No. 881,005. PATENTED MAR. 3, 1908.

E. E. KLEINSCHMIDT.

SIGNALING SYSTEM.

APPLICATION FILED DEC. 29, 1905.

4 SHEETS—SHEET 1.

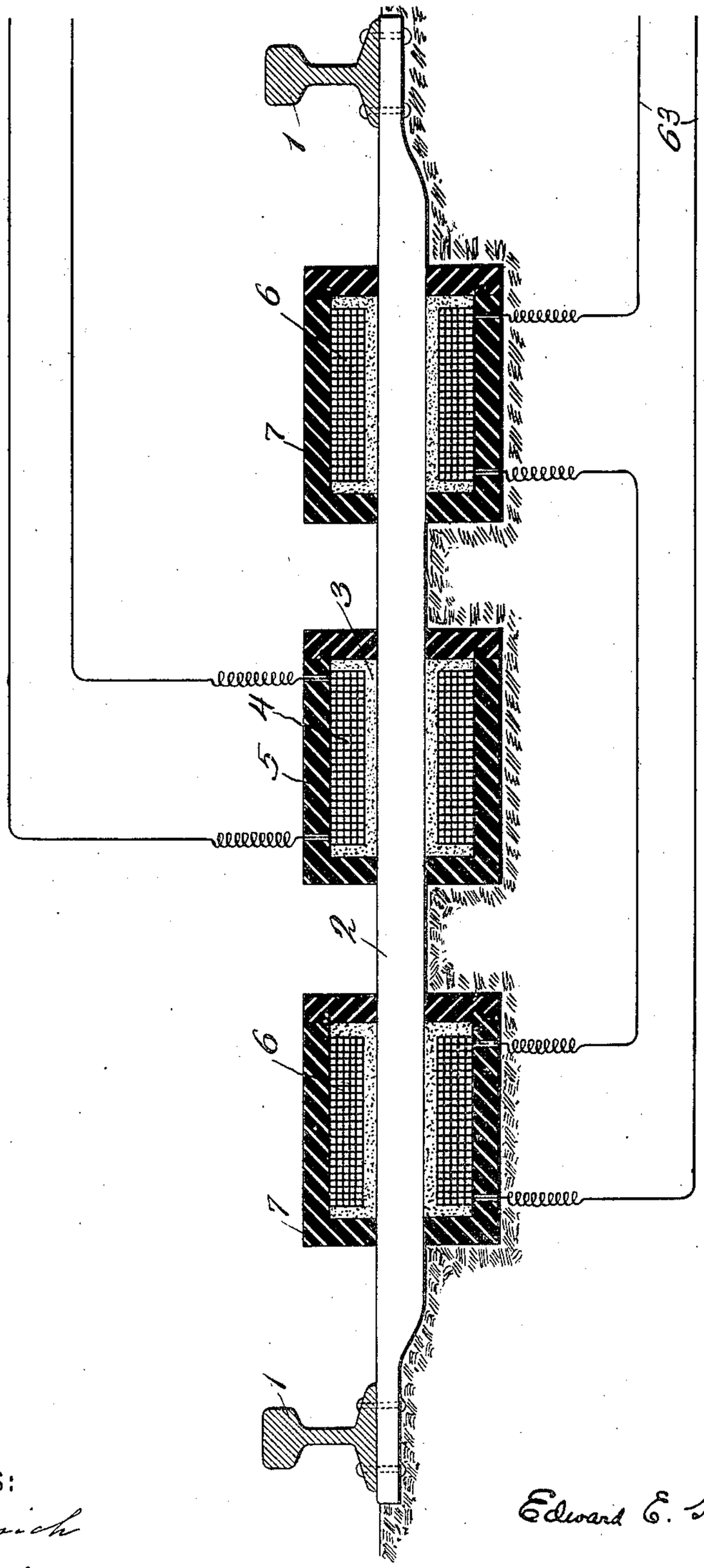

Fig. 1.

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4 SHEETS—SHEET 2.

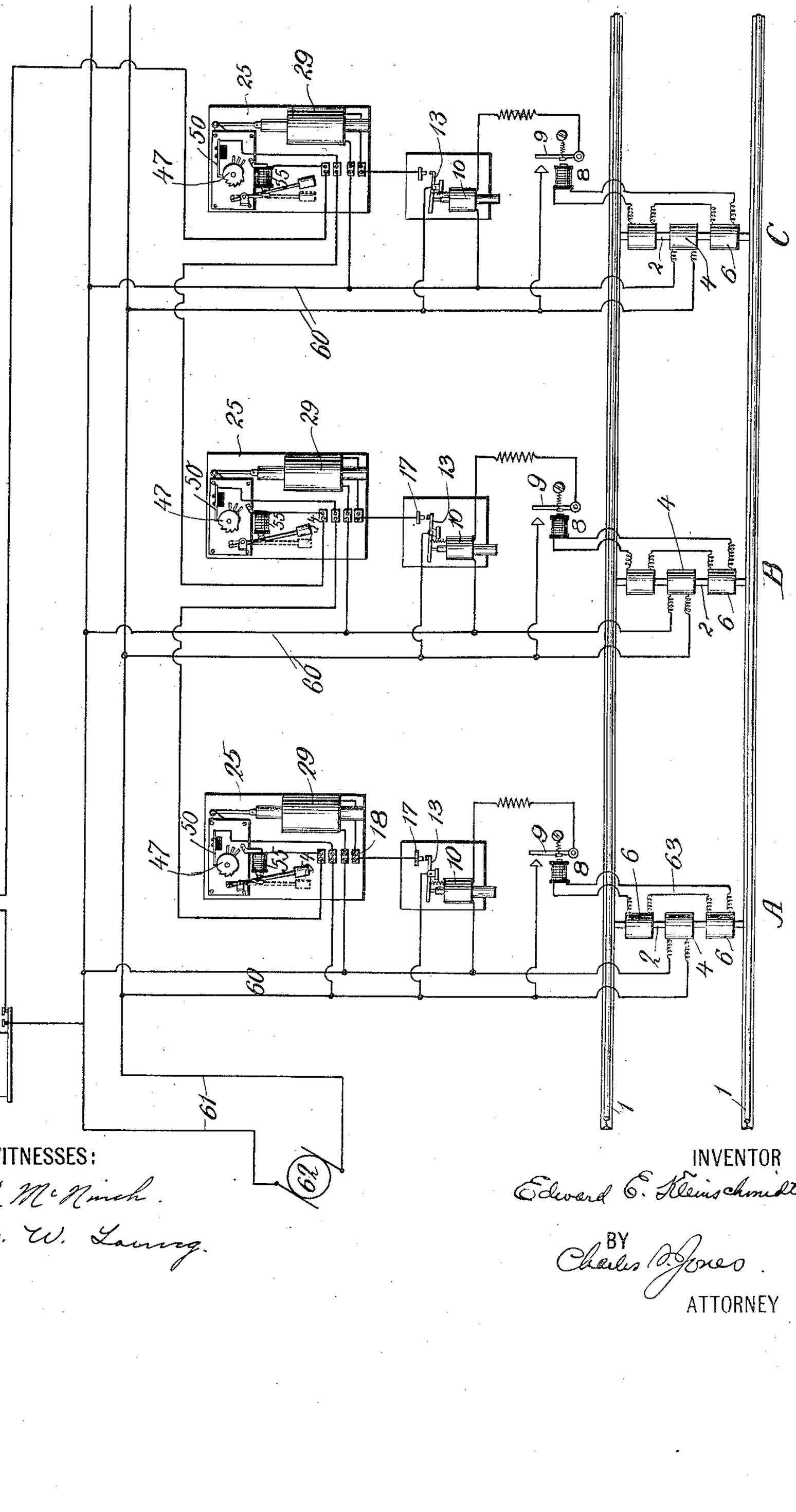

Fig. 2.

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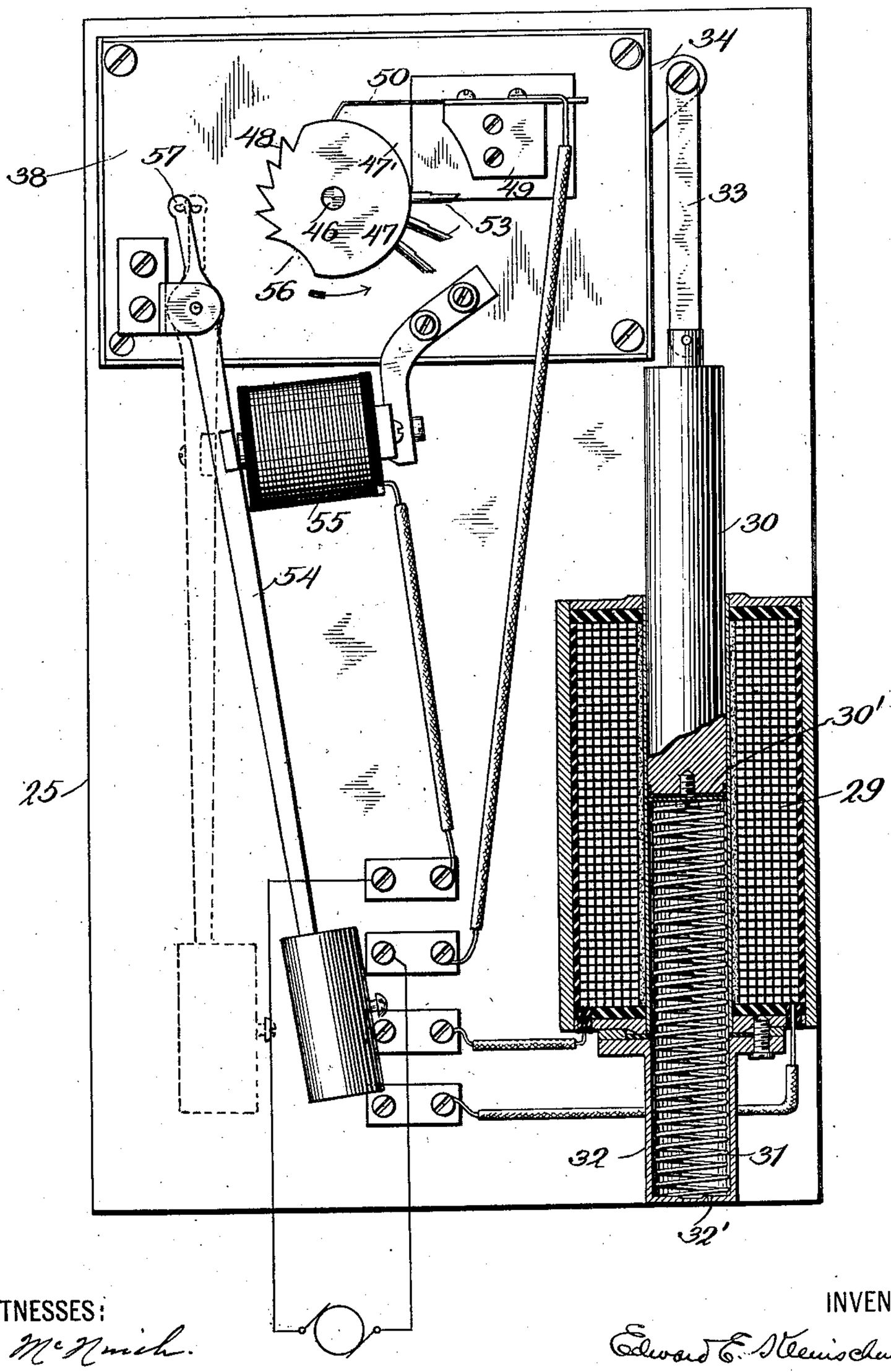
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4

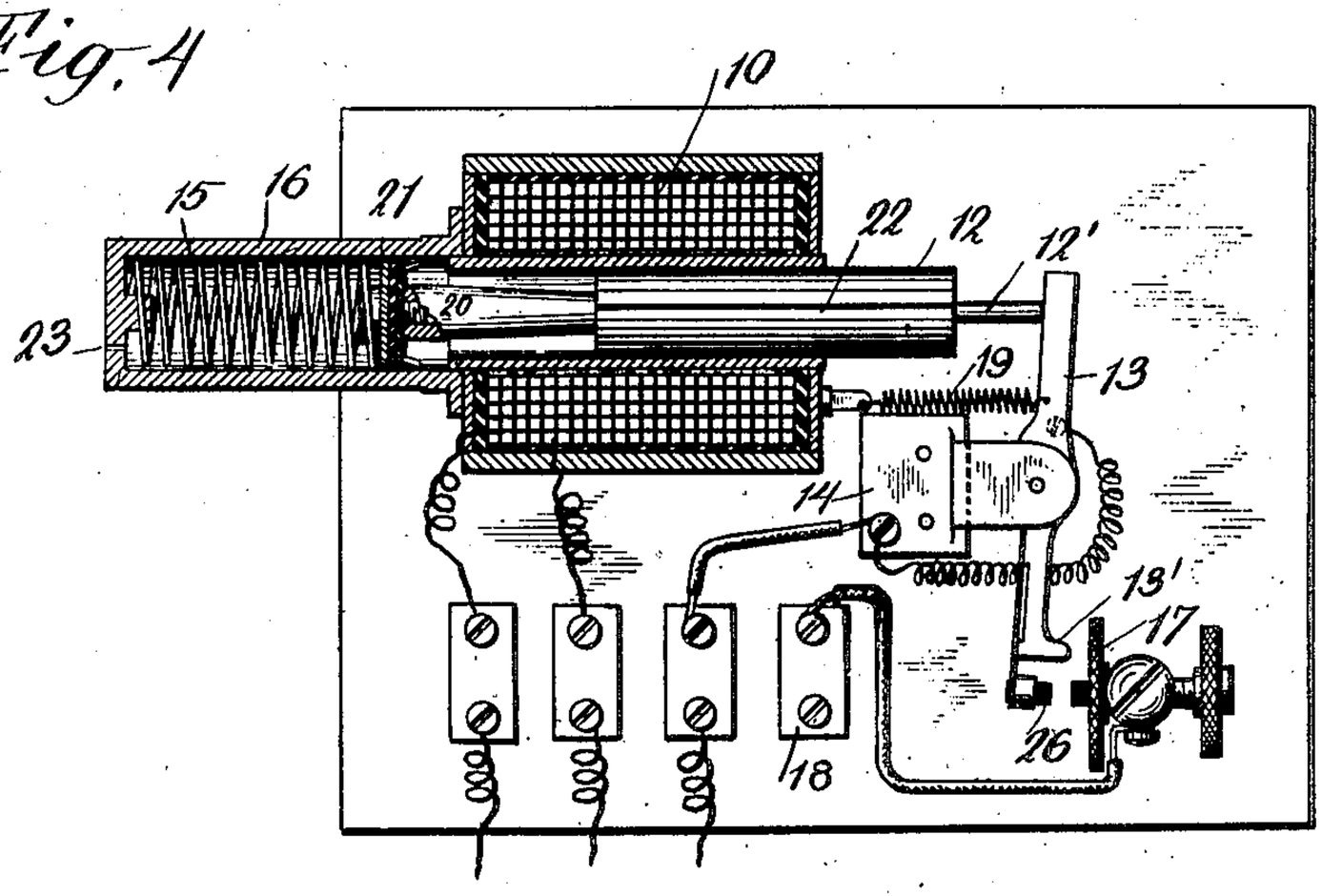


Fig. 5

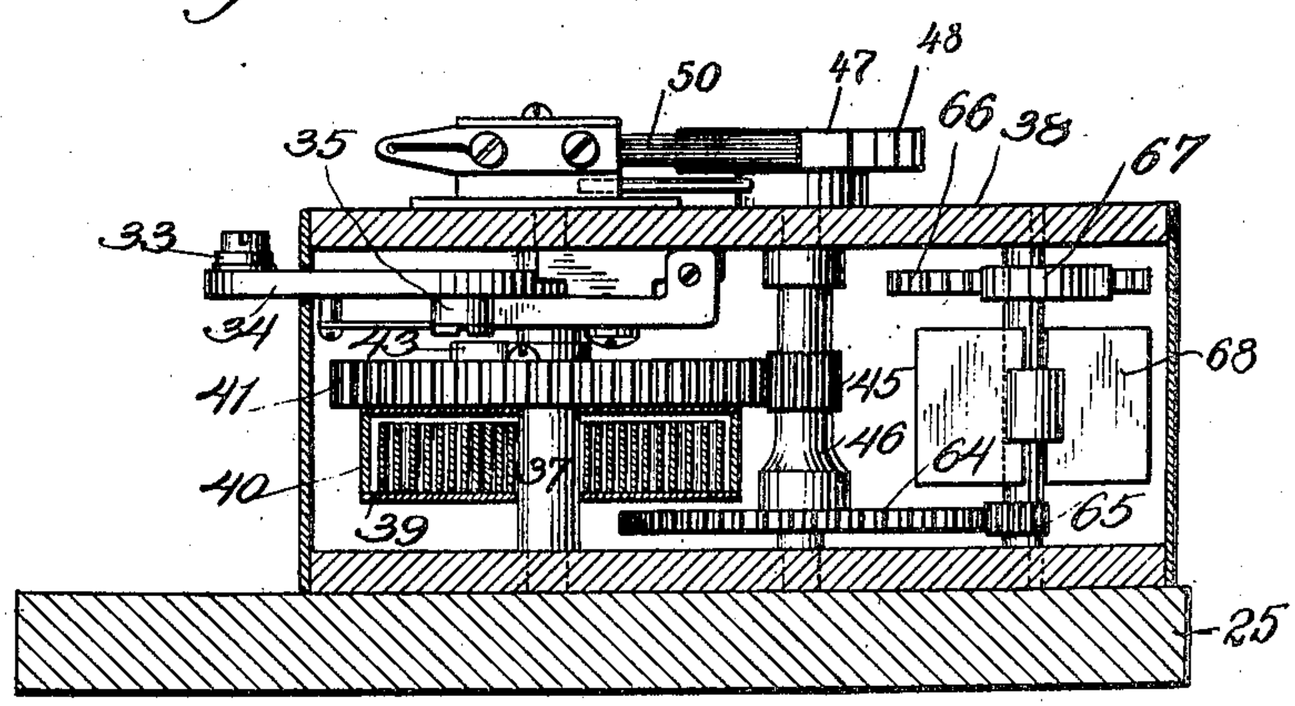
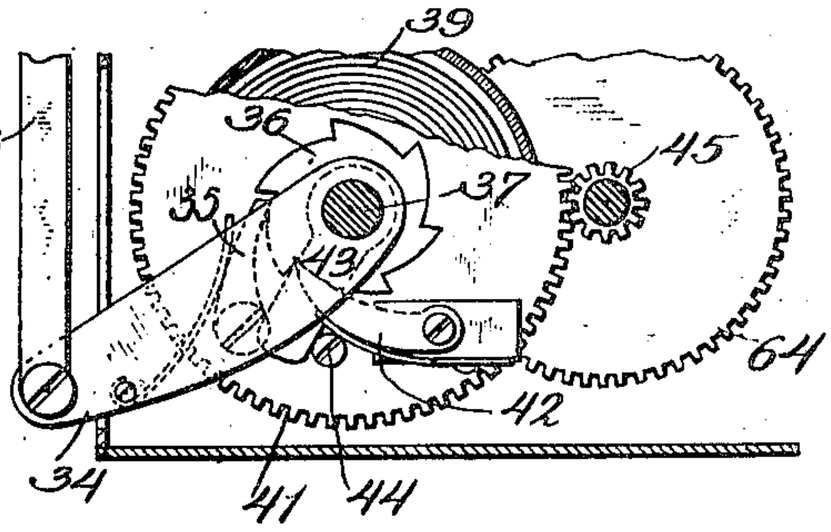


Fig. 6,



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UNITED STATES PATENT OFFICE.

EDWARD E. KLEINSCHMIDT, OF NEW YORK, N. Y., ASSIGNOR TO GEORGE M. SEELEY, OF NEW YORK, N. Y.

SIGNALING SYSTEM.

No. 881,005. Specification of Letters Patent. Patented March 3, 1908.

Application filed December 29, 1905. Serial No. 293,856.

To all whom it may concern:

Be it known that I, EDWARD E. KLEINSCHMIDT, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Signaling Systems, of which the following is a specification.

My invention relates to signaling systems and is more particularly intended for use in connection with single track electric or steam railroads, although it is not limited to such use.

Generally stated the system comprises a plurality of signaling stations established at suitable points along the road each station having a designating number. Upon the passage of a car or train at a given station the despatcher or home office is notified of that fact by the operation of an audible or visual signal or both which gives the number of the station. The system is also adapted to the operation of a signal at or near the signaling station.

To obviate the use of mechanical devices for setting in operation the signaling system each station comprises a track instrument in which an induced current is set up by the passage of a car or train over said instrument, such current being utilized to set in operation mechanism which will transmit or set the desired signal. Said mechanism comprises a call box and a solenoid included in the signal circuit, the function of said solenoid being to close the circuit for the call box to thereby operate the signal, special provisions being made to retard the return movement of the core of said solenoid to maintain the call box closed until after the completion of the signal.

In order to prevent interference of signals I provide each call box with a disabling mechanism which when a given call box is set in operation will lock all the other call boxes in such manner as to prevent or retard the sending in of a signal from any other station on the line.

The above and other features of the invention will be understood by reference to the accompanying drawings in which

Figure 1 is a sectional view of the track instrument; Fig. 2 is a diagrammatic view of one system showing the circuit connections; Fig. 3 a face view partly in section of what I have designated a call box; Fig. 4 a face view partly in section of the mechanism for converting the intermittent induced current into a continuous current; Fig. 5 a top view of the mechanism for sending into the despatcher's office the number of the track instrument operated; Fig. 6 is a detailed view of part of the call box mechanism.

Similar reference numerals indicate similar parts in the several views.

The track instrument may be used in connection with any one of the signaling systems herein described. In Fig. 2 I have shown three signaling stations, designated respectively A, B and C, although, as will be readily understood, any number may be installed. Each station comprises a track instrument placed between the rails 1—1. Each station also comprises a relay, a solenoid and a call box, said parts being inclosed in a suitable casing and suitably supported in proximity to the track. All of the signal stations in the system shown in Fig. 2 are connected with an audible signal 51 or a visual signal 52 or both at the home office. The relay, solenoid and call box are all connected by branches to feeders 60 as indicated in Fig. 2.

The track instrument above referred to which constitutes an essential feature of the several systems herein described, is shown in detail in Fig. 1 and consists of an iron bar 2 extending between and secured by suitable means to the rails 1 to insure good magnetic contact. Surrounding said bar but insulated therefrom by suitable insulation 3 is a coil 4 which may be protected by an inclosing casing of insulating material 5. The terminals of the coil 4 are connected to feeders 60 leading from the line circuit 61 which derives current from any suitable source of electric energy as 62. On electric roads the feeders 60 may be conveniently connected to the trolley circuit for operating the cars. Also surrounding the bar 2 are any suitable number of coils 6, the terminals of which, if two or more are employed, being connected in series. Said coils are insulated from the bar 2 and protected by insulating casings 7. From this construction of the track instrument it will be seen that the current flowing through the coil 4 magnetizes the bar 2 and as the trucks of a car on the rails 1 approach the track instrument the resistance of the magnetic circuit will be diminished, the magnetic flux passing through the wheels and axle of the truck. This disturbance of the magnetic field sets up an induced current in the coils 6

which reaches its maximum value when the axis of a pair of wheels is in a vertical plane with the axis of the bar 2. This induced current may be utilized to send a signal to the home office or to operate a visual or audible signal at or near the signal station. In Figs. 2 to 6 inclusive I have shown an adaptation of the invention to a system for sending a signal to the home office, and this system will now be described.

As obviously the intermittent pulsations of the induced current generated in the coils 6 cannot be utilized directly I lead such current through wires 63 to a relay 8 of any well known type, the movements of the armature 9 of which throws a solenoid 10 into and out of circuit. The function of the solenoid 10 is to throw the solenoid 29 of the call box mechanism into circuit and to maintain said latter solenoid energized while a car or train is passing over a given track instrument. This is accomplished as follows. The core 12 of solenoid 10 has projecting from its outer end a pin 12′ which normally bears against one end of a lever 13 pivoted on a bracket 14, said lever constituting one terminal of the circuit which includes the solenoid 29. The core 12 is maintained in its normal position, shown in Fig. 4, by a spring 15 inclosed within a cylindrical portion 16 of the solenoid casing. Located in proximity to the outer end 13′ of lever 13 is a fixed terminal 17 electrically connected to a terminal plate 18 which latter is connected to the solenoid 29. When the solenoid 10 is energized and the core 12 drawn inwardly the terminal lever 13 will be released and the outer end 13′ thereof brought into contact with terminal 17 by the action of a spring 19 thereby closing the circuit through solenoid 29. The outer end of lever 13 carries a carbon contact break 26 of the usual type.

After the forward wheels of a truck have passed over the track instrument the solenoid 10 is deënergized by the breaking of its circuit through the return movement of the armature lever 9 of the relay 8, and if the core 12 of said solenoid should be permitted to fully resume its normal position then the circuit between the terminals 13′ and 17 would also be broken thus deënergizing the solenoid 29. It is preferable that the solenoid 29 should be energized during the entire time that a car or train is passing over a given track instrument in order to prevent said solenoid 29 again actuating the mechanism hereafter described which would result in repeating the signal. To that end the return movement of the core 12 of solenoid 10 is retarded so as to permit the terminals 13′ and 17 to remain in contact with each other during such time. This retardation of the return movement of the core 12 may be effected by any suitable means. In the present example of my invention the core 12 is provided with a stem 20 to which is fixed any ordinary form of cup gasket 21. When the core 12 is drawn inwardly the gasket 21 collapses thus permitting the air within cylinder 16 back of said gasket to escape around the edge of the gasket and to the outer air through a slot 22 cut through the core 12. When the solenoid 10 is deënergized and the core 12 free to resume its normal position, the gasket 21 will be distended against the wall of cylinder 16 thereby preventing the admission of air from the under side thereof to said cylinder, air at such time passing into the cylinder only through a vent 23 in the end wall thereof, the size of the vent being controlled by a valve if desired. The tension of spring 15, the weight of core 12, and the size of vent 23 are so proportioned relative to each other that a comparatively long time is required for the admission of sufficient air through said vent to balance the atmospheric pressure on the under side of gasket 21. Thus the force of spring 12 is gradually expended in restoring the core 12 to its normal position. To accomplish the desired purpose the parts should be so proportioned that when the core 12 is drawn inwardly by the first impulse of the current induced in coils 6 said core should not be permitted to contact with lever 13 before the second impulse is sent over the line to the relay 8. The current impulses follow each other so rapidly while a car or train is passing over a given track instrument, that, although the solenoid 10 is alternately energized and deënergized in rapid succession, the core 12 will be so retarded in its return movement during the period that said solenoid is deënergized that it will not contact with lever 13 while the car or train is so passing. The terminal point 13′ of lever 13 will thus remain in contact with terminal 17 and the circuit of solenoid 29 will remain closed thus energizing said solenoid during the entire period that a car or train is passing over a given track instrument.

The call box mechanism is mounted on a suitable base 25. When the solenoid 29 is energized as above described, its core 30 will be drawn inwardly against the stress of a spring 31 inclosed in a case 32 as shown in Fig. 3. The core 30 has secured thereto a gasket 30′ and the casing 32 is provided with a vent 32′ similar to and for the purpose described in connection with solenoid 10, the said spring 31 tending to hold the core 30 in its outermost position. Secured to the outer projecting end of core 30 is a link 33 which carries a stud on which is pivoted one end of a lever 34, the other end of said lever having an opening through which loosely passes a shaft 37, said shaft having bearings in a box or casing 38 as shown in Fig. 5. Secured to lever 34 is a spring pressed pawl 35 which engages a ratchet 36 fast on shaft 37. A

spring 39 is fast at one end to said shaft and its other end fixed to an inclosing casing 40, the latter being secured to the side of a gear 41 having a loose bearing on shaft 37.

When the solenoid 29 is energized the inward movement of core 30 acting through link 33, lever 34 and pawl 35 will advance the ratchet 36 one tooth to thereby wind the spring 39. When lever 34 reaches the limit of its throw a pawl 42 mounted on frame 38 locks the ratchet 36 against reverse movement. During this forward movement an arm 43 fast on shaft 37 will be moved away from a stop pin 44 fixed to the side of gear 41. At the end of each forward movement of the ratchet 36 spring 39 is free to unwind, and when unwinding will turn the gear 41. Said gear meshes with a pinion 45 fast on a shaft 46, said pinion having such relation to the gear 41 that it makes one complete rotation for each advance movement of the ratchet 36. In the present construction the pinion 45 is made one-seventh of the diameter of gear 41. The shaft 46 projects beyond casing 38 and has keyed on its outer end a make and break wheel 47 which is rotated by the spring 39 in the direction of the arrow Fig. 3, and as will be seen makes one complete rotation for each advance of ratchet 36. The wheel 47 has cut on its periphery a number of teeth 48 corresponding to the number of the signaling station. Supported on an insulating block 49 is a spring contact finger 50 which normally rests upon the face 47′ of wheel 47, maintaining thereby the line circuit closed at that point. When wheel 47 is rotated as above described the line circuit will be broken when contact finger 50 drops between the teeth 48, the electric impulse being utilized to operate a signal at the home office. This may be an audible signal as a bell 51 which will ring a number corresponding to the number of the signaling station. At the same time there may be operated a visual signal 52 which, as shown, may be a recording apparatus of any well known type, to record by a series of dots or dashes the number of the station from which the signal is being sent. In order to regulate the rate of movement of break wheel 47 there is secured to the shaft 46 a gear 64 which meshes with a pinion 65 fast on a shaft which also carries an escapement wheel 66, to the pawl 67 of which is secured retarding vanes 68, the operation of such controlling means being well understood.

The operation of the system so far described will be readily understood from the foregoing description. The line circuit which includes the break wheel 47, bell 51 and recording apparatus 52 is normally closed. When the forward truck of a car passes over a given track instrument the first impulse of the induced current in the coils 6 due to the passage of the forward pair of wheels of said truck over the track instrument will be transmitted to relay 8. The movement of the armature lever 9 of said relay will close the circuit through solenoid 10 and the closing of that circuit in turn closes the circuit through solenoid 29 of the call box to thereby advance ratchet 36 one tooth to wind the spring 39. When the spring 39 is released it will unwind the distance of one tooth of said ratchet to impart one complete rotation to the make and break wheel 47. Owing to the retardation of the return movement of core 12 of solenoid 10 the circuit through solenoid 29 will not be interrupted during the whole period of time that the car or train is passing over the track instrument, or as otherwise stated the return movement of said core 12 is so retarded that although several impulses are transmitted to relay 8 the intermittent breaking of the circuit at said relay will not break the circuit through solenoid 29. Thus there will be but one movement of core 30 of solenoid 29 while a car or train is passing over a given track instrument.

The road may be equipped with any number of signaling stations constructed and operating as above described. These stations are similar except as to the number of teeth 48 in the break wheels 47, it being obvious that the number of said teeth should correspond to the number of the station at which it is installed. The signaling stations may be located at any convenient or desirable distance apart. On trolley roads they may be from one-quarter of a mile to one mile apart depending upon conditions of traffic and otherwise.

As there may be any number of signaling stations it is possible that two or more cars or trains may pass over different track instruments at the same time. In order to prevent interference of signals at the home office and that each signal may be properly received I have devised the following. Each call box includes an electro magnet 55, said magnets being connected in series as shown, and each having an armature in the form of a weighted lever 54 pivotally supported on a suitable bracket. The magnets 55 are normally energized by current from the line circuit so that their armatures are attracted and held in the position shown in full lines in Fig. 3. Each break wheel 47 in addition to the teeth 48 is provided with projecting fingers 53, there being preferably the same number of fingers at each call box, and to provide for all contingencies the number should correspond to the number of stations installed on the road. All of the break wheels 47 are also provided with a recess 56 between the last of the pins 53 and the first of the teeth 48 in the direction of rotation of said wheels. When a car or train is passing over the track instrument of any one of the signaling stations, and as-

suming for the present that all of the other stations are free, the particular break wheel 47 of that station will be given one complete rotation as before described, and in said movement the pins 53 will clear a stop pin 57 on the upper end of the corresponding armature lever 54. As soon as the pins 53 have passed said stop pin the line circuit will be broken by finger 50 dropping into recess 56 thus deënergizing all of the magnets 55 on the line and releasing all of the armature levers 54, the latter assuming the position indicated by dotted lines in Fig. 3. Continuing its rotation the given break wheel 47 will alternately close and break the line circuit as its teeth pass under contact finger 50. When the latter comes to rest on the face 47′ of the break wheel all of the magnets 55 will again be energized and their armature levers 54 will be restored to normal position.

Assume now that while station A, for example, is sending in its signal a car or train passes over the track instrument at station B. The solenoid 29 of station B being energized, the break wheel 47 of its call box will begin to rotate but said movement will be arrested by the first one of the pins 53 of that station contacting with stop pin 57 of the corresponding armature lever 54. As already explained the electro magnet 55 of station B was deënergized by the break 56 of wheel 47 of station A, the deënergizing of said magnet permitting its armature lever 54 to assume the vertical position indicated in dotted lines in Fig. 3 thus throwing stop pin 57 into the path of the pins 53 of all of the stations except station A, the pins 53 of said latter station having passed the stop pin 57 of its armature lever. Station B will, therefore, not be permitted to send in its signal as long as a car or train is passing over the track instrument of station A. As soon as station A has completed the sending in of its signal the magnets 55 of all of the call boxes will be energized, thus moving all of the armature levers 54 to normal position. When that occurs the break wheel 47 of station B will not be permitted to resume its rotation as the stop pin 57 will be moved out from under that one of the pins 53 which engaged it. After the pins 53 of the break wheel of station B have passed the corresponding stop pin 57, all of the magnets 55 will again be deënergized by finger 50 dropping into recess 56 of the break wheel of station B, thus setting the armature levers 54 of all of the other stations to prevent the sending in of a signal while that of station B is being sent in as above described in connection with station A.

The recess 56 of each wheel 47 should be of such length as to cause a break in the line circuit of sufficient duration to permit all of the armature levers 54 to move to the position indicated in dotted lines, and from the foregoing description it will be observed that with all of the stations free should one of them begin to send in its signal, the pins 53 of that particular station will always be able to escape the corresponding armature lever 54 and that having done so should the call box of another station be set in operation its break wheel 47 will be arrested until released by the completion of the signal from the call box which had been previously set in operation. Thus each signal will be received at the home office in the order of time in which the call boxes are set in operation.

Should the call box of station B, for example, be set in operation between the time of setting in operation of the call box of station A and the breaking of the circuit at 56 of wheel 47 of the latter station, then some of the pins 53 of the break wheel of the call box of station B may pass the corresponding armature lever 54. Each wheel 47 is however provided with such number of pins 53 as not to permit all of them to pass the corresponding armature lever 54 while any break wheel 47 is rotating between the last one of its pins 53 and the beginning of its recess 56. Thus it will always happen that should the call box of one station be set in operation before the call box of another station previously set in operation begins to actually send in its signal by contact of the teeth 48 with finger 50, the former will be arrested by either the first or some subsequent pin 53 of its wheel 47 being caught by the stop pin 57 of the corresponding armature lever 54. In other words when a given call box is once set in operation it is impossible for all of the pins 53 of any other call box along the line to pass the corresponding armature lever 54 until the call box first set in operation has completed the sending in of its signal.

It is to be noted that while the line circuit is closed by finger 50 riding over the tops of teeth 48 of any station from which a signal is being sent in the impulse is so short as not to energize the magnets 55 sufficiently to move the corresponding armature levers 54 to normal position.

Instead of employing an electro magnet in the track instrument I may make the bar 2 a permanent magnet, although I prefer the construction described.

What I claim and desire to secure by Letters Patent is:—

1. A signaling system comprising a plurality of signal stations, a home signal, a circuit including all of said stations and said signal, a solenoid at each signal station included in said circuit, a track instrument at each station in which an induced current is set up by the passage of a car or train over said instrument, and means controlled by the induced current to energize and deënergize a corresponding station solenoid to thereby operate the home signal.

2. In a system of the character described, a signal, a signaling station comprising a track instrument wherein an induced current is set up by the passage of a car or train over said instrument, a call box, and means controlled by the induced current from said track instrument to set in operation said call box to thereby actuate the signal.

3. In a system of the character described, a signal, a signaling station comprising a track instrument wherein an induced current is set up by the passage of a car or train over said instrument, a call box, and means controlled by the induced current from said track instrument to close the circuit through said call box to set the same in operation and to thereby operate said signal.

4. A signaling system comprising a plurality of signal stations, a home signal, a circuit including all of said stations and said signal, a normally deënergized solenoid at each signal station included in said circuit, a track instrument at each station in which an induced current is set up by the passage of a car or train over said instrument, means controlled by the induced current to energize a corresponding station solenoid, and mechanism connected to the core of said solenoid adapted to operate the home signal when the solenoid is energized.

5. A signaling system comprising a plurality of signal stations, a home signal, a circuit including all of said stations and said signal, a normally deënergized solenoid at each signal station included in said circuit, a track instrument at each station in which an induced current is set up by the passage of a car or train over said instrument, means controlled by the induced current to energize a corresponding station solenoid, a circuit make and break device, and mechanism controlled by said solenoid when energized to actuate said device to thereby operate the home signal.

6. In a system of the character described, a signal, a circuit controlling said signal, a solenoid included in said circuit, a core for said solenoid, means for energizing said solenoid, mechanism actuated by the movement of the solenoid core when the latter is energized to close said circuit and to thereby operate the signal, and means to retard the return movement of said core to prevent the breaking of said circuit until after the completion of the signal.

7. In a system of the character described, a signal, a circuit controlling said signal, a call box included in said circuit, a solenoid also included in said circuit, means to energize said solenoid to close the circuit for said call box to thereby operate the signal, and means to retard the return movement of the core of said solenoid to prevent the breaking of said call box circuit until after the completion of the signal.

8. In a system of the character described, a signal, a track instrument wherein an induced current is set up by the passage of a car or train over said instrument, a call box, a solenoid included in the circuit between said instrument and call box, means for closing the circuit through said solenoid to energize the same and to thereby close the circuit through said call box, and means for retarding the return movement of the core of said solenoid to prevent the breaking of the circuit through the call box until the car or train has passed said track instrument.

9. A signaling system comprising a plurality of signaling stations, each station including a make and break wheel having teeth adapted to transmit a signal, means to actuate said wheels, each of said wheels having a comparatively long break in advance of said teeth for the purpose of setting mechanism to prevent the sending in of a signal from two or more stations simultaneously.

10. A signaling system comprising a plurality of signaling stations, each station including a make and break wheel having teeth adapted to transmit a signal, means to actuate said wheels, each of said wheels having a comparatively long break in advance of said teeth, disabling mechanism adapted to be set at each station when the circuit is broken in advance of the sending in of the signal from a given station to thereby prevent the sending in of a signal from two or more stations simultaneously.

11. In a system of the character described, a signal, a circuit controlling said signal, a plurality of call boxes included in said circuit, a track instrument adapted to close a circuit to set said call boxes in operation to transmit the proper signal, and means controlled by the call box mechanism after one of said boxes is set in operation to prevent the sending in of a signal from any other call box at the same time.

12. In a system of the character described, a signal, a circuit controlling said signal, a plurality of call boxes included in said circuit, each of said boxes having a make and break device and a normally energized electro magnet, movable armatures for said magnets and means at each call box for breaking the circuit and thus deëngerizing all of the magnets when any one of said boxes is set in operation, whereby the armatures are permitted to assume an abnormal position to prevent the sending in of a signal from any station other than the one which has occasioned the break in the circuit or to retard the sending in of a signal from a station until a call box which has been previously set in operation has completed its signal.

13. A signaling system comprising a plurality of signaling stations, each station including a call box having a circuit make and break device adapted to transmit a signal

and a normally energized electro magnet having a movable armature, and means on said device adapted when any one of them is set in operation to break the circuit and to thereby deënergize all of said magnets, whereby said armatures are permitted to assume an abnormal position to prevent the sending in of a signal from any station other than the one which has occasioned the break in the circuit or to retard the sending in of a signal from a station until a call box which has been previously set in operation has completed its signal.

14. In a system of the character described, a signal, a circuit controlling said signal, a plurality of call boxes included in said circuit, each of said call boxes containing a make and break wheel having teeth adapted to transmit a signal, said wheels also having pins projecting therefrom and a comparatively long break between said pins and teeth, a normally energized electro magnet included in said circuit at each call box, and movable armatures for said magnets, whereby when the circuit is broken by the long break of any one of said wheels all of the magnets will be deënergized and their armatures permitted to assume an abnormal position in the path of the pins of all of said wheels except that one which has occasioned the break in the circuit.

15. A signaling system comprising a plurality of signaling stations, a home signal, a circuit including all of said stations and said signal, a track instrument at each station wherein an induced current is set up by the passage of a car or train over said instrument, and mechanism controlled by the induced current from said instrument to operate said signal when a car or train is passing any one of the stations.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

EDWARD E. KLEINSCHMIDT.

Witnesses:

OLIN A. FOSTER,

GEO. W. YOUNG.