train 17 is in block section 4, a train 17′ indicated in dotted lines is in block 2. Now for train 17′ to get into block 3, it will have to pass semaphore 18 set to danger, and likewise, since train 17′ in block 2 has set semaphore 20 to danger in the same way that train 17 set semaphore 19 to danger, train 17 will have to pass semaphore 20 before it can get into block 3.

Sidings or turnouts, and crossings are preferably placed within block sections, so that the straightway track thereof will be protected in the usual manner by the regular block signals at the terminals of said blocks as described, with reference to Fig. 1.

In addition to the regular block signals above mentioned I provide certain other and more immediate protection for sidings and crossings.

In the case of a siding I provide signals to indicate whether the siding switch is open or closed and also whether a train, having started onto the siding, has passed the clearing post. One arrangement for carrying this out is shown in Fig. 1ª, where 71—71 represent semaphores of the type herein described, located respectively at the entrances to the sidings. The circuits and apparatus at each end of the siding being the same, I shall employ similar reference numerals to indicate corresponding parts. Each semaphore is operated on a local circuit 72 controlled by a relay 73, the magnet coils of which are connected in a normally open circuit 74 to which is connected in parallel two sets of normally open contacts. One set of these contacts is controlled by the track switch and may consist of a movable contact such as the plate 75 mounted on and insulated from the switch rod 76, and a stationary contact 77 located in the path of the travel of contact 75, the two contacts being permanently connected separately to the circuit 74. The two other normally open contacts of circuits 74 comprise the insulated track rails 78. These insulated track sections extend from a point opposite the clear posts 79 to a point near the switch frog, the terminals of said sections being indicated by the insulations 80 and 81 respectively. The siding 82 between these insulated sections has no electrical connection with the rest of the track or with the signals and is therefore electrically dead. The electrical features of the main track remain the same as that of any other block, that is, it consists of the continuous conductor rails 1 and rails 7 electrically continuous only throughout a block section as between insulations O—O. and in order to make the rails 7 electrically continuous the break in these rails at a switch is closed as by rail bonds 83. The section of track in Fig. 1ª between insulations O—O is protected at its ends as any other block by the regular block semaphores controlled by relays 10, 11. Fig. 1ª may therefore be placed in the right of Fig. 1 and the track relay circuits traced from the relays 10, 11 in Fig. 1 to the corresponding relays in Fig. 1ª.

The operation of the siding signal is as follows: When the track switch is closed, that is, set to permit a train to pass by the siding without entering it, the contacts 75 and 77 will not be in engagement and the circuit 74 will be broken at those points. Likewise, if there is no train in that portion of the turnout which includes track sections 78, the circuit 74 will also be open through said sections. The relays 73 will therefore receive no current and the semaphores 71 will stand at the normal,—safety, for example. When a track switch is opened, this brings contacts 75 and 77 into engagement and this completes the circuit 74 of the relay 73 through said contacts. The relay 73 being energized will complete circuit 74 and current in this circuit will operate semaphore 71, causing the same to be set to danger as by lifting its arm to the horizontal position. This therefore places a danger signal at the entrance to an open switch.

Moreover, as long as there is a train in the turnout bewteen the main track and the clearing post, and therefore in danger of being side wiped by a train passing on the main track, the semaphores 71 will be operated, as for example to indicate danger, even though the track switch be closed and the contacts 75 and 77 therefore no longer in engagement. This is brought about by the completion of the circuit 74 by the wheels of the train resting on track sections 78, thus closing the second pair of normally open contacts of circuits 74 hereinbefore referred to. When the train passing onto a siding clears the section 78 and passes onto section 82 the semaphores 71 will return to the normal, since circuit 74 will no longer be completed.

An arrangement of crossing signals embodying my invention is shown in Fig. 1b, where 84, 85, 86 and 87 represent insulated track sections in the approach of the tracks to the crossing. The rails of each track in said sections are electrically continuous throughout a section, but are insulated from the rest of the track by suitable insulation 88, 89. The rails of these insulated sections constitute the terminals of four breaks in an open circuit which includes a relay 90 and a source of current 91 connected in series between one side of section 84 and one side of section 85; a relay 92 and a source of current 93 in series between the other side of section 85 and one side of section 86, a relay 94 and source of current 95 in series between the other side of section 86 and one side of section 87; and a relay 96 and a source of current 97 in series between the other side of section 87 and one side of section 84, all as shown in diagram, Fig. 1b. Around each of said track sections 84, 85, 86 and 87 and the source of current and relay magnet connected thereto, is a normally closed shunt. These shunts include respectively the windings of the magnets of four semaphores 98, 99, 100 and 101 and the tongues and contact of the relays 90, 92, 94 and 96 respectively.

The operation of the crossing signals is as follows: While there are no trains in track sections 84, 85, 86 or 87 no current will flow from any of the sources 91, 93, 95 or 97, since the circuit through all of these will be open. When, however, a train enters one of the track sections, the section 84 for example, this will set each of the semaphores 98, 99, and 100 to "danger" thereby preventing other trains from entering sections 85, 86 and 87. This is brought about in the following way: When a train enters section 84 it completes a circuit which may be traced as follows: from the source of current 97 to one of the rails of section 84, thence through the car wheels indicated in dotted lines in section 84, to the other rail of said section, thence through magnet 90, magnets of semaphore 98, contact and tongue of relay 92, magnets of semaphore 99; contact and tongue of relay 94, magnets of semaphore 100, contact and tongue of relay 96, back to the negative pole of the source of current 97. Current passing through this circuit energizes relay 90 and causes it to break the shunt including the magnet coils of semaphore 101. This semaphore will therefore not operate but will remain at safety. The current in the circuit above traced also energizes the magnets of semaphores 98, 99, 100. These semaphores will therefore be operated and by this operation may be made to display a "danger" signal at the entrance of each of the sections 85, 86 and 87. In a similar manner all of the other semaphores except semaphore 98 will be set to danger when a train enters section 85, and so on around the other sections, a train entering each section setting the semaphores of all other sections.

The crossing, as in the case of the turnout, is located within a block and is protected by the ordinary block signals at the termini of the blocks. The track rails are therefore made electrically continuous around the insulated approaches to a crossing as by conductors 102. The circuits of relays 10, 11, Figs. 1 and 1a may be traced along to the corresponding relays in Fig. 1b by placing Fig. 1b on the right of Fig. 1a.

The special form of semaphore actuation mechanism herein above referred to is shown in greater detail in Figs. 2 to 11 inclusive, where 21 represents a preferably hollow upright of any suitable form, near the upper end of which is pivoted in any suitable manner the semaphore arm 12. This semaphore arm is provided with a crank arm 22 which is connected to the upper end of the semaphore-actuating rod 13, the said crank arm passing through a vertical slot 22' in said hollow upright. The rod 13 passes down through the interior of the hollow upright 21 into an inclosing box or casing 23, to the top of which box the lower end of the upright 21 is secured as at 24. The lower end of the rod 13 is connected by means of a pivotal connection 25 to a pair of toggle levers 26, 27, which, at their outer ends are pivotally connected respectively to the ends of lever arms 28 and 29, and 30 and 31. The lever arms 28 and 30 are mounted to rock independently on a common fulcrum comprising, in the case shown, a rod 32 mounted in stationary side supports 33, made fast to the bottom of the box 23. Also mounted on the rod 32 are two collars 34 interposed between the lever arms 28 and 30 and the side supports 33 to hold said arms in position.

The lever arms 28 and 30 have at their lower ends, extensions 35 and 36 respectively, each of which forms a part of a rocking frame carrying a pair of electro-magnets 14 and 15 respectively. These frames comprise respectively end plates 37 and 38 preferably of brass or some other non-magnetic metal having at their upper ends upturned wings 39 and 40 which embrace and are made fast by bolts or otherwise to the lever extensions 35, 36. The lower ends of the plates 37, 38 are provided with sockets 41 and 42 which receive respectively one end of each of a pair of braces 43 and 44 preferably in the form of metal bars, the said braces being bolted or otherwise made fast in said sockets. The other ends of the braces 43 and 44 are held rigidly between pairs of preferably metal straps 45, 46 and 47, 48. These pairs of straps extend around and hold rigidly blocks 49 preferably of wood, and between each pair of these blocks is rigidly held an iron plate 50. The plates 50 are secured to and form yokes for the cores 51 of magnets 14 and 15, at the same time forming end supports for said magnets. The other ends of the cores of said magnets are supported respectively by plates 37 and 38 through which the ends of the said cores extend a short distance, as shown most clearly in Fig. 4. These magnets are so placed relative to each other that the core ends or poles of the magnets 14 extending through the plates 37 will be in line with the poles of magnets 15, and these magnets are so wound that juxtaposed pole pieces will be of opposite

polarity as indicated in the diagram, Fig. 7a. The coils of the magnets are wound between metallic heads 54, and between the heads next to the plates 49, and said plates, are inserted insulating washers 55. Between the upper and lower ends of the blocks 49 and the holding straps may be inserted insulating material 52, but this may be dispensed with.

The upper ends of the straps 45, 46 and 47, 48 are bolted respectively to the lever extensions 35 and 36 and to the lower ends of levers 31 and 29. These magnet-carrying frames may be further strengthened by means of braces 53 bolted thereto as shown.

The semaphore mechanism is so balanced and the magnet-carrying frames are set at such an angle that the facing poles of magnets 14, 15 will normally be held a short distance apart, as shown most clearly in Fig. 4.

For the purpose of saving the current required to operate magnets 14, 15, I provide an electro-magnetic locking device which, as soon as the magnets 14, 15 have actuated the semaphore, the current will be cut off from said magnets, and the semaphore will be held in the actuated position by said lock. This lock will also automatically release the semaphore when it is desired that it shall return to its normal position. The mechanism shown for accomplishing this comprises, among other parts, a short bar 56 rigidly secured at a suitable place on the semaphore actuating rod 13, as by means of a collar 57 and set screw 58 or otherwise. Against one face of this bar 56 is normally held a roller 59 forming a part of a pivoted latch 60 located in a suitable casing, preferably a strong metal box 61, secured rigidly to the inside of the top of the semaphore box 23. (See Fig. 2). The roller 59 is held normally in engagement with one face of the bar 56 by means of a suitable spring 62. Also mounted within the box 61 is an electro-magnet 63, above which is pivoted an armature 64. A spring 65 exerts a constant pull on the armature 64 away from the magnet, and the upward travel of the said armature is limited by a stop 66. The armature 64 is provided with an extension or lug 67 which serves as a stop to lock the latch 60, in a manner hereinafter described. The lock magnet 63 of each semaphore is operated upon a normally closed circuit 68 which may be controlled by a relay 69 connected in series with the main line relay 10. See diagram, Fig. 11.

For the purpose of automatically cutting off the operating current from semaphore magnets 14, 15, I may provide any suitable switching arrangement. The arrangement which I have shown consists merely of an insulated spring contact 70 which, in the normal position of the semaphore, makes contact with the block 56 on the semaphore rod. By including the said rod in the electric circuit of the winding of said magnets 14—15 and connecting the contact 70 also in said circuit, the said contact will be brought into engagement with the block 56 when the rod 13 is in the normal position and will be disengaged therefrom as soon as the rod rises in actuating the semaphore, and will thus make and break the circuit.

The complete operation of the semaphore mechanism is as follows: When the main line relay 10 on the left, Fig. 11, is energized as by train 17^2 coming in block 3, as hereinbefore described, it closes the circuit through its tongue and contact from the battery 16 through the coils of magnets 14—15 and contacts 70 and 56, the latter contacts then being in engagement as in the apparatus shown on the right in Fig. 11. The magnets 14 and 15 becoming energized jump quickly together, pulling arms 35 and 36 of the swinging magnet frames down, and acting on rod 32 as a fulcrum, send the upper ends of lever arms 28, 29, 30 and 31 inward. These in turn acting on the toggle levers 26 and 27 cause the semaphore-actuating rod 13 to rise and in doing so it acts through the crank connection with the semaphore arm 12 to cause the latter to be lifted to the horizontal or raised position. This movement of the rod 13, however, may be very slight to effect the desired operation of the arm 12, and by the arrangement of levers shown the space through which the magnets 14, 15 are required to move may be extremely small thereby effecting a considerable saving in the power necessary to effect such movement. Moreover, this saving of power is further augmented by the arrangement of levers shown. The action of the magnets 14, 15 is instantaneous and as soon as they act the circuit through them is broken by the disengagement of contact 70 with block 56 due to the rising of rod 13. When semaphore rod 13 has risen to the limit of its upward travel, the catch roller 59 is sent by spring 62 under the lower end of block 56 (see Fig. 10) and thus acts as a support to hold the semaphore rod in the elevated position. The pressure of the block 56 down on roller 59 would, however, be sufficient to push latch 60 back and allow the rod 13 to descend, but the lock magnet 63 having become deenergized by the breaking of its circuit by the relay 69, will release its armature 64, which will be drawn by spring 65 against stop 66. In this position of the armature 64, its end 67 forms an obstruction in the path of the back travel of the latch 60, so that the latter may not be moved back to disengage the roller 59 from the block 56. When the magnets of relays 10 and 69 no longer receive current, as when the train passes off the block which operates them, the circuit through magnet 63 will again be completed by relay 69 releasing its armature. Magnet 63 will then attract armature 64, remove lug 67 from the path of latch 60 and allow the latter to become free to swing back away from the rod 13. The superposed weight of the rod 13 and parts connected thereto will cause the block 56 to push the latch 60 in the direction of the arrow (Fig. 10) thus permitting the semaphore rod to descend. With this mechanism only a battery 16 of only a few dry cells will operate a semaphore, and operate it quickly.

Having thus described my invention, what I claim is:—

1. Railway signaling apparatus, comprising a track divided into insulated block sections, track circuits for the respective blocks, each of said circuits including track rails of its respective block, a plurality of translating devices connected in and for operation by each of said circuits, and track signals located at the distant ends of blocks adjoining an intermediate block and operatively connected each to a translating device in the circuit of the intermediate insulated block rails.

2. Railway block signaling apparatus, comprising a track divided into block sections, track signals located at the distant end of each block adjoining an intermediate block, a normally open electric circuit for each of said blocks, to operate the said signals at the distant ends of the adjacent blocks, said circuits including each the track rails of its respective block, and train operated means to complete said circuits.

3. Railway block signaling apparatus, comprising a

track the rails of one side of which are electrically connected to form continuous conductors for individual block lengths, the said rails of one block being normally insulated from those of another block, and the rails of the other side of the track electrically connected to form a continuous electrical conductor extending over a plurality of blocks, a normally open electric circuit for each of said blocks, each of said circuits including the insulated track rails of its respective block, a feed wire, a source of electrical energy, and the continuous conductor rails of said track, and a pair of track signals controlled by each of said circuits, one of said track signals being located at the distant end of each block adjacent to the one whose rails form a part of the circuit to control said signals.

4. Railway block signaling apparatus, comprising a track the rails of one side of which are electrically connected to form continuous conductors for individual block lengths, the said rails of one block being normally insulated from those of another block, and the rails of the other side of the track electrically connected to form a continuous electrical conductor extending over a plurality of blocks, a normally open electric circuit for each of said blocks, each of said circuits including the insulated track rails of its respective block, a pair of translating devices, a feed wire, a source of electrical energy, and continuous conductor rails of said track, and track signals controlled respectively by said translating devices, one of said track signals being located at the distant end of each block adjacent to the one whose rails form a part of the circuit to control said signals.

5. Railway block signaling apparatus, comprising a track the rails of one side of which are electrically connected to form continuous conductors for individual block lengths, the said rails of one block being normally insulated from those of another block, and the rails of the other side of the track electrically connected to form a continuous electrical conductor extending over a plurality of blocks, a normally open electric circuit for each of said blocks, each of said circuits including the insulated track rails of its respective block, the magnet windings of a pair of relays, a feed wire, a source of electrical energy, and the continuous conductor rails of said track, a relay circuit controlled by each of said relays, and electrically operated track signals operated respectively by said relay circuits, one of said track signals being located at the distant end of each block adjacent to the one whose rails form a part of the circuit to control said signals.

6. Railway block signaling apparatus, comprising a track the rails of one side of which are electrically connected to form continuous conductors for individual block lengths, the said rails of one block being normally insulated from those of another block, and the rails of the other side of the track electrically connected to form a continuous electrical conductor extending over a plurality of blocks, a normally open electric circuit for each of said blocks, each of said circuits including the insulated track rails of its respective block, the magnet windings of a pair of relays, a feed wire, a source of electrical energy, and the continuous conductor rails of said track, a relay circuit controlled by each of said relays, a semaphore operated by current in each of said relay circuits, means to automatically break the said relay circuits when their respective semaphores are operated, and electrically operated locking devices for the respective semaphores, controlled by current in the track circuits.

7. Signaling apparatus for railway sidings, comprising an electric switch controlled by the track switch, two movable electro-magnets wound and arranged for mutual attraction, means to connect said magnets in circuit with the terminals of said switch, and a semaphore operatively connected to said magnets.

8. Signaling apparatus for crossing railway tracks, comprising insulated block sections in the approach of each track to the crossing, a source of current and the winding of a magnet connected in circuit from the rails of one side of each of said sections to the rails of one side of an adjacent section, a shunt around each of said sections and around the source of current and magnet winding connected to opposite sides of said sections, each of said shunts including a normally closed contact controlled each by one of said magnets, and electrically operated signaling means connected in each of said shunts.

9. Railway signaling apparatus, comprising a system of levers, electro-magnets mounted thereon for mutual attraction, and a signal actuating member connected to said levers.

10. Railway signaling apparatus, comprising a semaphore actuating member, a pair of levers, a toggle joint forming a connection between said levers and said member, and electro-magnetic means to apply power to the power-arms of said levers.

11. Railway signaling apparatus, comprising a semaphore actuating member, a pair of levers mounted on a common fulcrum, a toggle joint forming a connection between said levers and said member, and electro-magnets mounted for mutual attraction on the power-arms of said levers.

12. Railway signaling apparatus, comprising a semaphore arm, a semaphore actuating rod connected thereto, toggle levers connected to said rod, a pair of levers mounted on a common fulcrum and having their weight arms connected respectively to said toggle levers, frames connected respectively to the power arms of said levers, and electro-magnets mounted respectively to each of said frames, the magnets in one frame being arranged to attract those in the other frame when excited, and thereby actuate said rod through the medium of said levers.

13. Railway signaling apparatus, comprising a system of levers, electro-magnets mounted thereon for mutual attraction, a signal actuating member connected to said levers, and a train-controlled circuit to operate said magnets.

14. Railway signaling apparatus, comprising a semaphore actuating member, a pair of levers mounted on a common fulcrum, a toggle joint forming a connection between said levers and said member, electro-magnets mounted for mutual attraction on the power-arms of said levers, and a train-controlled circuit to operate said magnets.

15. Railway signaling apparatus, comprising a semaphore arm, a semaphore actuating rod connected thereto, toggle levers connected to said rod, a pair of levers mounted on a common fulcrum and having their weight arms connected respectively to said toggle levers, frames connected respectively to the power arms of said levers, electro-magnets mounted respectively in each of said frames, the magnets in one frame being arranged to attract those in the other frame when excited, and thereby actuate said rod through the medium of said levers, and a train-controlled circuit to operate said magnets.

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

CHARLES W. S. TURNER.

Witnesses:

FRANCIS S. MAGUIRE,

K. E. MONTAGUE.