Aug. 20, 1935. R. M. HOPKINS 2,011,636

ALARM OR SIGNAL SENDING SYSTEM

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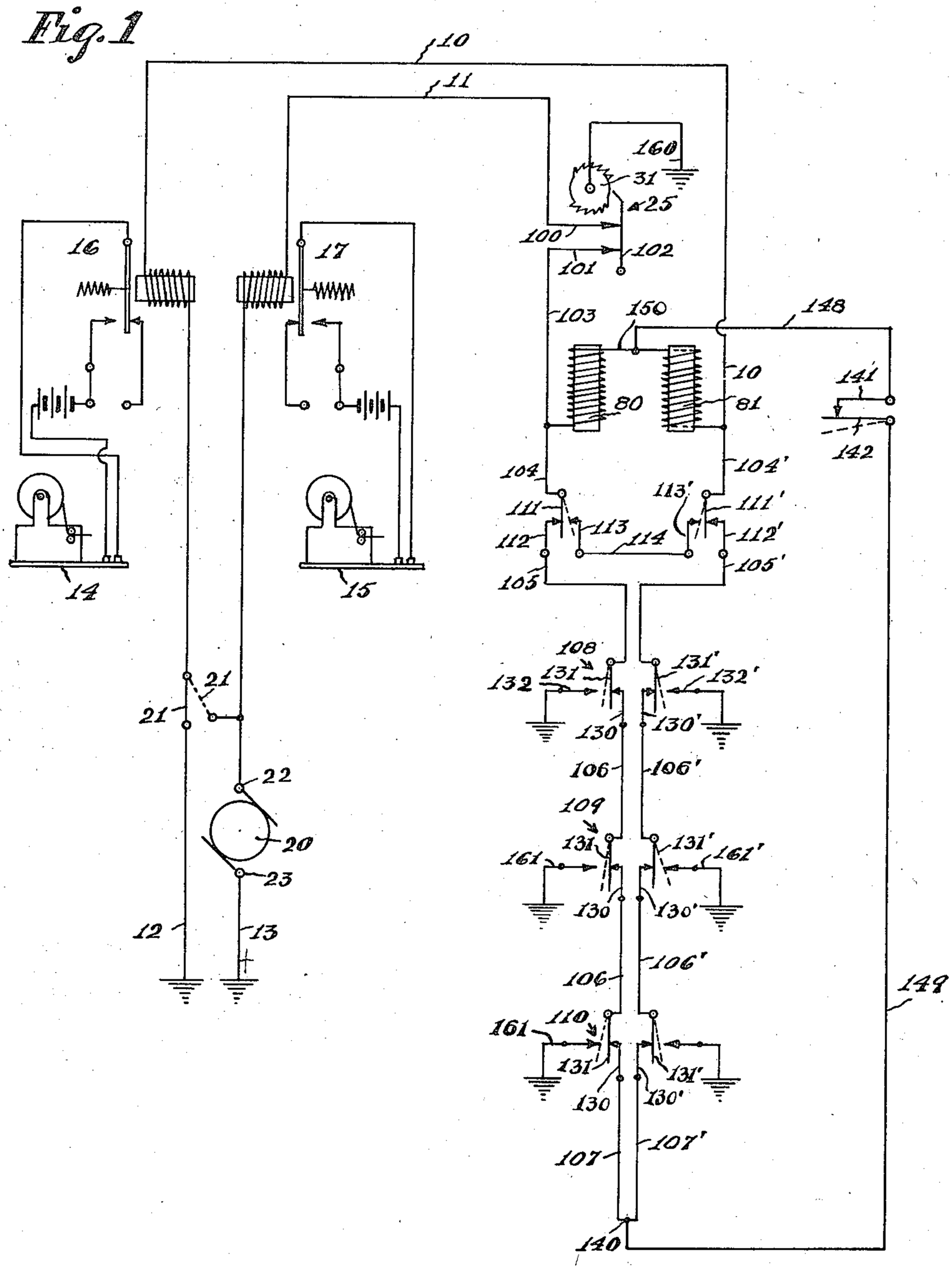
Fig. 1



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ALARM OR SIGNAL SENDING SYSTEM

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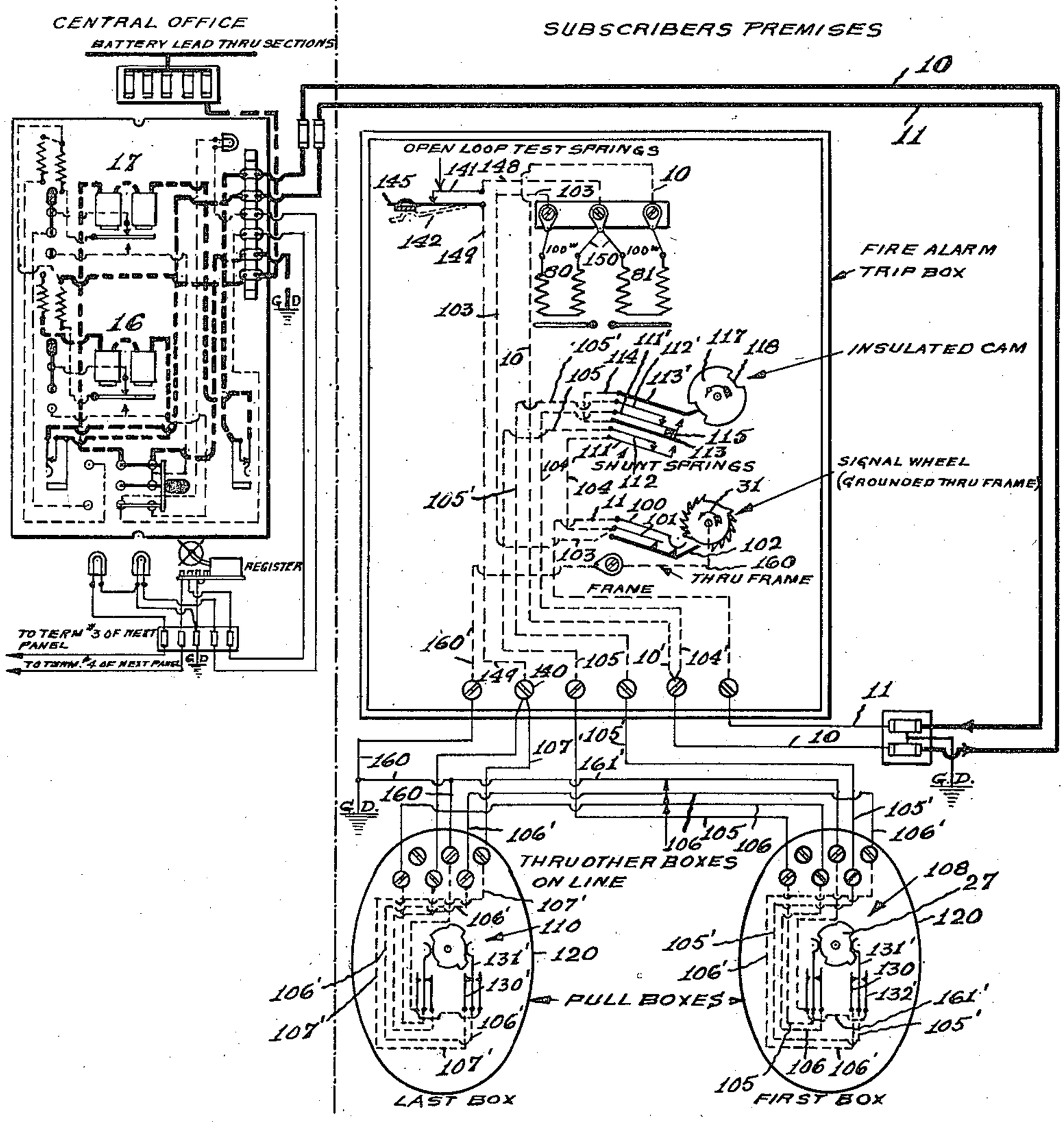
Fig. 2



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ALARM OR SIGNAL SENDING SYSTEM

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Fig. 9

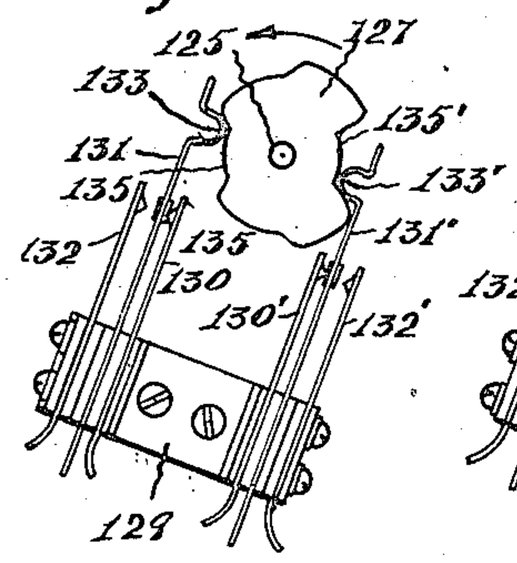


Fig. 11

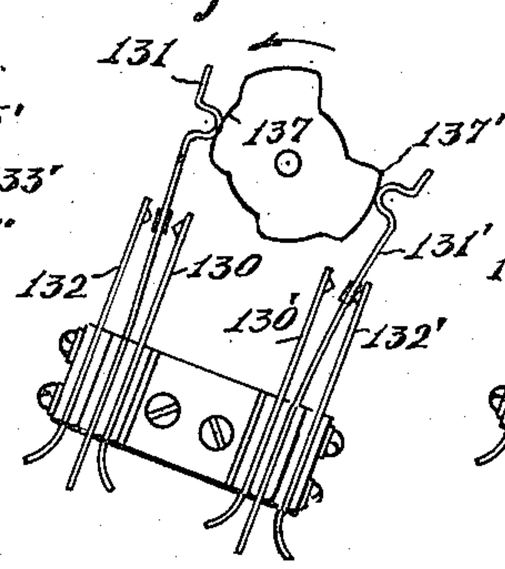


Fig. 12

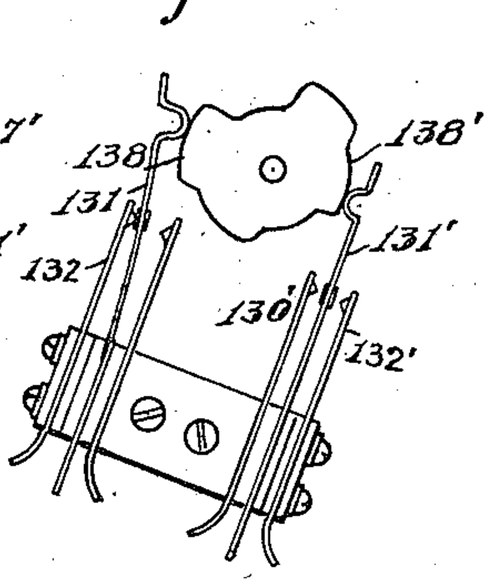


Fig. 10

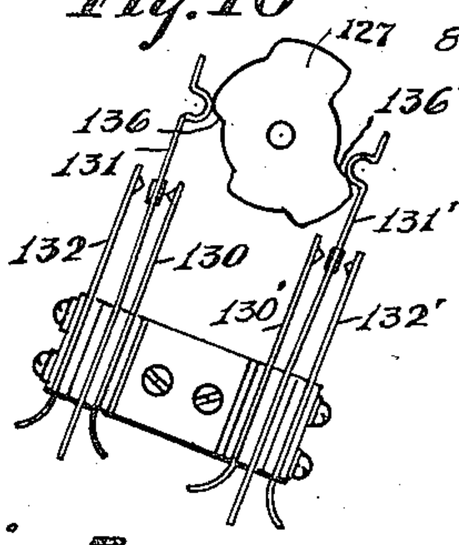


Fig. 8

Fig. 3

Fig. 5

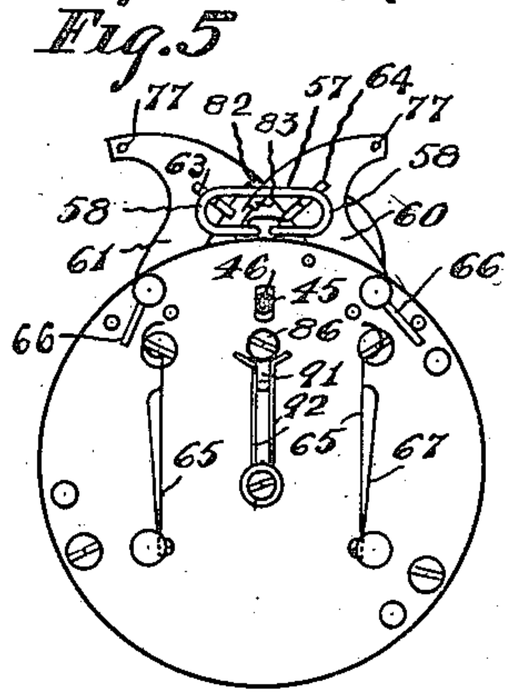


Fig. 4

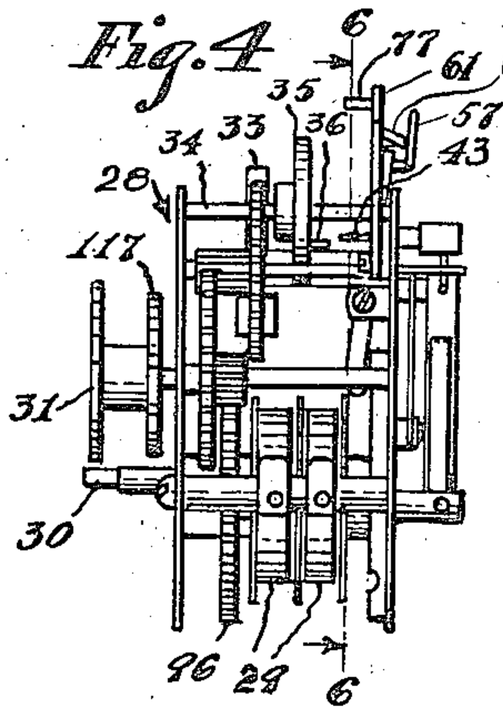


Fig. 6

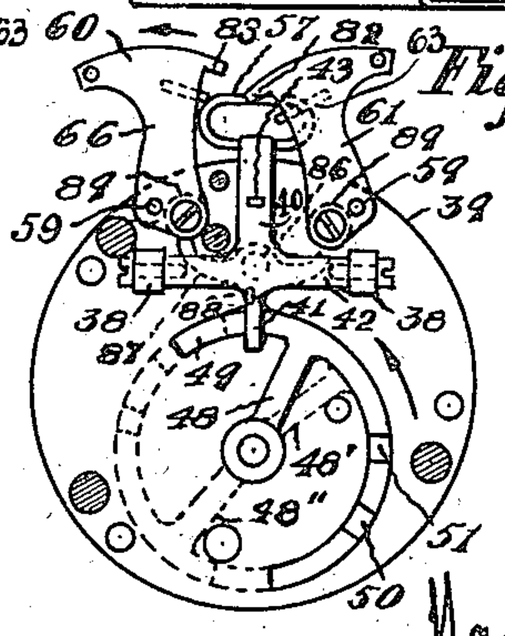
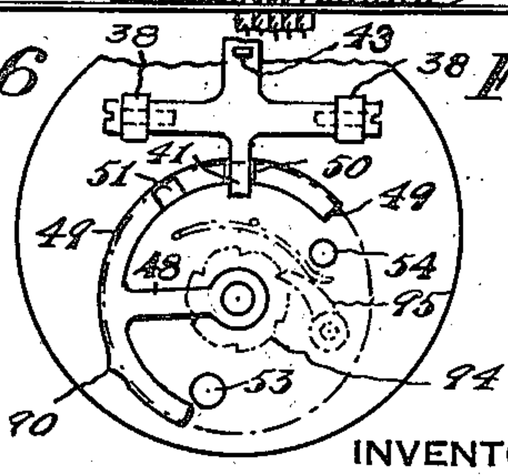


Fig. 7



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ALARM OR SIGNAL SENDING SYSTEM

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Fig. 15

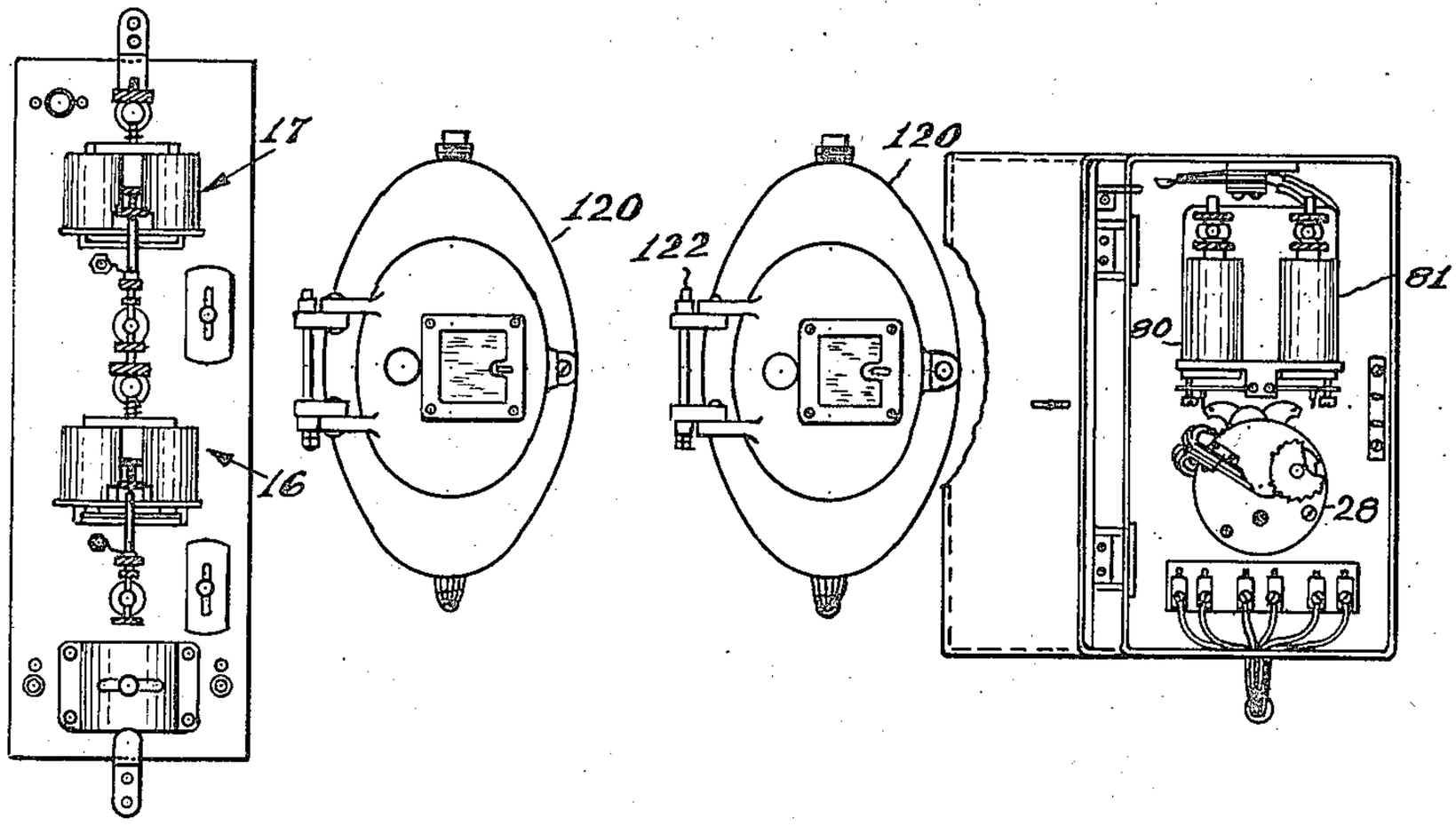


Fig. 13

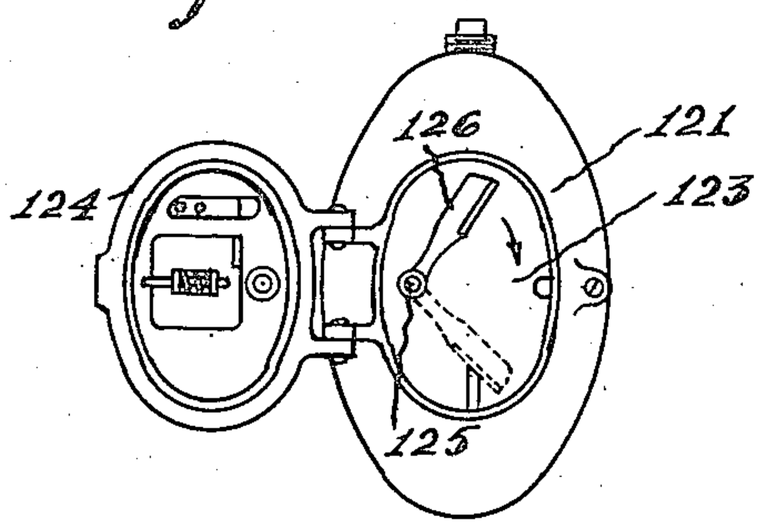
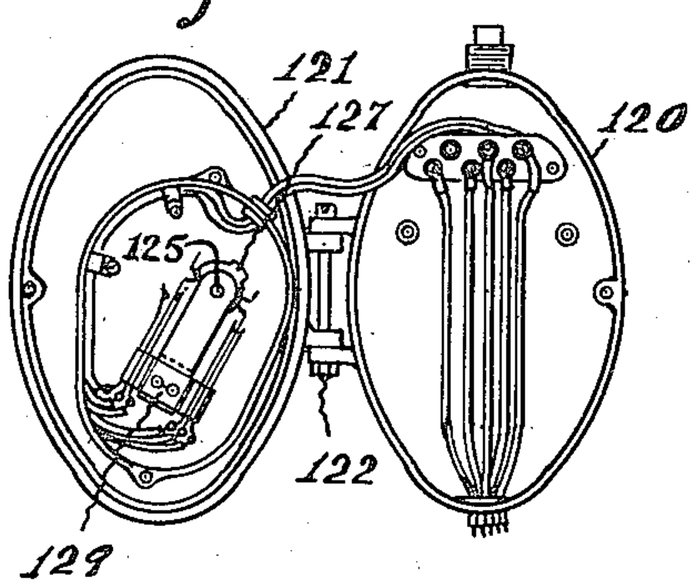


Fig. 14



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Patented Aug. 20, 1935 2,011,636

UNITED STATES PATENT OFFICE

2,011,636

ALARM OR SIGNAL SENDING SYSTEM

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Application January 3, 1930, Serial No. 418,328

18 Claims. (Cl. 177—369)

This invention relates to alarm or signal sending systems comprising a transmitter on the premises to be serviced, connected in a central station circuit and controlled by pull stations on the premises, though it is noted that the invention is not limited to features of the system as a whole but includes also features of the transmitter and pull stations.

One object of the invention is to provide an improved system of this kind having a single transmitter controlled by a plurality of inexpensive pull stations at various locations and connected to the transmitter by local circuits.

Another object of the invention is to provide a system of this kind which will operate with a break in one of the main lines and which will automatically send a signal should a break occur in a local circuit, while maintaining the local circuit operative for sending an alarm.

Another object of the invention is to provide an improved pull station for a system of this kind and an improved transmitter which will send a winding signal and other kinds of signals from a single winding.

Other objects of the invention are to improve generally the simplicity and efficiency of such systems and apparatus and to provide a system or apparatus of the kind stated which will be economical, durable and reliable in operation, and economical to manufacture and install.

Still other objects of the invention will appear as the description proceeds; and while herein details of the invention are described and claimed, the invention is not limited to these, since many and various changes may be made without departing from the scope of the invention as claimed in the broader claims.

The inventive features for the accomplishment of these and other objects are shown herein in connection with an improved alarm system which, briefly stated, includes a transmitter interposed between the pair of main line wires and including normally shunted electromagnets and a signal-wheel-operated switch interposed in the circuit, said transmitter including means whereby a short trouble signal is sent if one magnet is energized and a long alarm signal is sent when both have been energized.

A pair of local shunt circuits both passing through a series of pull stations normally short circuit and deenergize the magnets respectively, whereby if a break occurs in either local circuit one of the magnets will be energized and not shunted, thus causing a short trouble signal.

A lever operated switch assembly in each pull station is operable to break both shunts, thereby to send a long alarm signal.

In the accompanying drawings showing, by way of example, one of many possible embodiments of the invention,

Fig. 1 is a simplified diagram showing the circuits of the complete system;

Fig. 2 is a less simplified a less diagrammatic diagram showing the circuits of the transmitter, pull stations and central office;

Fig. 3 is a front elevation showing the transmitter and its housing;

Fig. 4 is a side elevation showing the transmitter clockwise;

Fig. 5 is a rear elevation of the clockwork;

Fig. 6 is an elevation, partly in section, showing the details of the transmitter control means;

Fig. 7 is a fragmental front elevation showing the rear pillar plate of the clockwork and parts of the transmitter control means in another position;

Fig. 8 is a side elevation of one of the tripping cams;

Figs. 9 to 12 are rear elevations showing different positions of the pull switch;

Fig. 13 is a front elevation of a pull box showing the lever compartment open;

Fig. 14 is a front elevation of a pull box showing the switch compartment open; and

Fig. 15 is a front elevation showing a group of all of the apparatus as exposed in use.

The herein signalling system may be used in connection with any usual or desired suitable arrangement of central office, such for instance as that shown very diagrammatically in Fig. 1 wherein a pair of main line wires 10 and 11 terminate in the central office in a pair of grounded legs 12 and 13 respectively.

Recording receivers 14 and 15 have relays 16 and 17 in said line wires respectively.

A generator 20 is interposed in one of the grounded legs 13 between the receiver and the ground.

A switch 21, used in case of a break in one of the main line wires, is provided, whereby both of said lines 10 and 11 may be connected to one terminal 22 of the generator, only the other terminal 23 remaining grounded, the relay 16 being ungrounded, thereby to send current of the same sign into both ends of the main line, the circuit to be completed through the grounds at the local stations only during operation of the transmitting or pull stations as will be explained.

A normally closed signal circuit is shown in-

cluding said pair of main line wires and one or a plurality of transmitters 25 interposed therein.

The main features of the system will first be very briefly described; and then the parts will be described in detail.

The system as a whole

The transmitter includes a pair of normally shunted and de-energized electromagnets 80, 81 and a signal-wheel-operated normally closed signal switch 100, 101, 102, the switch and magnet coils being adapted to be interposed in series in said circuit between said main line wires 10 and 11.

The transmitter 25 includes mechanism, which will be fully described, whereby a short winding signal is automatically sent whenever the transmitter is completely wound up, and means whereby an additional short trouble signal is sent if only one magnet 80 or 81 is energized and a long alarm signal is sent when both magnets have been energized.

The signal initiating system includes a normally closed testing or trouble switch 141, 142 having one member 141 connected to a part 150 of the main circuit between said magnets, and a double-shunt local circuit comprising a pair of associated local shunt circuits 104, 104', 105, 105', 106, 106', 107, 107' connecting said main lines 11 and 10 respectively to a binding post 140 and thence through a conductor 149 to the other member 142 of the trouble switch.

Said local shunt circuits pass through pull stations 108, 109, 110 and Figs. 9 to 12 normally short circuit the magnets 80, 81 respectively, whereby if a break occurs in either local circuit one of the magnets will become not shunted, but will be energized and a trouble signal will be sent.

Means 151, 153 carried by the transmitter cover serves for momentarily opening said trouble switch 141, 142 during closing movement of the cover, thereby to cause the energizing of both magnets 80, 81 and the sending of an alarm signal should the break in the shunt circuit be not repaired.

A pair of manually operated switches 131, 131, 130', 131' (Figs. 1 and 9 to 12) in each pull box box inserted in both circuits respectively are operated by a single lever to break both shunts, thereby to magnetize both magnets and send an alarm signal, said switches being constructed to ground both shunt circuits, one at a time only, thereby to energize said magnets 80, 81 through one circuit or the other if one of the main lines 10 or 11 be broken, thereby to send an alarm signal.

A cut-out switch means 111, 112, 113, 111', 112', 113' (Figs. 1 and 2 operated by the transmitter whenever the signal wheel rotates, serves to cut-out the double shunt circuit completely while the signal is being sent and to cause a direct shunt 104, 111, 113, 114, 113', 111', 104' connecting the main lines in series with the signal switch, thus to prevent the interference with any signals being transmitted by the trip box after a pull station has been once operated.

Now the various parts of the system will be described in detail.

The transmitter or trip box

The signal transmitter 25 (Figs. 3 to 8) comprises a clockwork 28 (Fig. 4) having springs 29, a winding arbor 30, a toothed signal or break wheel 31 thereon having two sets 32 of signal teeth, and an escapement 33 including an oscillatory escapement arbor 34 carrying fast thereon an oscillatory disk 35 carrying an engagement pin 36.

The detent mechanism

A pair of horizontally alined fulcrum blocks 38 (Fig. 6) fast on the inner face of the rear pillar plate 39 carry an inverted cross-shaped detent lever 40, 41 having horizontal members 42 journaled at their ends between said blocks 38, and a substantially vertical portion 40, 41 forming a short downwardly extended rounded engagement arm 41 and a long upper detent arm 40 provided with a detent pin 43 adapted to engage said engagement pin 36 when the detent arm is rocked frontwardly and said engagement arm 41 is rocked rearwardly.

A pin 45 (Fig. 5) projecting rearwardly from said detent arm into a hole in the pillar plate is surrounded by a weak spring 46 compressed between the pillar plate and detent arm to move the detent arm and pin frontwardly for stopping the clockwork.

An actuating member 48, 49 (Figs. 6 and 7) comprises a radial arm 48 fast on the winding arbor, and an arcuate rim 49 about 185 degrees in length co-axial with the arbor and engageable with said engagement arm 41 to hold the detent pin 43 rearward in releasing position and provided in its front face with a winding signal notch 50 and a trouble signal notch 51 both remote from the end of the rim and adapted to receive the engagement arm 41 to permit the detent pin 43 to move under the action of the weak spring to detent position.

Pins 53, 54 fast on the pillar plate and engageable by the radial arm limit the winding and unwinding movement of the engagement piece and winding arbor to about 180 degrees and serve to prevent the rim from disengaging the engagement arm at either end of the rim.

The winding signal notch 50 is spaced a sufficient distance from the engagement arm 41 when the clockwork is wound up, to cause the detent pin to be held disengaged until the signal wheel makes a half turn and sends one winding signal to indicate to the central office that the transmitter has been wound up.

The tripping levers

A horizontally elongated wire loop 57 fast on the upper end of the detent arm 40 has curved engagement end portions 58; and a pair of short spindles 59 journaled in the rear pillar plate below said portions respectively carry fast thereon normally raised tripping levers 60, 61 adapted to pivot downwardly toward each other to the position of Fig. 5, and each provided with a tripping cam 63 adapted to be disposed outside of and to clear the loop 57, as at the left of Fig. 6 when the lever is in upright position and when the lever moves downwardly to engage the front face of one of said engagement portions 58, force back the loop and detent pin and pass inwardly of the engagement portion, and to clear the engagement portion after the tripping lever has moved to its lowest position of movement, thereby to momentarily release the detent pin from the engagement pin to permit the notch to move away from said engagement arm so that an unnotched portion of the rim 49 will cause the detent to move back.

Springs 65 (Fig. 5) mounted on the rear of the pillar plate respectively engage downwardly pointed radial arms 66 on each of said spindles for yieldably moving inward the upper ends of the tripping levers, the movement of the springs being

limited by plate members 67, gravity completely lowering the tripping levers.

Each tripping cam 63 has an outer slanting cam face 69 (Fig. 8) to cam past the engagement portion 58 when the tripping lever is reset, and an inner slanting cam face 70 to engage the engagement portion 58, when the tripping lever falls, to release the detent, and an inner abrupt face 71 to engage the outer face of the engagement portion to hold the cam against further inward movement until the notch 50 or 51 of the arcuate portion has time to move away from the engagement arm to cause the unnotched portion of the arcuate member to hold back the loop then to permit the tripping cam to pass inward.

The tripping magnets

A horizontally disposed plate 74 (Fig. 3) pivoted above each tripping lever carries an armature 75 and a downwardly projecting retaining pin 76 engaging a projection 77 or each tripping lever to hold the lever upright when the armature is lowered; and an electro-magnet 80, 81 over each armature is adapted when energized to raise the associated armature and release the tripping lever. Behind the magnets 80, 81 are similar magnets as indicated diagrammatically in Fig. 2, but hereinafter each magnet and the one behind it will be considered as one magnet.

Said tripping levers respectively have on the upper end thereof, inner extensions 82, 83 (Figs. 5 and 6) adapted to occupy a common space when either tripping lever is lowered to its lowest position and when in said space to prevent the entrance thereto of the other extension, thus to hold the other tripping lever in an intermediate position nearly as low as its lowest position, each tripping cam having thereon a projection 84 adapted to pass the engagement portion 58 of the loop when the cam passes to its lowest position, but adapted, when its tripping lever is in said intermediate position, to engage the engagement portion 58 and hold the detent pin 43 disengaged whereby when both magnets have been energized and both tripping levers lowered, as in Fig. 5, the transmitter will run down completely.

Tripper-lever resetting means

A short shaft 86 (Fig. 5) projecting through the rear pillar plate 39 carries fast thereon an intermediately fulcrumed lever 87 disposed against the inner face of the pillar plate and provided under the fulcrum point with a downward projection 88 and having its arms slightly upturned and engaged under rollers 89 inwardly eccentrically mounted on the tripping levers respectively.

The actuating member rim 49 (Figs. 6 and 7) has a cam projection 90 on its peripheral face engageable with said downward projection 88 to move the downward projection 88 in one direction as the transmitter is nearly rundown, thereby to raise one upturned end and associated roller 89 and tripping lever 61, and engageable with said downward projection to move it in the opposite direction and raise the other tripping lever 60 as the rewinding is starting.

A downwardly and frontwardly extending arm 91 fast on the rear part of said short shaft 86 is engaged by a pair of vertical springs 92 having their lower ends mounted on the pillar plate and their upper ends pressing upon opposite sides of said short shaft and said arm 91, to yieldably press the lever 87 to mid-position, the shaft limiting the inward movement of the springs.

Operation of the transmitter clockwork

If after the winding signal, while the arm 41 is still received in the notch 50, a break develops in one of the local circuits 105, 106, 107 or 105', 106', 107', one of the electromagnets 80 or 81 will become not shunted and energized, thus raising an armature 75 permitting to fall one of the levers 60 or 61. If, for instance, the lever 61 falls, the face 70 (Fig. 8) of the tripping cam 63 engages the loop portion 58 and forces back the detent lever 40 and pin 43 against the action of the spring 46, until the engagement portion 58 rests against the abrupt face 71, thus preventing the further fall of the tripping lever 61 and holding the detent pin 43 disengaged until notch 50 moves from the arm 41 and the unnotched portion of the rim 49 engages the arm 41 and pushes the arm 41 further forward and the arm 40 further back, to cause the portion 58 to clear the face 71 (Fig. 8) and let the trip lever drop to the lowest position.

When the unnotched portion of the rim 49 is thus engaged, it holds the detent pin 43 in releasing position until the next notch 51 receives the arm 41, thus permitting the pin 43 to stop the escapement after one trouble signal has been sent.

When the transmitter is rundown, the actuating member 48, 49 is in the position indicated by the dotted lines 48' (Fig. 6). In winding up completely, the operator applies the key and turns the winding arbor until the arm 48 takes the position 48'' with one end 49' (Fig. 7) of the rim 49 close to the arm 41. The operator then releases the key and the member 49 moves 30 degrees to the position of Fig. 7, thus rotating the signal wheel a half turn, thus sending one signal, which is interpreted at the central office as a winding signal, showing that the transmitter was completely wound up.

When the end 49 is adjacent to the arm 41, the unnotched portion of the rim 49 holds the arm 41 frontward and holds the detent pin 42 disengaged from the pin 36, and the transmitter runs until the arm 41 is received in the notch 50 permitting the spring 46 to cause the detent pin 42 to stop the escapement, thus sending the one winding signal.

If no trouble signal is sent and a pull station lever is pulled next after the winding signal while the arm 41 is in the notch 50, both shunt circuits will be broken, both magnets will be energized, and both trip levers will fall. It is not practically possible that both levers should reach the lowest limit at the same instant, and one lever, for instance the lever 60, will reach the lower limit first, and the extension 82 of the lever 61 will later rest on the extension 83 of the lever 60 and hold the projection 84 (Fig. 8) in engagement with the adjacent loop portion 58 and hold back the detent arm 40 and prevent the entrance of the arm 41 into the recess 51 as the latter moves to the arm 41, thus preventing the stopping of the clockwork until the latter is completely run down and a long alarm signal is sent.

If after a trouble signal and the lowering of one trip lever, caused by the energization of one magnet, the other or both magnets be energized, the trip levers will take a position, for instance as in Fig. 5, and the transmitter will rundown completely and send a long alarm, one signal less in number than if a trouble signal had not been sent.

The usual ratchet 94 (Fig. 7) fast on the winding arbor is engaged by a pawl 95 on the main

drive wheel 96. The teeth of the ratchet are sixty degrees apart and the signal wheel gives two complete signals when the winding arbor unwinds the angle between adjacent ratchet teeth. If the arbor be wound up less than one tooth the pawl will not catch on a new tooth and no signal will be sounded. If the arbor is wound up as much as one tooth and less than two teeth, two signals will be sounded showing the office that the transmitter was not completely wound up. If the arbor be wound up as much as the distance of two teeth, the engagement arm 41 will be received in the trouble notch; no signal will be sent, and the main office will want to know why. If the arbor be wound up more than two and less than three teeth, no ratchet will engage the pawl and the winding arbor will move freely back to the trouble notch position and no signal will be sounded. Only when the arbor is wound the distance of three full teeth can one signal as distiguished from two signals be sent, thus indicating positively that the transmitter is fully wound. If the winding up signal has been given, a second rewinding will not cause the pawl to be engaged and no further signal will be then given.

From the above, it will be seen that after an alarm, the only way possible to send a winding signal (a single signal) is to completely wind the arbor.

The signal switch

Associated with the signal wheel 31 is a normally closed signal switch 100, 101, 102 (Fig. 2) comprising a pair of spring contacts 100, 101 respectively connected to the main line wire 11 and a conductor 103 connected to the magnet 80. A spring contact pen 102 normally engages said contacts to close the main line circuit, and is engageable with the grounded signal wheel 31 to break the main line circuit in normal signalling or to connect the main line wires through the frame or a conductor 160 to the ground for signalling through the ground and either one of the main line wires if the other main line wire should be broken.

The pair of pairs of releasing electro-magnets 80, 81 are interposed in series between the lines 10 and 11 substantially near the normally closed signal switch, whereby said magnets whenever the current is not shunted around them, will be energized by the main line current to raise the armatures 75 to permit signalling, and whereby when the magnets are shunted or short circuited the magnets will not be energized, armatures 75 will not be lifted and no signal will be sent.

The pull-station cut-out

The signal initiating system for short circuiting the one or more magnets comprise a normally closed double shunt circuit 103, 104, 105, 106, 107 and 104', 105', 106', 107' (Figs. 1 and 2) normally connecting the magnets and signal switch, a plurality of grounding pull stations 108, 109, 110 interposed in said shunt circuits, and a cut-out switch mechanism 111, 112, 113, 111', 112', 113' operative during signal transmitting for maintaining the magnets short circuited and completely cutting out the shunt circuit to prevent interference by the ground of the stations with the signal transmission.

Each cut-out mechanism comprises shunt springs forming a double throw cut out switch comprising intermediate spring contact members 111, 111' connected by conductors 104, 104' respectively to the ends of the main lines 11 and 10 adjacent to the magnets.

Said intermediate members 111, 111' respectively normally engage spring shunt contact members 112, 112' connected to opposite ends 105, 105' of said local line respectively, whereby the local line normally shunts the current around the magnets 80, 81 and leaves them de-energized and the armatures down.

Short circuiting spring contact members 113, 113' are electrically connected to each other by a conductor 114 and have their contact ends operatively associated to each other by an insulating block 115 and are normally disengaged from said intermediate members 111, 111'.

An insulating shunt-cut out disk cam 117 fast on the signal arbor is provided with a pair of diametrically opposite recesses 118, and is engageable by the short circuiting member 113' formed as a pen normally engaging in one of said cam recesses 118 while the signal wheel is disengaged and while the transmitter is normally stationary, and adapted to be engaged by the periphery of the cam 117 when rotating, and when the signal is being transmitted, to move the ends of the short circuiting members 113, 113' and cause them to engage the intermediate members 111, 111' to electrically shunt the line around the magnets and to push the intermediate members from the normally engaged shunt members 112, 112', thereby to cut out the local double shunt circuit completely while the signal is being sent to prevent possible interference of the grounds with the signal.

The pull boxes

Each pull station comprises a main housing 120 (Fig. 14) including a front wall 121 hinged at 122 thereto and formed with a front compartment 123 (Fig. 13) having a door 124.

A pull lever shaft 125 passing through the wall 121 carries a pull lever 126 fast on its front end and a cam 127 fast on its rear end, suitable well known means (not shown) normally yieldably raising the lever and limiting the movement of the lever and cam.

Pull station switches

An insulating bracket 129 (Fig. 9) on the inner face of the wall 121 below the cam 127 carries a pair of jacks respectively comprising normally engaged inner contact springs 130, 130' and cam-engaging intermediate active springs 131, 131' having normally inter-engaging contacts thereon and forming a normally closed local-shunt-line switch, and also outer grounded springs 132, 132' adapted to be contacted by the active spring respectively when the latter are forced outwardly.

Each active spring 131, 131' has its outer end portion 133, 133' curved to form an engagement portion engageable with the cam 127.

Said cam 127 has diametrically opposite normally engaged portions 135, 135' of small radius adapted to receive the engagement portions 133, 133' to let the active springs touch both inner springs respectively when the lever is in normal raised position as in Fig. 9.

As the lever is moved downward, the portions 133, 133' are engaged by a pair of diametrically opposite circuit breaking inclined portions 136, 136' respectively, as in Fig. 10, for simultaneously breaking both circuits as the lever is lowered, thus to break both shunt circuits 105, 105', 106, 106', 107, 107'.

Diametrically opposite land portions 137, 137'

(Fig. 11) respectively of intermediate and maximum radius, adjacent to said inclined portions engage said engagement portions 133, 133′ respectively as the lever is further lowered, one of said land portions 137′ having a radius sufficient to hold open the associated local switch 130′, 131′ and to cause one active spring 131′ to engage the associated grounded spring 132′, the other land portion 137 having a radius only sufficient to open the adjacent local switch without causing the active spring to engage the associated grounded spring 132, as in Fig. 11.

Final portions 138, 138′ respectively engage the active springs when the lever is in final down position and have radius respectively equal to but reversed to that of the land portions 137, 137′ for causing the other active spring 131 to be grounded leaving the switch 130′, 131′ open as in Fig. 12.

The double shunt circuit

The double shunt circuit comprises an intermediate binding post 140 (Figs. 1 and 2) connected by the pair of shunt circuits to said main lines respectively.

Said shunt circuits comprise conductors 105, 105′ respectively connecting said shunt contact members 112, 112′ to active springs 131, 131′ respectively of the pull station 108, conductors 106, 106′ respectively connecting the normally engaged inner contact springs 130, 130′ of said stations except the last station 110 to the respective active springs 131, 131′ of the next station 109, 110, and conductors 107, 107′ connecting the normally engaged contact springs 130, 130′ of the last station with said binding post 140.

The testing switch

A normally closed testing switch 141, 142 (Figs. 1 and 3) mounted on the inner face of the top wall 143 of the transmitter housing 144 comprises normally interengaged upper and lower insulated contact springs 141, 142 mounted on said face, the lower spring 142 having a projecting end 145 projected beyond the upper spring and having a frontwardly and downwardly inclined lip 146.

Conductors 148, 149 respectively connect said upper and lower springs 141, 142 to the part 150 of the main circuit between said magnets and said binding post 140.

An insulated blade 151 mounted on the cover 152 of the transmitter housing has a free-end lug 153 adapted, during door-closing movement, to cam over said projecting end 145 and to momentarily open the switch, and to cam under said end 145, without opening the switch, during door-opening movement.

Operation of the system

Under normal conditions, the system is on a closed unbroken main line circuit and the current flows through the shunt circuit 105, 106, 107, 105′, 106′, 107′, short circuiting the magnets, which are thus deenergized.

When the clockwork is rewound, both trip levers are automatically raised, a winding signal is sent, leaving the member 48, 49 in the position of Fig. 7.

If an alarm is to be sent, the pull lever 126 (Fig. 13) is lowered, thus breaking both shunt circuits at the springs 130, 131 and 130′, 131′, as at the switch 108 (Figs. 1 and 10), thus causing both magnets to be energized and both trip levers to fall, sending a long alarm.

If a break should occur in, either shunt circuit, for instance in the conductor 105 (Fig. 1), no current could flow through the shunt circuit 105, 106, 107, 140, 149, 142, 141, 148, 150 and the magnet 80 would be not short circuited and would be energized, the trip lever 61 would fall and a trouble signal would be sent, leaving the other trip lever 60 raised and the arm 41 (Fig. 7) received in the notch 51.

If after this break and trouble signal, the break be not yet repaired, an alarm may still be sent in the usual way, by pulling the lever 126, causing the switch 130′, 131′ to open, breaking the shunt circuits 105′, 106′, 107′, 149, 148 around the magnet 81, thus dropping the remaining trip lever and sending an alarm.

If after the break in the shunt circuit and the consequent trouble signal, the break be not repaired, the subsequent winding of the transmitter will send a winding signal and trouble signal, then the subsequent closing of the transmitter cover, will open the trouble switches 141, 142 and cause the conductors 148, 149 to be removed from the double shunt circuit, whereupon the two shunt circuits form a single shunt circuit 104, 105, 106, 107, 107′, 106′, 105′, 104′. If a single element of this circuit be broken, the magnets are no longer shunted and both become energized on the opening of the switch 141, 142, thus causing the transmitter to run down on closing the transmitter cover, thus calling further attention to the fact that the break still exists.

If there should develop a break in one of the main line wires 10 or 11, the switch 21 (Fig. 1) would be moved to the position of the dotted lines, sending current of the same sign into both ends of the main line, to cause signal current to pass through the contact member 100 or 101, the pen 102, the signal wheel 31, the frame or conductor 160 to the ground.

Under such circumstances the transmitter is normally on open circuit and current must be led through the magnets if an alarm is to be sent. If, for instance, the break is in the line 11 between the transmitter and the central office, the partial lowering of the lever, breaks the shunt circuits as at the dotted lines station 108 and at a later instant closes the contact between springs 131′, 132′ as shown by the dotted lines at station 109, thus connecting the line 11 to the pull box frame or conductor 161′ to the ground. This, however, does not energize the magnets, as the current would take the short circuit through 104′, 105′, 106′. When, however, further movement of the lever 126 causes contact between the springs 131, 132 as at the dotted line in station 110, and current will pass through line 10, magnets 81, 80, conductors 104, 105, 106, springs 131, 132 of station 110, conductor 161 to the ground, thus energizing both magnets and sending an alarm.

If the break is in line wire 10, pulling of the lever causes current in wire 11, the magnets, conductors 104′, 105′, 106′, springs 131′, 132′, and the ground.

If in either of the above cases, the operator should hold the lever 126 in position to close the switch 131, 132 or 131′, 132′, the operation of the cam 117 (Figs. 2 and 3), would open switches 111, 112 and 111′, 112′ (Fig. 1 and close switches 111, 113 and 111′, 113′, shunting the double shunt current through the direct shunt 114 during the actual sending of the signal, so that the signal current could never be led off through the grounds 161 or 161′ instead of through the grounded signal wheel.

I claim as my invention:

1. In combination, a pair of main line wires; a

transmitter interposed therebetween including a normally shunted electromagnet, a grounded signal wheel, a switch in one main line wire operable by the wheel, said transmitter including means whereby a signal is sent if the magnet is energized; a plurality of pull stations; a local shunt circuit short circuiting the magnet; and a switch assembly in each pull station having grounded members operable to break the shunt and to apply the grounded members respectively to points of the shunt on both sides of the break.

2. In combination, a pair of main line wires; a transmitter interposed therebetween including normally shunted electromagnets and means whereby a signal is sent, through the wires or one wire and the ground, if a magnet is energized; a plurality of stations; circuits short circuiting the magnets respectively; and a switch in each station operable to break said circuits, and ground the circuits respectively at different times.

3. In combination, a transmitter operative through a ground; a plurality of stations; a pair of local lines connecting the stations and transmitter; means in the stations for breaking both lines; means for causing the transmitter to signal if one of said lines break; means for causing another signal if the other line is broken; means for grounding both of said lines; and means for causing a signal if one of said lines is grounded.

4. In combination, a transmitter operative through a ground; a plurality of stations; a line connecting the stations to the transmitter; means in the stations for breaking the line; means for causing the transmitter to signal if said line breaks; means in the stations for applying a ground to said line when broken; means for causing a signal if said line is grounded; and means for separating the grounded portion of the line from the transmitter during signalling.

5. In combination, a pair of main line wires; a transmitter interposed therebetween including a normally shunted electromagnet and grounded means whereby a signal is sent in part through the ground if the magnet is energized; a plurality of stations; a shunt short circuiting the magnet; a switch in each station operable to break the shunt and ground both sides of the break; and means operable to short circuit the grounded shunt during signal sending.

6. In combination, a pair of main line wires; a transmitter including an electromagnet connected between said lines and means whereby a signal is sent when the magnet is energized; a plurality of stations; a shunt circuit shunting said magnet and passing through the stations; a switch in each station operable to break the shunt; and means operable by said transmitter to disconnect both ends of the shunt circuit from the magnet during transmitting.

7. In combination a transmitter; a circuit controlling the transmitter; a casing for the transmitter having a door; a testing means for said circuit; and means for operating the testing means when door is operated.

8. A system comprising a pair of main line wires; a transmitter including an electromagnet interposed between said main line wires and means whereby a signal is sent when the magnet is energized; a local shunt circuit connecting the main lines; a normally closed local station switch adapted when operated to break the shunt; and a normally closed trouble switch connected in series in said shunt circuit for causing the transmitter to give a signal when the trouble switch is opened and the shunt is broken; a casing for the transmitter having a door; and means for momentarily opening said trouble switch when the door is closed.

9. In combination a pair of main line wires; a transmitter including an electromagnet interposed between said main line wires and means whereby a signal is sent when the magnet is energized; a normally closed trouble switch having one member connected to one line wire near said magnet; a plurality of stations; a local shunt circuit connecting the main lines to the other member of the trouble switch and passing through the pull stations, thereby short circuiting the magnet; a switch in each station adapted when operated to break the shunt; and means including a magnet shunted by said trouble switch when closed, for causing the transmitter to give an additional signal when said last named magnet is energized.

10. In combination, a pair of main line wires; a transmitter including a signal wheel switch in one main line wire and electromagnets connected in series between said lines to form a signal circuit; said transmitter including means whereby one signal is sent if either magnet only is energized and a long signal is sent when both are energized; pull stations; a pair of local shunt circuits connecting said main lines respectively to the signal circuit between said magnets and passing through the pull stations; a switch assembly in each station operable to break both shunts; and means operated by the transmitter to cut out said local circuits and direct shunt the magnets until a complete signal is transmitted.

11. In combination, a pair of main wires; receiver means connected thereto and adaptable for closed circuit operation or grounded open circuit operation; a transmitter including a normally closed signal switch in one line wire, a grounded signal wheel normally out of contact with the switch, electromagnets interposed in series between said main line wires to form a signal circuit; means whereby one signal is sent if either magnet only is energized and a longer signal is sent when both are energized; pull stations; a pair of local shunt circuits connecting said main lines respectively to the part of the main circuit between said magnets and passing through the pull stations; a switch assembly in each pull station adapted when operated to break both shunts and to ground both shunt circuits, one at a time; and cut-out means operated by the transmitter when the signal wheel rotates, to cut-out the shunt circuits and to direct shunt the magnets.

12. In combination, a pair of main wires; receiver means connected thereto and adaptable for closed circuit operation or grounded open circuit operation; a transmitter including a normally closed signal switch in one line wire, a grounded signal wheel normally out of contact with the switch, electromagnets interposed in series between said main line wires to form a signal circuit, means whereby a short signal is sent if either magnet only is energized and an additional signal is sent when both magnets have been energized; a normally closed trouble switch having one member connected to the main circuit between said magnets; a plurality of stations; a pair of local shunt circuits connecting said main lines respectively to the other member of the trouble switch and passing through the pull stations; and a switch assembly in each pull station adapted when operated to break both shunts and to ground both shunt circuits.

13. In combination, a source of current having

a grounded and an ungrounded terminal; a pair of main lines wires extending respectively from said terminals; means for connecting both wires to the ungrounded terminal only; receiving means operated by impulses in said wires; a transmitter including a pair of normally deenergized electromagnets having their coils in series between said wires; a normally closed code switch in one wire; means set in operation by the transmitter when either electromagnet only is energized to intermittently ground and open the switch to send one signal, and to send an additional signal when both magnets are energized; local stations; loops passing from the respective lines through said stations to the conductor between said magnets, thereby shunting and deenergizing the coils; a unitary movable manual operating means at each station; means operated by a single stroke of the operating means for successively breaking the loops and then successively grounding only that portion of the loops connected to the lines; and means operated by the transmitter for shunting said coils and disconnecting the loops from transmitter only during transmitting.

14. In combination, a source of current having a grounded and an ungrounded terminal; a pair of main line wires extending respectively from said terminals; means for connecting both wires to the ungrounded terminal only; receiving means operated by impulses in said wires; a transmitter including a pair of normally deenergized electromagnets having their coils in series between said wires; a normally closed code switch in one wire; means set in operation by the transmitter when either electromagnet only is energized to intermittently ground and open the switch to send one signal, and to send an additional signal when both magnets are energized; local stations; a conductor connected between said coils; loops passing from the respective lines through said stations to said conductor thereby shunting and deenergizing the coils; means for breaking the loops and then successively grounding only the portion of the loops connected to the lines; and means operated by the transmitter when transmitting for shunting said coils and disconnecting the loops from transmitter only during transmitting.

15. In combination, a source of current having a grounded and an ungrounded terminal; a pair of main line wires extending respectively from said terminals; means for connecting both wires to the ungrounded terminal only; receiving means operated by impulses in said wires; a transmitter including a pair of normally deenergized electromagnets having their coils in series between said wires; a normally closed code switch in one wire; means set in operation by the transmitter when either electromagnet only is energized to intermittently ground and open the switch to send one signal, and to send an additional signal when both magnets are energized; local stations; a door for the transmitter; a normally closed trouble switch having one element connected between said coils; means operated by the door for opening the trouble switch whenever the door moves closed; loops passing from the respective lines through said stations to the other element of said switch, thereby shunting and deenergizing the coils; manual operating means and means operated by the operating means for breaking the loops and then successively grounding only the portion of the loops connected to the lines; and means operated by the transmitter for shunting said coils and disconnecting the loops from transmitter only during transmitting.

16. In combination, a pair of main line wires; a transmitter interposed therebetween including adjacent electromagnets and a signal wheel switch connected in series between the main line wires; said transmitter including means whereby one signal is sent if one magnet is energized and an additional signal is sent when both magnets have been energized; a pair of local shunt lines connected to said main lines respectively adjacent to said magnets; normally closed local-station switches in said shunt lines; and means normally connecting the outer end portions of said shunt lines to a point in the main circuit between said magnets and operable to disconnect said outer end portions from said point while holding said outer ends connected to each other.

17. In combination, a pair of main line wires; a transmitter interposed therebetween including adjacent electromagnets and a signal wheel switch connected in series between the main line wires; said transmitter including means whereby one signal is sent if one magnet is energized and an additional signal is sent when both magnets have been energized; a pair of local shunt lines connected to said main lines respectively adjacent to said magnets; normally closed local-station switches in said shunt lines; and means normally connecting the outer end portions of said shunt lines to each other and to a point in the main circuit between said magnets, said means being operable to disconnect said outer end portions from said point while said outer ends are still connected to each other.

18. In combination, a source of current having a grounded and an ungrounded terminal; a pair of main line wires extending respectively from said terminals; means for connecting both wires to the ungrounded terminal only; receiving means operated by impulses in said wires; a transmitter including a pair of normally deenergized electromagnets interposed in series between adjacent end portions of the wires, a transfer switch associated with each wire, each having a normally engaged contact, a normally disengaged contact, and a transfer element connected to the end of the associated wire; a normally closed code switch in one wire between the receiving means and the magnets; means set in operation by the transmitter when either electromagnet only is energized to intermittently ground and open the switch to send one signal, and to send an additional signal when both magnets are energized; a conductor connected between said coils; local stations; loops passing from the respective normally engaged contacts through said stations to said conductor thereby shunting and deenergizing the coils; means for breaking the loops and then successively grounding only the portions of the loops connected during the break to the normally engaged contacts; a conductor in the transmitter connecting said normally disengaged contacts; and means operated by the transmitter for transferring said transfer elements to the normally disengaged contacts for shunting said coils and disconnecting the loops from the transfer element only during transmitting.

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