

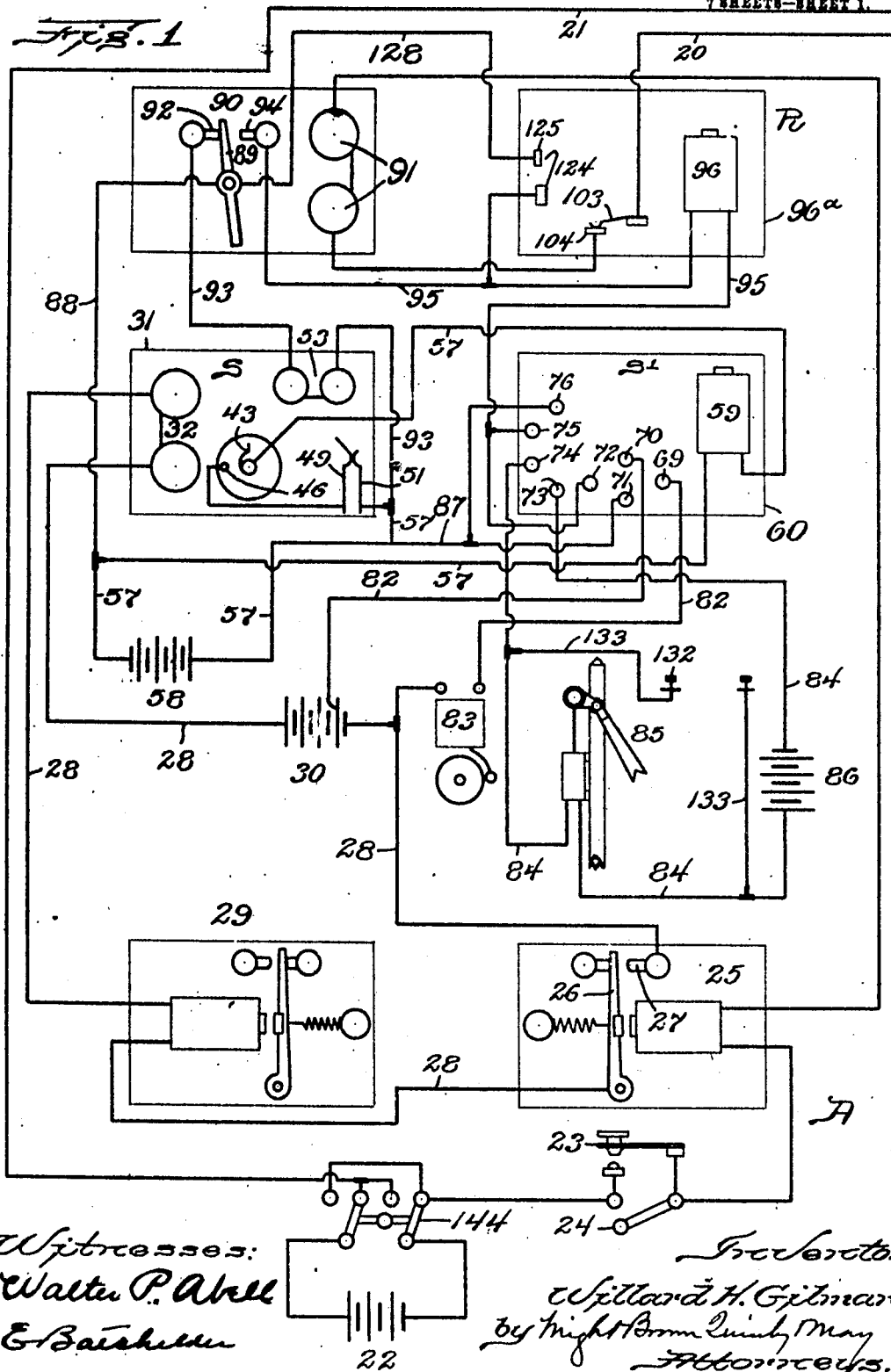
No. 870,622.

PATENTED NOV. 12, 1907.

W. H. GILMAN.
ELECTRIC SIGNALING SYSTEM.

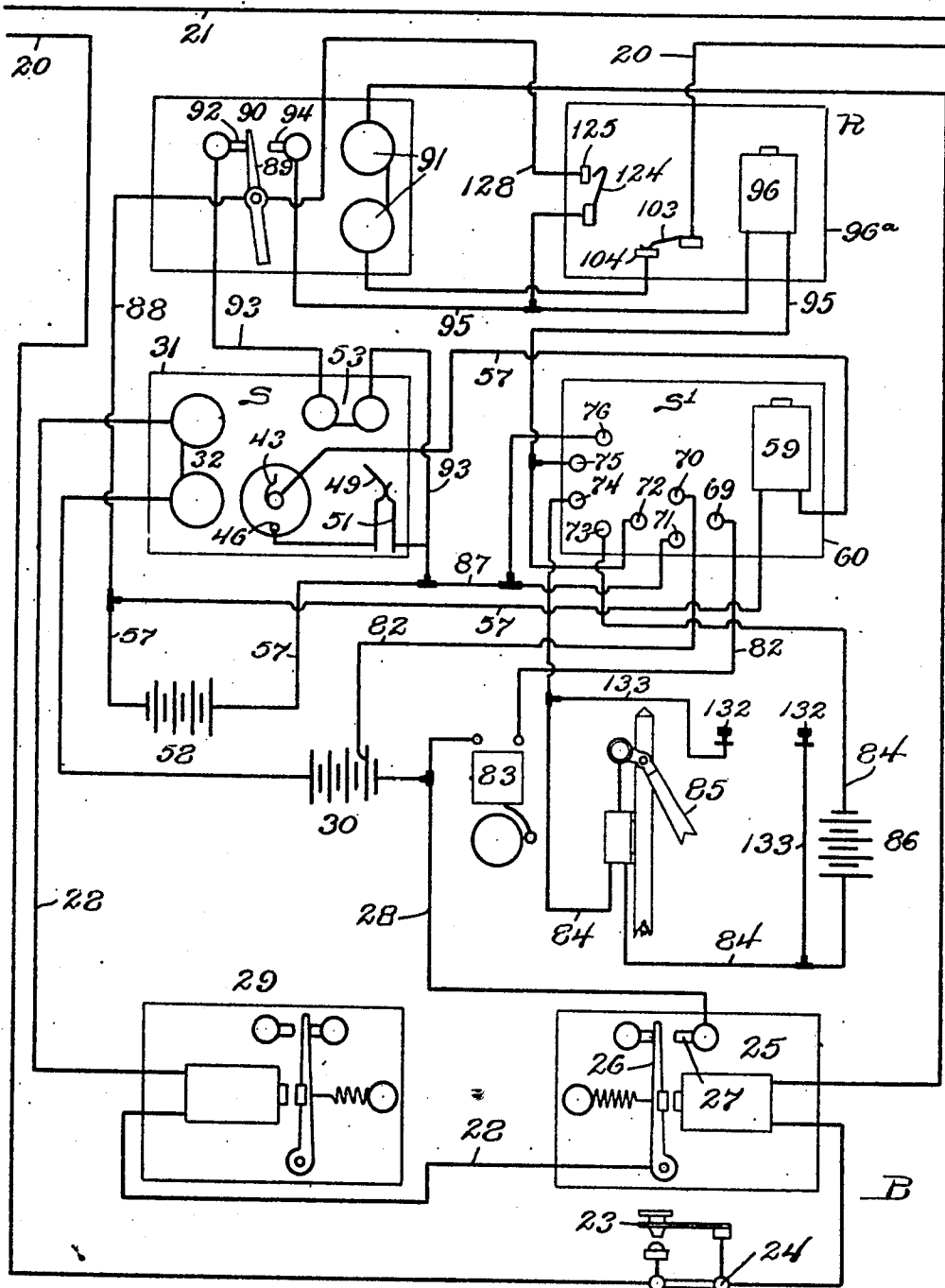
APPLICATION FILED OCT. 31, 1906.

7 SHEETS—SHEET 1.



W. H. GILMAN.
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7 SHEETS—SHEET 2.

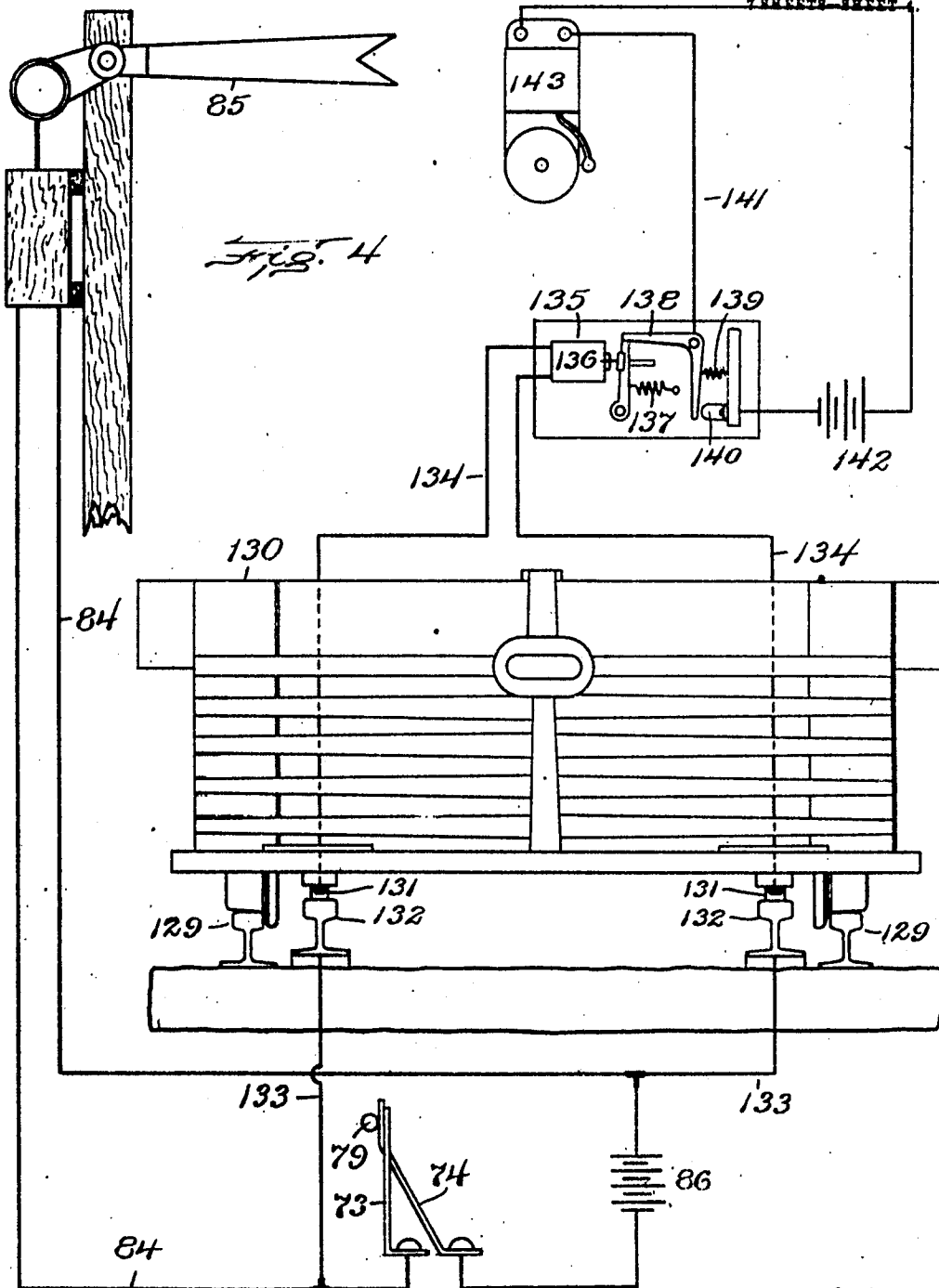


Witnesses: *Fig. 2*
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7 SHEETS—SHEET 4.

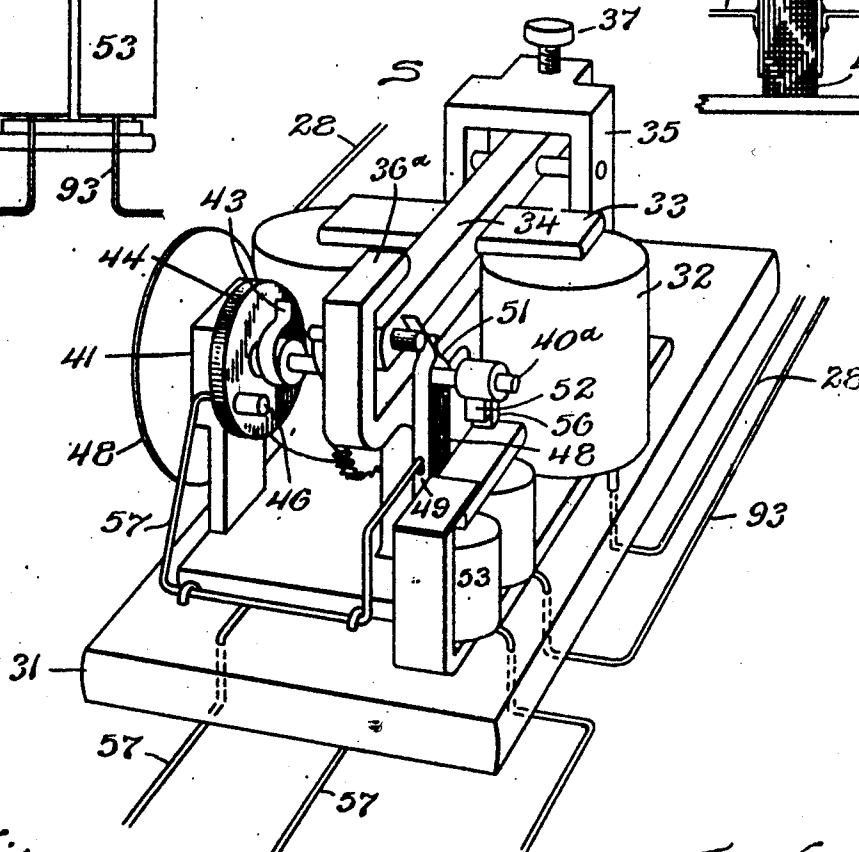
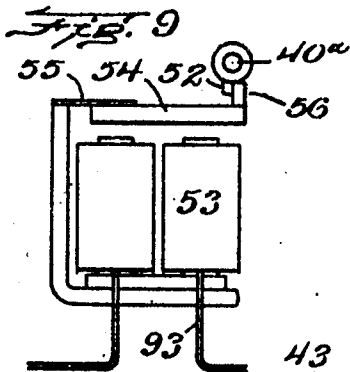
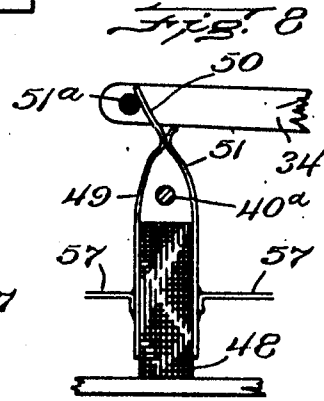
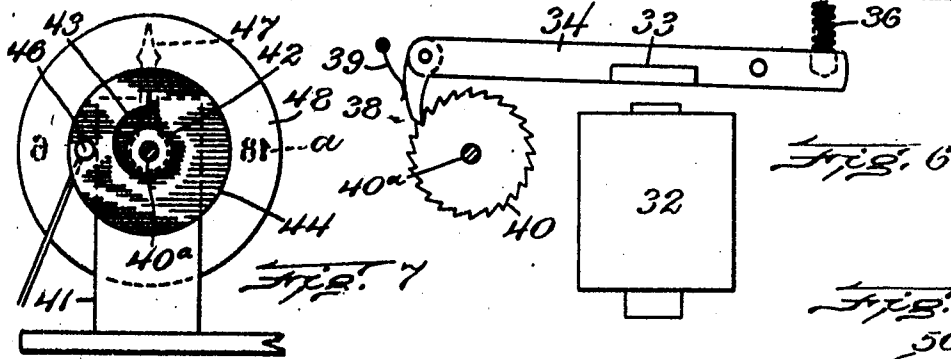


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7 SHEETS—SHEET 6.

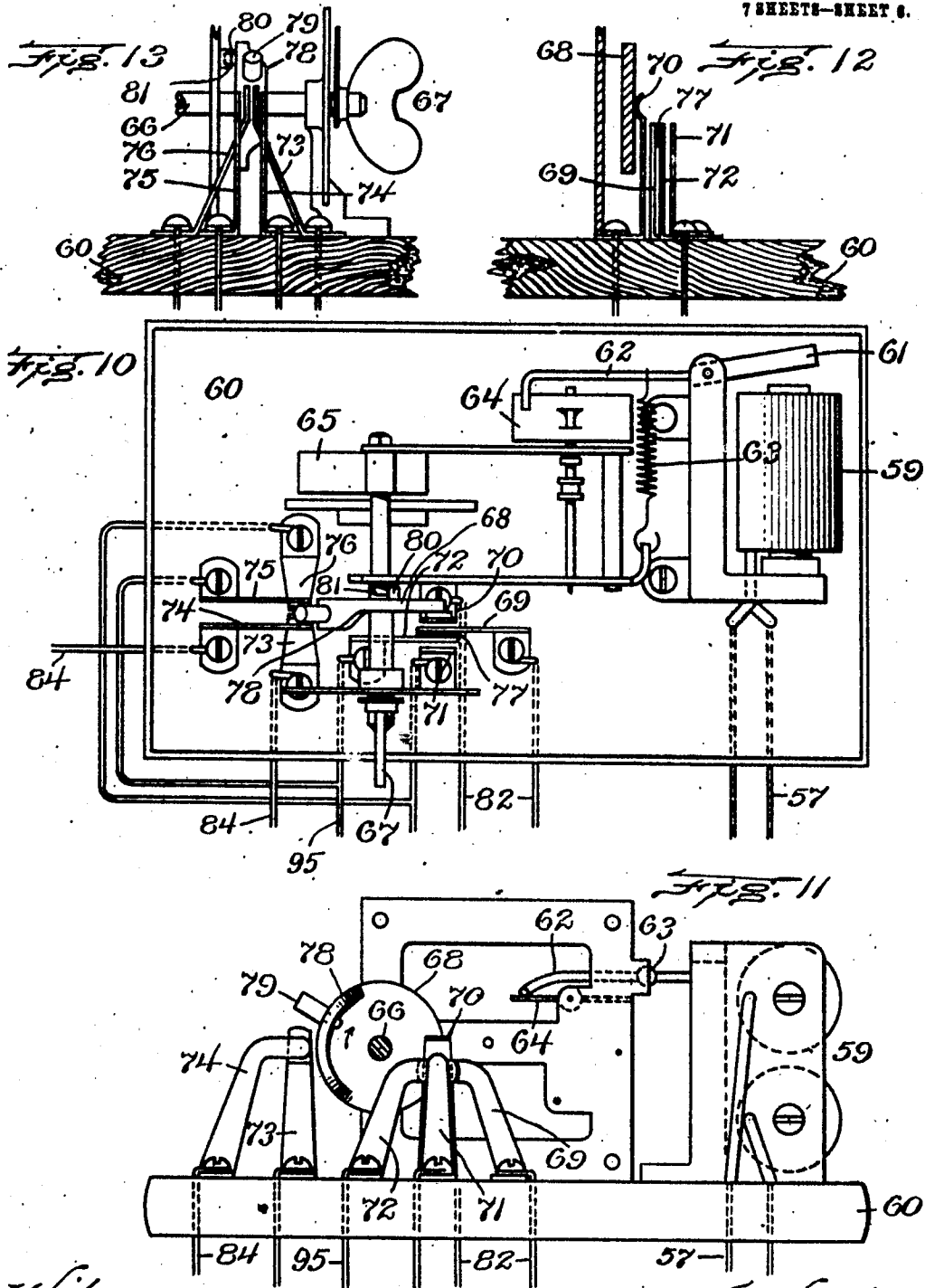


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7 SHEETS—SHEET 7.

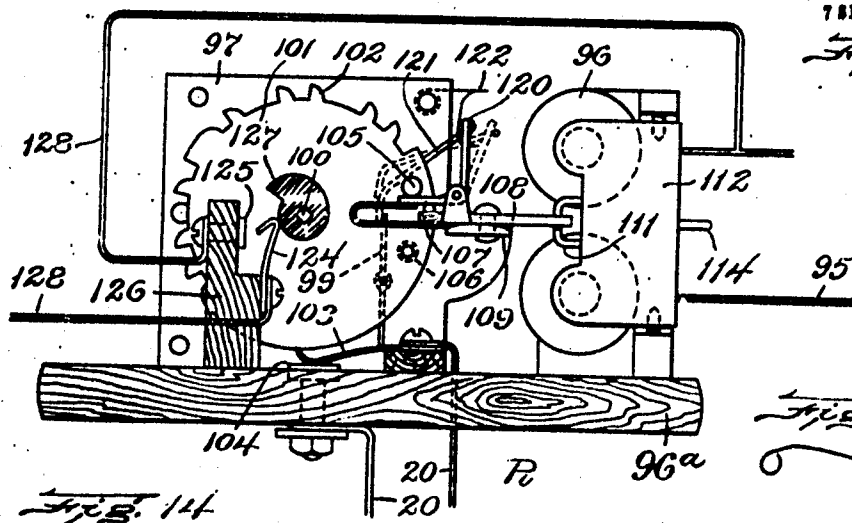
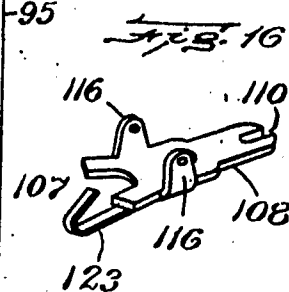
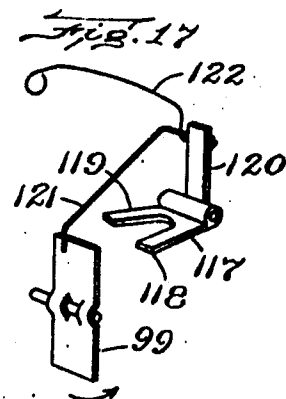
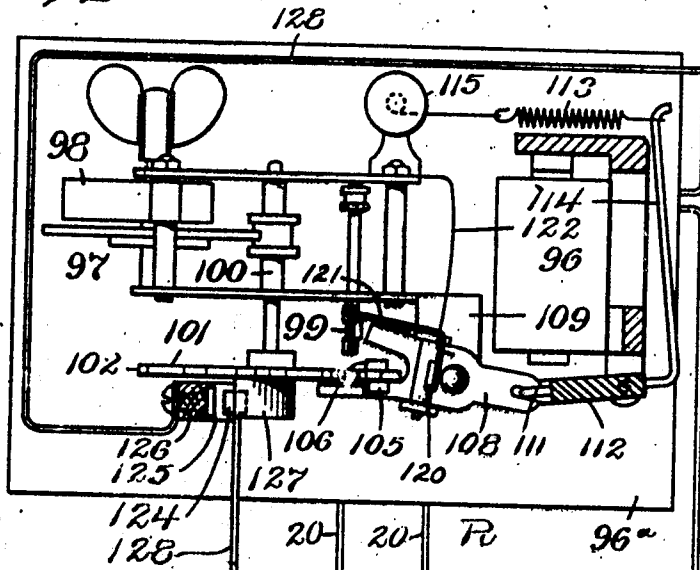


Fig. 14



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UNITED STATES PATENT OFFICE.

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TO INTERNATIONAL TELEMETER COMPANY, A CORPORATION OF ARIZONA TERRITORY.

ELECTRIC SIGNALING SYSTEM.

No. 870,822.

Specification of Letters Patent.

Patented Nov. 12, 1907.

Application filed October 31, 1906. Serial No. 341,428.

To all whom it may concern:

Be it known that I, WILLARD H. GILMAN, of Medford, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Electric Signaling Systems, of which the following is a specification.

This invention relates to electric signaling systems, and especially to those in which signals may be actuated selectively at one of a plurality of stations. Such an organization is capable of many applications, one of the most important of which is in connection with the control of train or car movements by telegraph from a despatcher's office. The train despatching system while much used and presenting marked advantages, is in its present form subject to serious defects.

To keep trains moving properly, orders must be promptly received, and this is dependent upon the presence of every operator at his station at the moment the despatcher's office desires to reach him. In event of an operator's unavoidable absence the despatcher should be able to establish communication at predetermined points along the line with the trains under his direction, or to give a warning thereto. This warning should be such that it cannot escape the engineer's attention, and the despatcher should have the power to reserve to himself a control of the signals and should receive an accurate verification that his communications have reached the proper station and operated as intended. In train despatching by telegraph none of these ends is at present attained. Operators go beyond hearing of their sounders, sometimes in the performance of legitimate duties, sometimes negligently, and arriving trains are blocked by the absence of orders, or venture ahead with disastrous results, and even when signals are set against engineers, they fail to see them. All operators possess, with the despatcher, equal control of the line and all apparatus actuated thereover, thus permitting such apparatus to be governed by irresponsible persons.

The principal objects of my invention are to obviate these difficulties and to provide a simple and reliable system by which different signals may be controlled over a single line circuit to individually warn, for example, operators and engineers, and by which the train despatcher or other authorized sender may solely exercise this control and may receive at will a return signal indicating the successful performance of the selective operation. This system is so organized that it may be quickly applied to a line without modification of the existing apparatus.

A further object of the invention is to provide means whereby the setting of a signal may give a warning or perform some other act directly upon the train signaled and also render it possible for persons not operators to

receive directions from a distant station and to respond thereto.

In the accompanying drawings, in which similar characters designate like parts throughout the several views: Figures 1, 2 and 3 are diagrammatic illustrations of successive portions of one embodiment of my invention which is adapted for train despatching or the like. Fig. 4 is a similar view of a portion of the system applied to the securing of direct communication with a train. Fig. 5 is a perspective view of the primary controlling mechanism situated at each station. Fig. 6 is a sectional detail showing the step-by-step actuating mechanism thereof. Fig. 7 is a similar view of the disk, rotatable contact and dial. Fig. 8 is a sectional detail of a second pair of contacts. Fig. 9 is a detail in side elevation of the locking mechanism. Fig. 10 is a top plan view of the secondary controlling mechanism. Fig. 11 is a side elevation thereof. Fig. 12 is a transverse sectional detail taken adjacent to the contacts of the audible signal circuit. Fig. 13 shows the contacts of the visible signal circuit and more closely associated elements in elevation. Fig. 14 is a top plan view of the return signal mechanism. Fig. 15 is a side elevation thereof. Fig. 16 is a perspective view of a portion of the detent. Fig. 17 is a similar view of another portion of said detent and the cooperating fly of the clock work.

Referring particularly to Figs. 1, 2 and 3 the numeral 20 designates a main line or conducting circuit which may be grounded at its extremities, but which, in the present instance, is shown as a full metallic circuit including a return conductor 21. This line connects a plurality of stations, there being three here shown and designated by the characters A B C. The system is arranged for telegraphic transmission, and particularly for the control of train or car movements from the despatcher's office, which is at the station A, there being here a battery 22 or other source of electrical energy connected in series with the limb 20 of the line. Each station is provided with the usual key or transmitting means 23 which in its inactive position is open, the circuit being kept normally closed by a switch 24. In the line at each station is also the winding of the customary neutral relay 25, having an armature 26 which closes upon its front contact 27 a local circuit 28. Each local circuit includes a sounder 29, a battery 30 and the winding of a primary signal-controlling apparatus S which I prefer to term a "telemeter."

One embodiment of the apparatus S is illustrated in Figs. 5 to 9, inclusive. Here a base 31 has mounted upon it an electro-magnet 32, the coils of which are connected in the circuit 28, and cooperating with this magnet is an armature 33 carried by a lever 34. This lever is trunnioned upon a yoke or double standard 35

rising from the base, and is forced upwardly by a spring 36 which brings the lever into contact with its back stop 36^a. An adjusting screw 37, having its inner end coacting with the spring, allows the tension of the latter to be varied. Pivoted upon the outer end of the armature lever is a pawl 38 which is forced by a spring 39 against the teeth of a ratchet wheel 40 fast upon a spindle 40^a, this being journaled in a standard 41 fixed to the base and in the back stop standard. Secured to or formed upon the spindle is a collar 42 having projecting from it a spring contact brush or flexible member 43. Supported adjacent to this brush, it being conveniently carried by the standard 41, is a disk or plate 44 preferably of insulating material. Near the periphery of the disk is mounted a contact pin 46 which is of such length that it projects into the path of the outer end of the brush 43. The contact pins of the instruments S are all situated in different circumferential positions about the disks at the various stations so that the angular distances between them and the brushes, which occupy the same initial positions at all stations, are different, and these pins are so arranged that the contacts of the brushes therewith at the series of stations are successively made. Carried upon the extremity of the spindle 40^a is a hand or pointer 47 which corresponds in angular position to the associated brush and which moves over a dial 48 having about its periphery a series of numerals corresponding to the line stations and thus indicating which contact pin thereof has been reached.

Situated adjacent to the lever 34, conveniently mounted upon the back stop standard but insulated therefrom by a block 48, is a contact spring 49 having an inclined end portion 50 with which coöperates a stud 51^a projecting from the end of the lever. Upon the opposite side of the block is a companion contact spring 51. Secured to the opposite extremity of the spindle 40^a from the dial is a stop arm 52 and adjacent thereto upon the base of the telemeter is mounted an electro-magnet 53, the armature 54 of which is retracted by its supporting spring 55 to bring a stop projection 56 rising from its free end into the path of the arm 52. When the armature is attracted by the magnet, its projection 56 is withdrawn from coaction with the stop arm, leaving the spindle and the brush 43 free to rotate. These elements constitute a locking mechanism for the controlling apparatus.

The conductive relation of the elements of the controlling apparatus S will be clear from a consideration of any one of the diagrams in Figs. 1, 2 and 3. It will be seen that the coils of the magnet 32 are in the local circuit 28, as previously stated, while the pairs of contacts 43, 46 and 49, 51 are in series in a second local circuit 57 provided with a battery 58 and containing the winding of an electro-magnet 59 of a secondary controlling mechanism S'.

The secondary portion of the controlling mechanism is more particularly illustrated in Figs. 10 to 13, inclusive. The magnet 59 is mounted upon a base 60 and has an armature 61 from which extends an arm 62 which is moved upon the retraction of the armature by a spring 63 into the path of a regulating vane or fly 64 of motor mechanism, here shown as a clock work with portions of the train omitted, and including a spring 65 having its spindle 66 provided with a finger

piece 67 at the front of the base. This spring exerts its force to turn the fly against the extension 62, and when the latter is withdrawn by the armature to rotate it at a predetermined rate. A contact controlling device in the form of an insulating disk 68 is fastened upon the spindle between the clock work and the finger piece. Situated in proximity to the disk are two sets of contact springs, each arranged in two pairs, one set including pairs 69 70 and 71 72, and the other comprising the pairs 73 74 and 75 76. The springs 69 and 71 are separated by insulating material 77 and these pairs are brought into coaction by a cam projection 78 extending along the circumference of the disk 68 at the front face and pressing against the inner spring 70. Contact between the pairs 73 74 and 75 76 is effected by a stud 79 extending radially from the disk and wedging between the springs 73 and 76. In the present form of apparatus the contact springs and their operating cam and stud bear such a relation to one another that coöperation between the first set will occur after about one-quarter of a rotation of the disk following the release of the clock work. This will continue for, say, another quarter of a rotation and finally the pairs of the last set will be brought together as the disk approaches the end of its travel, it coming to a positive stop when the operating stud is between the springs, by a lateral projection 80 which strikes a relatively fixed projection 81, here illustrated as carried by the frame of the clock work.

Reference again being had to Figs. 1 to 3, in which the contacts of the secondary controlling apparatus are represented by their termini, contacts 69 70 serve to close a local circuit 82 including an electrically operated bell or audible signal 83 and fed from a section of the battery 30. Contacts 73 74 control a local circuit 84 in which is an electrically actuated mechanism consisting of some convenient type of semaphore or other visual signal 85 and a battery 86. The contacts 71 76 are multiplied together and connected by a conductor 87 to a portion of the circuit 57, thus placing upon them a potential from one side of the battery 58. From the opposite side of the battery a conductor 88 leads to an armature 89 of a polarized relay 90, the winding 91 of which is included in the line conductor 20. One terminal 92 of the relay 90 is connected by a conductor 93 through the winding of the magnet 53 of the locking mechanism of the primary controller back to the circuit 57 of the battery 58. The opposite terminal 94 of the polarized relay is joined by a conductor 95 with the multiplied contacts 72 and 75 of the secondary controlling mechanism. The conductor 95 passes through the winding of an electro-magnet 96 forming a part of return-signal mechanism R.

Reference being had to Figs. 14 to 17, inclusive, for the details of the apparatus R the numeral 96^a designates a base supporting the electro-magnet 96 and a motor mechanism conveniently furnished by clock work 97, different parts of which are here illustrated, which includes a spring 98, a fly 99 and an intermediate spindle 100. Fast upon the spindle is a disk 101 provided with a series of peripheral depressions separated by projections 102. The edge of the disk and the projections maintain coöperation between a spring contact member 103 and a contact anvil 104, but when the depressions pass over the spring it is permitted

to leave the anvil. The rotation of the disk 101 is controlled by an escapement which may comprise a pair of studs 105 106 projecting from the front and rear of the disk, respectively, and a cooperating compound detent 107. This detent has a main portion 108 pivoted upon a bracket 109 to move horizontally, and provided at one extremity with a slot 110 to receive the reduced extremity 111 of the armature 112 of magnet 96. The armature, when released by the magnet, is retracted to swing the detent to the position shown in Fig. 14 by a spring 113 connecting an angular extension 114 from the armature to an adjusting screw 115. The portion 108 of the detent has opposite perforated lugs 116 116, upon which is pivoted an independently movable detent portion 117. This second portion straddles the edge of the disk 101, it having two arms 118 119 which may be carried by the swing of the main portion 108, beneath the studs 105 and 106, respectively. This portion 117 is also provided with a comparatively long angular arm 120 having a hooked extremity 121 which may engage the fly 99. A spring 122 fastened to some stationary portion of the instrument contacts with the arm 120 near its outer end and exerts its tension to tilt the portion 117 back to the position shown in dotted lines in Fig. 15 when disengaged by the studs. The downward movement of the detent portion 117 is here shown as limited by the contact of its arm 118 with an extension 123 from the portion 108. When the armature of the return-signal mechanism is in its normally retracted position, the hook 121 engages the fly, and the stud 105 rests upon the arm 118, and the disk occupies the position indicated in Fig. 15 of the drawings, the unbroken portion of its periphery holding the spring 103 upon the anvil. When the magnet 96 attracts its armature, the detent is swung outwardly, carrying the arm 118 from beneath the stud 105 freeing the disk. This leaves the portion 117 of the detent at liberty to be raised by the action of the spring 122 releasing the fly. On account of the point of engagement of these last-named elements the spring acts upon a lever of considerable length and readily overcomes the frictional resistance to disengagement. The disk is then rotated by the clock work to advance the depressions in its rim over the spring 103. After the depressions have passed the spring, the stud 106 reaches the arm 119 which now lies in its path pressing it down and causing the hook 121 to again engage the fly slowing the clock work. The disk continues to rotate for a short distance or until the arm 118 contacts with the extension 123 when the entire return-signal mechanism is brought to a stop. Upon the retraction of the armature, the disk is again released and turns through a small angle or until engagement is effected between the stud 105 and the arm 118, the action being similar to that just described. The mechanism is now ready to send a second "answer-back". Attention is called to the fact that upon the arrest of the clock work by the detent for either movement of the armature, the operation is inaugurated by the conjoint action of the arm 122 and the fly, and the mechanism is thus gradually slowed down until it is brought to a positive stop by the contact of one of the studs with its arm. This diminishes the force with which the studs are pressed against said arms, and renders the releasing movement of the de-

tent therefrom easier. The return-signal mechanism also has in addition to the members 103 and 104 a pair of contacts comprising a spring 124 and an anvil 125 mounted upon an insulating standard 126 rising from the base. As the apparatus is normally positioned, 70 or when the stud 105 rests upon the detent, these contacts are separated by the action of the spring member, but after the disk 101 has completed its signal and the stud 106 engages the detent the contacts 124 and 125 are brought together by a cam 127 rotatable with the 75 spindle 100, and there maintained until the detent releases the stud 106 to allow the elements to assume their initial positions, whereupon the cam allows the contacts to abruptly open. The relation of both pairs of contacts of the return-signal mechanism to the circuit appears in the diagrams. The signaling couple 80 is inserted in the conductor 20, and in consequence the spring 103 when it rises from the anvil, breaks the line and sends thereover a code signal governed by the length and spacing of the depressions, while the companion pair are included in a conductor 128 extending 85 from the armature 89 of a polarized relay to the conductor 95 between the terminal 94 and the winding of the return-signal magnet 96. This insures a flow of current through said magnet, while the disk 101 is in 90 the position previously indicated, irrespective of which terminal the armature 89 is in contact with.

In Fig. 4 of the drawings is best shown the elements of the system which establish direct connection with a train or car. The numeral 129 designates the track 95 rails and 130 a portion of a locomotive carried thereon. Carried at each side of the locomotive is a brush or shoe 131 adapted to slide over contact rails 132 located inside the track rails and preferably extending for some distance upon opposite sides of each semaphore 85 100. The contact rails are preferably higher than the track rails to avoid interference of the brushes with frogs and switches. These rails 132 are bridged across the semaphore circuit 84 by conductors 133, they being so connected that potential is put upon them by the battery 105 86 only when the contacts 73 74 of the secondary controlling mechanism are closed. Upon the locomotive this bridge circuit is continued by a conductor 134 passing through the winding of a magnet 135 which may be carried in the cab. Associated with this mag- 110 net is an armature 136 normally retracted by a spring 137. A lever 138 forced against the armature by a spring 139 is tripped when the armature is attracted and closes by a contact 140 a local circuit 141, in the present instance including a battery 142 and a signal 115 bell 143.

Assuming that the system here shown is to be utilized for train despatching and that the despatcher's office is station A, this has been illustrated as equipped with my complete apparatus, although this might not be 120 necessary or desirable. It has in addition a pole-changing switch 144, by which the connection of the main battery 22 with the line may be reversed at will. For the ordinary transmission of messages, the despatcher or any operator may break the line at his 125 switch 24 and then by means of the key 23 set up current impulses forming the character or characters distinguishing the particular station with which he desires to communicate. In this embodiment of my invention these current impulses are generated by the 130

presence or absence of current upon the line, although the system would be applicable to organizations operating by increase or diminution of a continuous current. All the relays and sounders of the system operate in a well-known manner, and if the called operator responds reciprocal transmission of messages may proceed. At this time the pole-changer is in the opposite position from that illustrated and the armature of the polarized relay engages the stop 94 so that the circuit 93 of magnet 53 is open and the primary signal-controlling mechanism of the telemeter is locked by the retracted armature. The return-signal mechanism is inactive, for although the contact at 94 is closed, the circuit of the magnet 96 is open at both pairs of contacts 71 72 and 75 76. The release of the locking mechanism lies wholly with the train despatcher through the manipulation of the pole-changer. Suppose now the operator which it is desired to reach fails to respond to the call, the despatcher closing his switch 24 throws the pole-changer to the point shown in Fig. 1, altering the polarity of the battery with respect to the line and bringing the armatures of all polarized relays therein upon the terminals 92. This completes the circuits, including conductors 57 88 and 93 through the magnets 53 and current flows from the batteries 58 attracting the armatures and unlocking the telemeters. The switch 24 is now again opened and the key 23 depressed. Upon each closure of the line circuit by the key, every telemeter lever is drawn down, as each magnet 32 is actuated by current from the battery 30 over the circuit 28 and controlled by its neutral relay 25, and its pawl advances the associated brush 43 to a point opposite the succeeding numeral of the dial 48. At one of the stations, provided there are as many upon the line as there are dial divisions, this will bring the brush into contact with its pin 46. At this time the pressure of the stud 51* is removed from the contact spring 49 so that this is permitted to separate from its companion contact, thus opening the local circuit 57, and consequently no current flows therethrough. Thus the inactive condition of the apparatus is maintained during the normal closure of the line. Upon the up-stroke, however, the elements 43 and 46 are left in contact, while 49 and 51 are now pressed together by the stud 51. This would result in a passage of current from the battery 58 through the magnet 59 of the secondary controlling mechanism which would attract the armature 61 were it not for the fact that the intervals between the impulses are so short that the self induction of the winding of magnet 59 and the reluctance of its cores are not sufficiently overcome before the circuit 28 is again closed, resulting in the opening of the circuit 57, as previously indicated. As a consequence the armature extension 62 is not withdrawn from the fly 64 of the clock work, and the associated signals are not operated. This effect of electro-magnetic inertia may also be aided by the proper adjustment of the tension of the springs of the telemeters. When the despatcher sees that the hand of his telemeter points to the hand of the station with which communication is wished, since all the hands of the system are moved in synchronism by their actuating mechanisms he knows that the brush 43 and the pin 46 at said station are in contact. He now allows his key to remain open for a greater interval. This time change in the character of

the impulses is such that current from the battery 58 flows long enough through the magnet 59 to withdraw the armature extension 62 from the fly. This leaves the motor means free to act, advancing the disk 68 at some predetermined speed, say, at the rate of 60 seconds for a complete revolution. The sending operator therefore knows that he has only to leave the line open, say, 45 seconds for the cam projection 78 to have passed over the contacts 69 70 and 71 72, and the stud 79 to have reached the contacts 73 74 and 75 76. After an interval 75 of 15 seconds the first-named contacts will be made and during the following 15 seconds, in which the cam projection is traversing them, the circuit 82 will be closed, and the bell 83 will ring to indicate to the operator that his presence is required at the instrument. If he is 80 within hearing of this audible signal the operator can respond by breaking the circuit at his switch to notify the despatcher of his presence, and setting back the secondary controlling mechanism to its initial position by the finger piece 67, thus stopping the bell and also 85 preparing the apparatus for another call.

It should be noted that as the secondary controlling mechanism is arranged, even if the character of the message transmitting impulses is such as to cause the magnet 59 to be sufficiently energized to release the 90 clock work of the secondary controlling mechanism so that its contact actuating devices will be slightly advanced, this will not cause the sounding of the signal bell on account of the distance through which the cam must move to reach the contacts 69 70. The operator 95 seeing any intermittent forward travel will return the disk to its normal position. That this advance should be considerable is impossible since to cause it to occur at any particular station the increased intervals of closure of the circuit 28 through the manipulation of the 100 despatcher's key must take place when the brushes 43 are at the same angle, this representing but a slight portion of their total time of revolution. The crawling of the contact mechanism, if it exists, is in this manner distributed among the apparatus at all the stations and 105 therefore minimized.

In event of the called operator not answering the despatcher may determine whether the system is operating properly and that it has given the signal at the desired station. To do this during the time that the 110 signal contacts 69 and 70 are closed, the despatcher shifts the pole-changer to its initial position, transferring the armature of the polarized relay to the terminal 94. Now the contacts 71 72 are always closed with their companion contacts, and a circuit is completed for the battery 58 and return-signal magnet 96, including conductors 57 88 and 95 so that the armature 115 112 of the magnet is attracted and the detent operated to release the clock work and disk 101. The depressions in the disk allow the spring 103 to open the line, 120 sending back to the despatcher the code signal of the station with which it is associated. The reversal of the pole-changer will restore the detent to its first position, and prepare the mechanism for another answer-back signal. The clock work must, of course, be 125 wound at suitable intervals. If upon getting this return signal he finds that because of a departure of the telemeters from synchronism or for any other reason he has signaled the wrong station, the despatcher has only to operate his key 23 for a sufficient time to insure 130

all the arms 52 of the telemeters reaching the locking projections 56 which are now raised. It will then be certain that the instruments are all at zero and therefore in step, and the signaling operation may be repeated as just described. If the called operator does not turn back the disk 68 it continues to advance until the projection 81 arrests it. Then the stud 79 will close the contacts 73 74 completing the semaphore circuit 84 and setting said semaphore to arrest or control train movements. Upon approaching the signal set against it, a train will receive current from the battery 86 through the sections of contact rails 132 and its own shoes 131, this being dependent upon the closure of the semaphore circuit by the contacts 73 74. This completes the local train circuit 141 and gives the engineer a warning which will continue until he has reset the tripped contact mechanism and which cannot be well overlooked. Obviously this train circuit can be applied to the performing of other operations, such as automatically shutting off the power or applying the brakes by means of a suitable electro-magnetic mechanism substituted for the bell. In the same manner as described in connection with the operator's audible, the closing of the contacts 75 76 simultaneously with the semaphore contacts 73 74 will establish the same return-signal circuit and the verifying answer-back similarly transmitted. It may happen that while the despatcher's office has either the audible or visible signal at one station in operation, it will become necessary to similarly signal another station. In shifting the pole-changer to get the return signal for this second station the despatcher would again release the mechanism of the first station by the movement of its polarized relay, and a jumble of signals would result were it not for the path maintained for current by the contacts 124 independently of the terminal 94, while the secondary controlling mechanism is in its signal actuating position. This retains the armature 112 attracted and no answer-back can be sent by any previously operated station mechanism which is in control of its signals until the return-signal circuit has been opened in its contacts 71 72 or 75 76. Then the consequent movement of its detent causes the cam 127 to open the guard conductor 128.

It will therefore be seen that without extra lines and without materially complicating the system or disturbing the standard apparatus already in use a means is supplied for enabling the despatcher's office exclusively to call a distant or inattentive operator, or this failing to perform signaling operations which will prevent his absence from resulting in uncontrolled and perhaps disastrous train movements, and furthermore the despatcher can always verify the correctness of the operations, and if these are found to be at fault can promptly bring the system into proper action. In addition my system furnishes a means for communication between the despatcher's office and employees who are not telegraph operators, as, for instance, train conductors. The apparatus peculiar to a station may be set up in a pole box or any other convenient shelter by a siding and trains stopped by the associated semaphore. Then the crew may signal their presence by the return-signal mechanism and receive orders by noting the position of the telemeter hand at certain numerals upon its dial in accordance with a definite code.

These orders, being received they may be acknowledged by another answer-back signal.

While I have described a particular form and application of my system it will be clear that these may be varied widely without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. A signaling system, comprising a conducting circuit, means for transmitting current impulses of different character over the circuit, and signal-controlling apparatus, operable only by certain of the impulses and including primary and secondary rotatable contact mechanisms. 75
2. A signaling system, comprising a conducting circuit, means for transmitting current impulses of different length over the circuit, and signal-controlling mechanism operable only by the longer of the impulses. 80
3. The combination with a main circuit, of transmitting means, a local signal-controlling circuit, electro-magnetic mechanism associated with the main circuit and having a movable actuating member, and a rotatable contact member controlling the local circuit, said local circuit being closed upon one movement of the actuating member and opening on its reverse movement. 85
4. The combination with a main circuit, of transmitting means, a local signal-controlling circuit, electro-magnetic mechanism associated with the main circuit and having a movable actuating member and a plurality of pairs of contact members included in the local circuit, said local circuit being closed at one pair of contacts for each movement of the actuating member and at another pair of contacts only for certain of such movements. 90
5. A signaling system comprising a conducting circuit, means for transmitting current impulses of different length over the circuit, primary controlling mechanism associated with said circuit, secondary controlling mechanism under the influence of the primary controlling mechanism and being controlled only by the longer of the impulses, and a signal operable by the secondary controlling mechanism. 95
6. The combination with a conducting circuit, of transmitting means, primary controlling mechanism operable by the transmitting means, secondary controlling mechanism provided with motor means which may be released by the primary controlling mechanism, and a signal operable by the travel of the secondary controlling mechanism. 100
7. The combination with a conducting circuit, of transmitting means, primary controlling mechanism operable by the transmitting means, secondary controlling mechanism under the influence of the primary controlling mechanism, and audible and visual signals successively operated by the controlling mechanism. 110
8. The combination with a conducting circuit, of transmitting means, controlling mechanism under the influence of the transmitting means and having a traveling contact member, a signal governed by the controlling mechanism during the travel of said contact, and a second signal operable at the end of its travel. 115
9. The combination with a conducting circuit, of transmitting means, controlling mechanism under the influence of the transmitting means and having a traveling contact operating member and two relatively fixed contact devices, one of said fixed contact devices being operable for a considerable time by the traveling member and the other of which is situated at the termination of travel of the contact operating member, an audible signal operated by the coaction of the first-named contact device and the traveling member, and a visual signal operable by the arrival of the traveling member at the terminal contact device. 120
10. A signaling system comprising a main line, current transmitting means included therein, electro-magnetic mechanism associated with the main line, a traveling and a relatively fixed contact member, the latter being advanced by the electro-magnetic mechanism, a local circuit including said contacts, and rotatable signal-controlling mechanism connected in the local circuit. 125
11. A signaling system comprising a main line, current transmitting means included therein, electro-magnetic mechanism associated with the main line, a traveling and a relatively fixed contact member, the latter being ad- 130

vanced by the electro-magnetic mechanism, a local circuit including said contacts, and signal-controlling mechanism connected in the local circuit and having motor means released by the closing of the contacts.

- 5 12. A train-despatching system comprising a line conductor provided with stations each having telegraphic transmitting and receiving instruments, signal-controlling mechanism at a plurality of the stations governed by the operation of a telegraph transmitting instrument, and
10 means situated at fewer than the whole number of stations and being independent of said governing transmitting instrument for rendering the controlling mechanism operative.

13. A signaling system comprising a main line provided with a plurality of stations, signal-controlling mechanism at each station, a lock for each of the controlling mechanisms, and means situated at one of the stations for releasing the locks, said means being actuated over the same portion of the main line as is the signal-controlling mechanism, but by a current of different polarity.

14. A signaling system comprising a conducting circuit, means for transmitting current impulses over the circuit, signal-controlling mechanism and a locking mechanism therefor associated with the conducting circuit, means for varying the character of the impulses in one way to operate the locking mechanism, and in another way to operate the signal-controlling mechanism.

15. A signaling system comprising a conducting circuit, means for transmitting current impulses over the circuit, signal-controlling mechanism and a locking mechanism therefor associated with the conducting circuit, means for varying the direction of current in the circuit to operate the locking mechanism, and means for varying the strength of the current for operating the signal-controlling mechanism.

16. The combination with a conducting circuit, of a source of electrical energy and signal-controlling mechanism included therein, an electro-magnetic lock for the signal-controlling mechanism, and means for reversing the polarity of the source of electrical energy to operate the lock.

17. A signaling system comprising a line circuit, a local circuit, signal-controlling mechanism associated with the local circuit, locking means for the signal-controlling mechanism, and a relay having its winding included in the line circuit and its contacts included in the local circuit with the locking means.

18. A signaling system comprising a line circuit, including a source of electrical energy, a pole-changer and a circuit breaker, a local circuit, a signal-controlling mechanism associated with the local circuit and being operable by the circuit breaker, and a polarized relay having its winding included in the line circuit and its contacts in the local circuit with the locking means and being responsive to the pole-changer to govern the locking mechanism.

19. The combination with a conducting circuit, of transmitting means, primary controlling mechanism operable by the transmitting means, secondary controlling mechanism under the influence of the primary controlling mechanism, a signal operable by the secondary controlling mechanism, and an electro-magnetic lock for the primary controlling mechanism.

20. The combination with a conducting circuit, of transmitting means, primary controlling mechanism operable by the transmitting means, rotatable secondary controlling mechanism provided with motor means and being under the influence of the primary controlling mechanism, a signal operable by the secondary controlling mechanism, an automatic return-signal mechanism governed by the secondary controlling mechanism during its rotation.

21. The combination with a conducting circuit, of transmitting means, primary controlling mechanism operable by the transmitting means, secondary controlling mechanism under the influence of the primary controlling mechanism and having a traveling member, a signal operable by the secondary controlling mechanism, and an automatic return-signal mechanism operable by the secondary controlling mechanism at a plurality of points in its travel.

22. The combination with a conducting circuit, of transmitting means, controlling mechanism under the influence

of the transmitting means, audible and visual signals successively operable by the controlling mechanism, and return-signal mechanism automatically operable by the operation of both the audible and visual signals.

23. The combination with a conducting circuit, of transmitting means, controlling mechanism under the influence of the transmitting means, audible and visual signals successively operable by the controlling mechanism, and return-signal mechanism automatically operable by the operation of both the audible and visual signals and governed by the controlling mechanism.

24. The combination with a conducting circuit, of signal-controlling mechanism, a return-signal mechanism governed by the controlling mechanism, and independent means for governing the return-signal mechanism.

25. The combination with a conducting circuit, of signal-controlling mechanism, a return-signal mechanism governed by the controlling mechanism, independent means for governing the return-signal mechanism, and means associated with the return-signal mechanism for nullifying the effect of the last-named governing means.

26. The combination with a conducting circuit, of signal-controlling mechanism, a return-signal mechanism governed by the controlling mechanism, independent means for governing the return-signal mechanism, and means associated with the return-signal mechanism for nullifying the effect of the last-named governing means during the operation of the signal by the controlling mechanism.

27. A signaling system comprising a conducting circuit, signal-controlling mechanism, a lock therefor, a return-signal mechanism, and means common to both for governing the lock and return-signal mechanism.

28. A signaling system comprising a line circuit, local circuits, signal-controlling mechanism, an electro-magnetic lock therefor and a return-signal mechanism, all having windings in the local circuits, and a relay provided with a winding included in the main circuit and terminals included in the local circuits with both the lock and return-signal mechanism.

29. A signaling system comprising a conducting circuit, signal-controlling mechanism, a lock therefor, a return-signal mechanism, means common to both for governing the lock and return-signal mechanism, and means for nullifying the effect of the governing means upon the return-signal mechanism in certain positions thereof.

30. A signaling system comprising a line circuit, local circuits, signal-controlling mechanism, an electro-magnetic lock therefor and a return-signal mechanism, all having windings in the local circuits, and a relay provided with a winding included in the main circuit and terminals included in the local circuits with both the lock and return-signal mechanism, and with an armature adapted to complete more than one of said local circuits.

31. A signaling system comprising a line circuit, local circuits, signal-controlling mechanism, an electro-magnetic lock therefor and a return-signal mechanism, all having windings in the local circuits, a relay provided with a winding included in the main circuit and terminals included in the local circuits with both the lock and return-signal mechanism, and with an armature adapted to complete more than one of said local circuits, and means operable by the return-signal mechanism for maintaining the circuit through its windings independently of the position of the armature.

32. A train despatching system comprising a telegraph line having stations provided with keys in said line and local circuits associated therewith, an electro-magnetic circuit-controlling mechanism included in each local circuit and having a movable contact operating member and a plurality of relatively fixed coacting contact devices, a bell circuit connected with one of the fixed contact devices, and a semaphore circuit connected with another fixed contact device.

33. A telegraph system comprising a main line having stations provided with keys and line relays, local circuits governed by the relays, signals associated with said local circuits, and a controlling mechanism for each signal

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rotatable step by step and continually in one direction upon the opening and closing of the line by a key.

34. A telegraph system comprising a main line having stations provided with keys and line relays, local circuits governed by the relays, signals associated with said local circuits, and a controlling mechanism for each signal rotatable step by step and continually in one direction upon the opening and closing of the line by a key, and each having a plurality of signal-controlling contacts, all of which are closed when said line is open.

35. A telegraph system comprising a main line having stations provided with keys and line relays, local circuits governed by the relays, signals associated with said local circuits and a controlling mechanism for each signal rotatable step by step and continually in one direction upon the opening and closing of the line by a key, each of said controlling mechanisms being provided with a rotatable contact operating member and a companion contact differently situated at each of the stations.

36. A telegraph system comprising a main line having stations provided with keys and line relays, local circuits governed by the relays, signals associated with said local circuits, a controlling mechanism for each signal rotatable step by step and continually in one direction upon the opening and closing of the line by a key, each of said controlling mechanisms being provided with a rotatable contact operating member and a companion contact differently situated at each of the stations, and an independent contact device for each controlling mechanism.

37. A telegraph system comprising a main line having stations provided with keys and line relays, local circuits governed by the relays, signals associated with said local circuits, a controlling mechanism for each signal rotatable step by step and continually in one direction upon the opening and closing of the line by a key, each of said controlling mechanisms being provided with a rotatable contact operating member and a companion contact differently situated at each of the stations, an independent contact device for each controlling mechanism, the contacts under the influence of the rotatable member being operable once for each complete rotation, and a second set of contacts operable for each step of the controlling mechanism.

38. A train despatching system comprising a main line having stations, one of which is appropriated to the use of the train despatcher, keys and line relays at the stations, local circuits governed by the relays, signals associated with the local circuits at a plurality of the stations, controlling mechanism for each signal, an electro-magnetic lock for the controlling mechanism, and means situated at the train despatcher's station only for operating the lock.

39. A train despatching system comprising a main line having stations, one of which is appropriated to the use of the train despatcher, keys and line relays at the stations, local circuits governed by the relays, signals associated with the local circuits at a plurality of the stations, controlling mechanism for each signal, return-signal mechanism associated with each controlling mechanism, and means situated at the train despatcher's station only for permitting the sending out of a return signal.

40. A train despatching system comprising a main line having stations, one of which is appropriated to the use of the train despatcher, keys and line relays at the stations, local circuits governed by the relays, signals associated with the local circuits at a plurality of the stations, primary signal-controlling mechanism responsive to the key of the train despatcher, and motor-driven controlling mechanism released by the primary controlling mechanism and serving to operate the signal.

41. A railway signaling system comprising a conducting line provided with a plurality of stations, controlling mechanism at a station included in a local circuit, relatively fixed signals operable by the controlling mechanism, and electro-magnetic mechanism movable with trains and being dependent for its operation upon the closure of said local circuit by the controlling mechanism.

42. A railway signaling system comprising a conducting line provided with a plurality of stations, controlling mechanism at a station included in a local circuit, relatively fixed signals operable thereby, contact rails associated with the signals and being connected with the local circuit at a station, continuations of said station circuit situated upon a train, a local train circuit governed by the combined station and track circuit, and an electro-magnetic mechanism in the local train circuit.

43. A railway signaling system comprising a conducting line provided with a plurality of stations, controlling mechanism at one station included in a local circuit, relatively fixed signals operable thereby, contact rails associated with the signals and being connected with the local circuit at a station, continuations of said station circuit situated upon a train, contacts in the controlling mechanism included in the combined station and train, and electro-magnetic mechanism associated with said combined circuit and governed in the contacts.

In testimony whereof I have affixed my signature, in presence of two witnesses.

WILLARD H. GILMAN

Witnesses:

C. F. BROWN,
JAY B. CHAWFORD.