J. H. GARRATT & W. J. McGIVERN.

FIRE ALARM SYSTEM.

APPLICATION FILED FEB. 2, 1905.

961,853. Patented June 21, 1910.

6 SHEETS—SHEET 1.

Fig. 1.

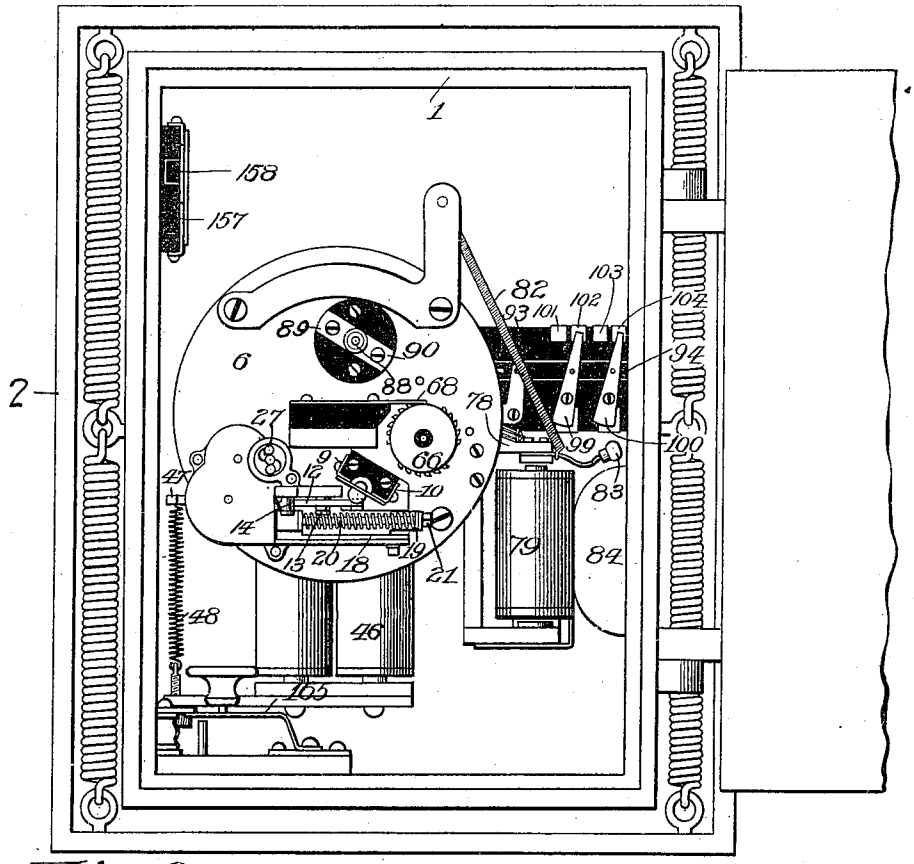



Fig. 6.

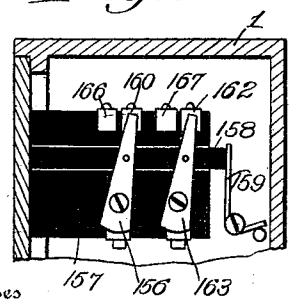
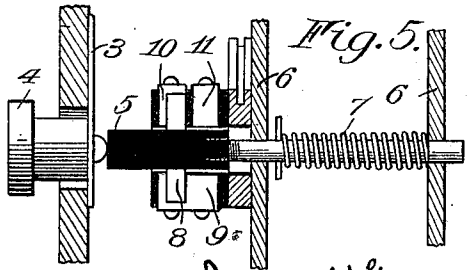



Fig. 5.

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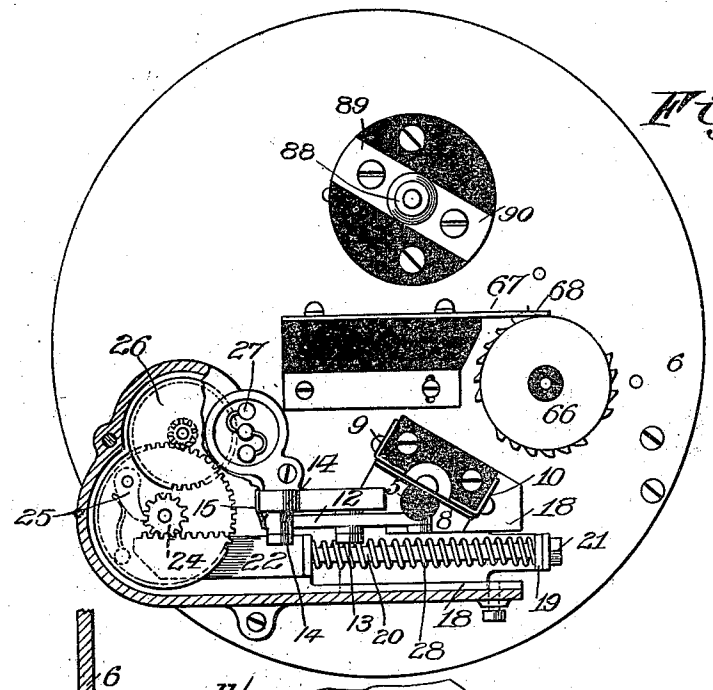
6 SHEETS—SHEET 2.

Fig. 2.



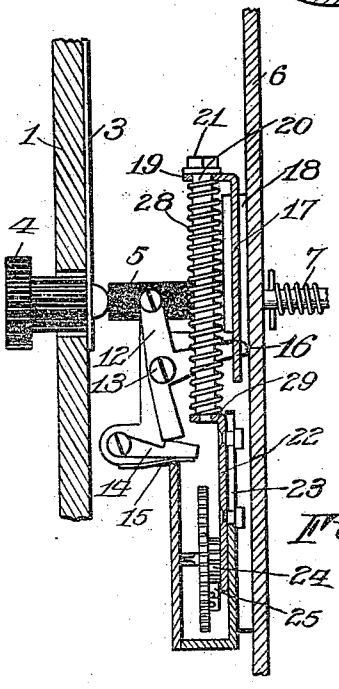




Fig. 4.

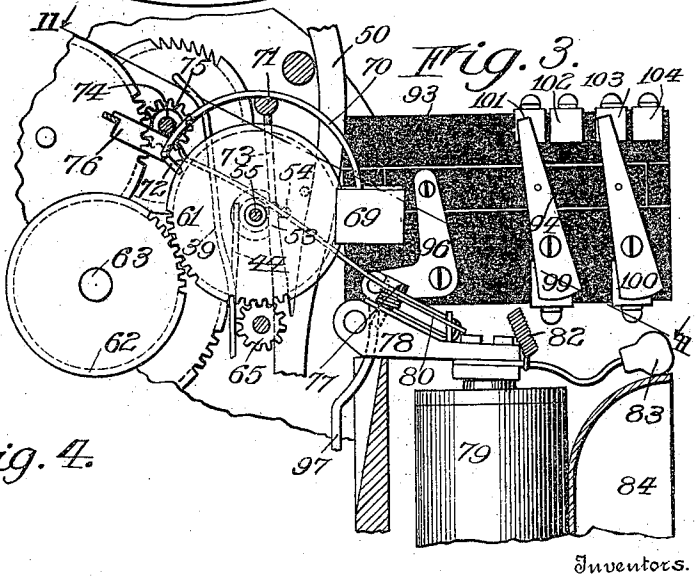



Fig. 3.

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6 SHEETS—SHEET 3.

Fig. 7.

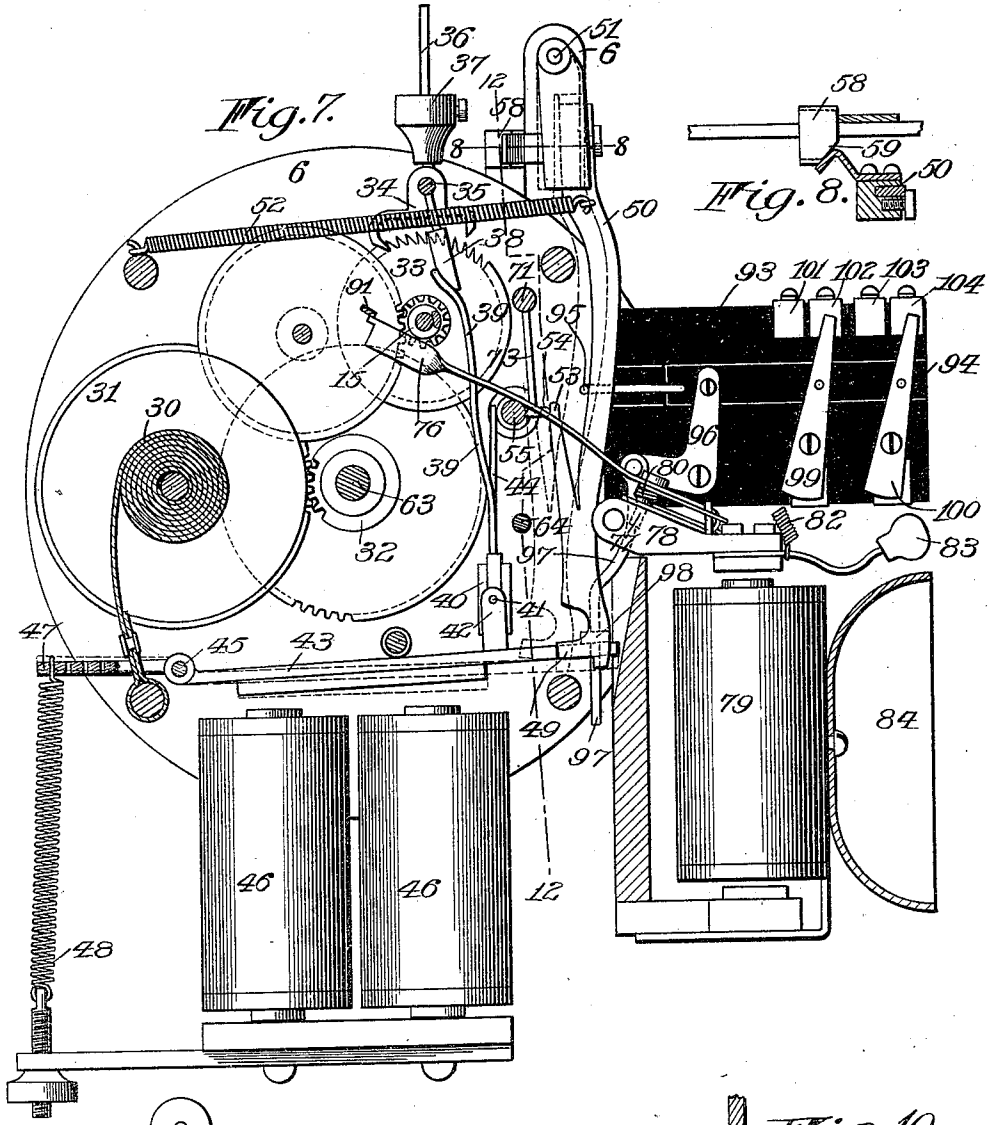



Fig. 8.




Fig. 9.

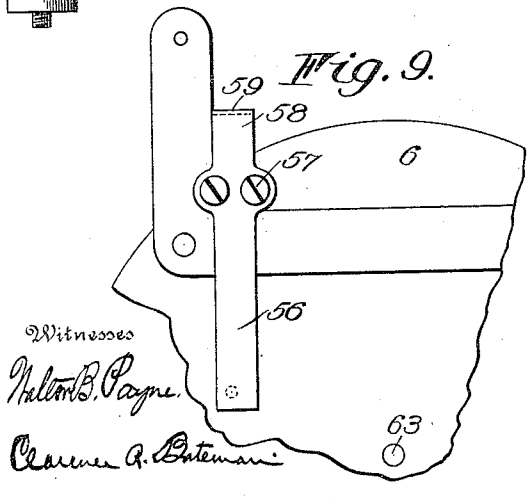
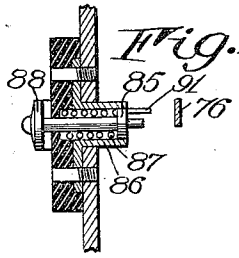



Fig. 10.

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6 SHEETS—SHEET 4.

Fig. 13.

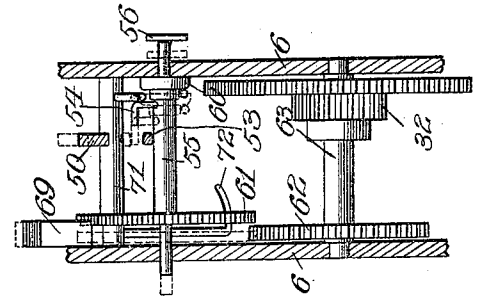



Fig. 12.

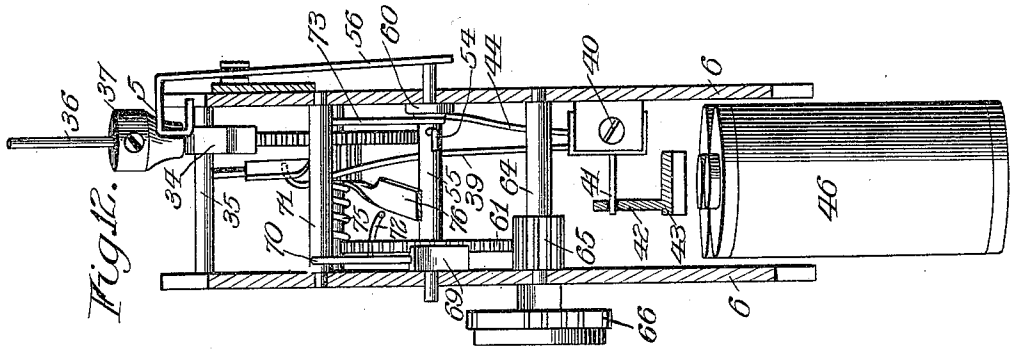
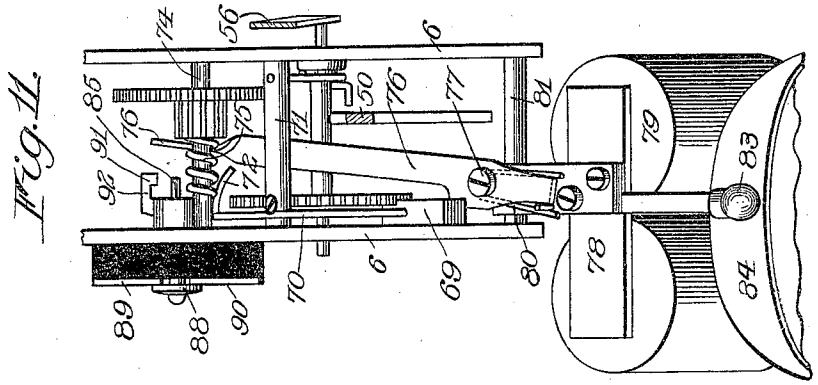



Fig. 11.

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6 SHEETS—SHEET 5.

Fig. 14.

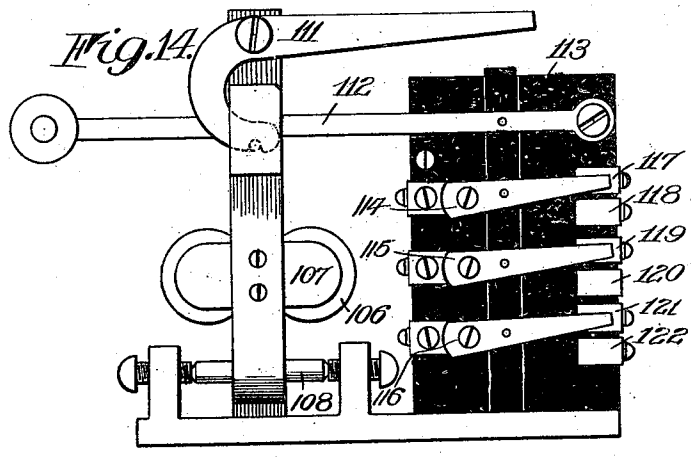



Fig. 16.

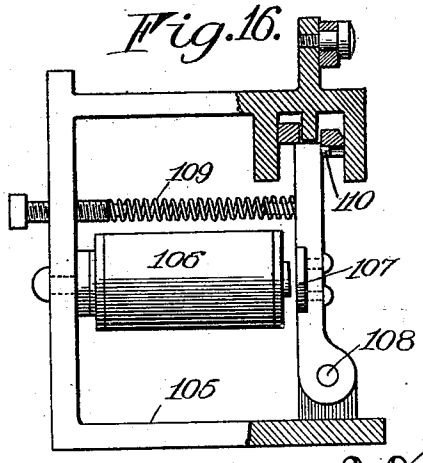



Fig. 15.

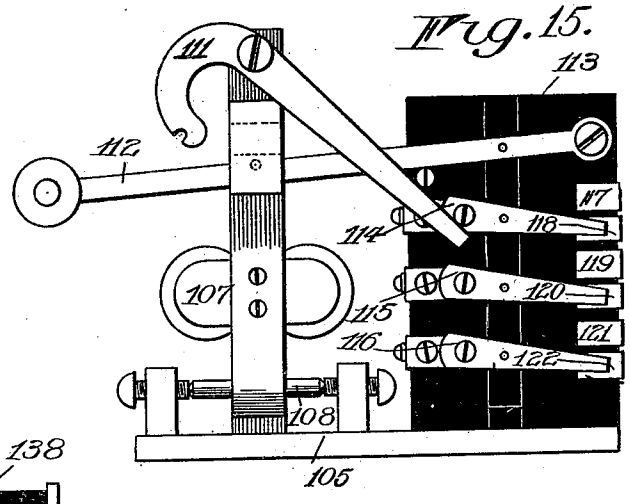
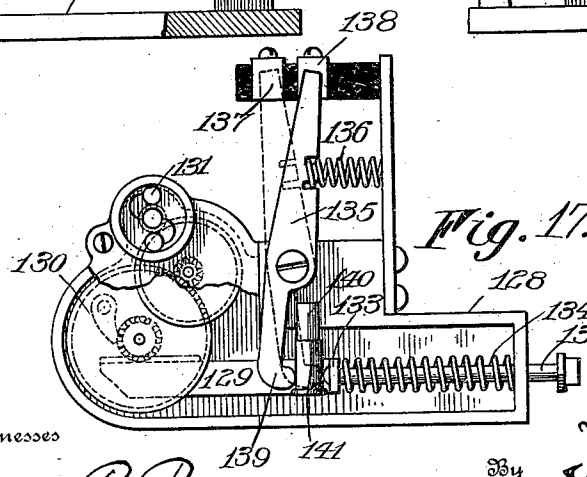



Fig. 17.

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6 SHEETS—SHEET 6.

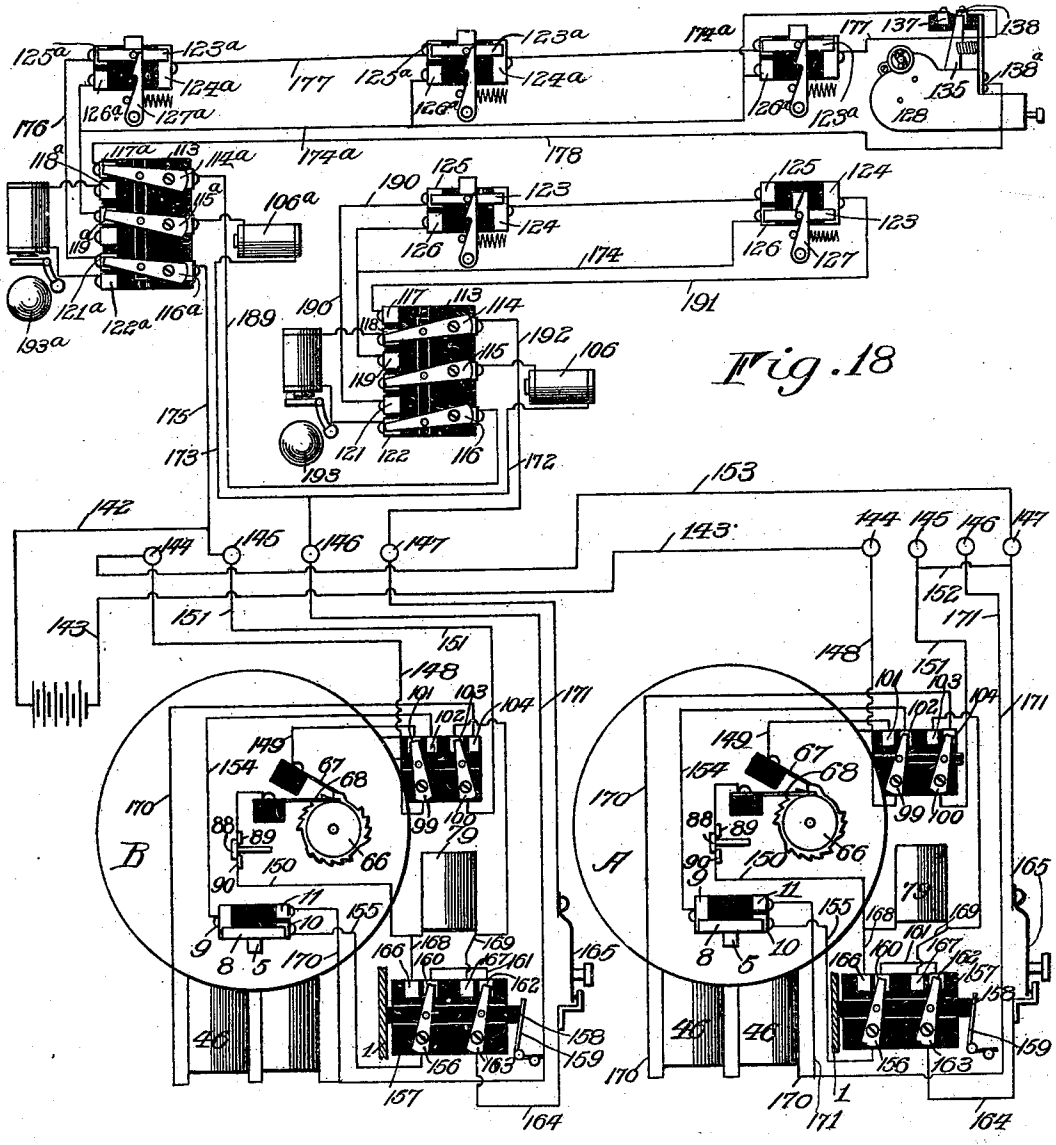

Fig. 18

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# UNITED STATES PATENT OFFICE.

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## FIRE-ALARM SYSTEM.

961,853. Specification of Letters Patent. **Patented June 21, 1910.**

Application filed February 2, 1905. Serial No. 243,844.

*To all whom it may concern:*

Be it known that we, JAMES H. GARRATT and WILLIAM J. McGIVERN, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Fire-Alarm Systems; and we do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing and to the reference-numerals marked thereon.

Our present invention relates to improvements in fire alarm systems, and particularly of that kind wherein a plurality of boxes are located on the same circuit, and it is the object of our invention to provide a system of this kind wherein the operation of one of the boxes will control the circuit to the exclusion of the others until the complete alarm or signal is sent in, and should another box be released either simultaneously with or during the operation of the first box, the signal from the second box will be delayed until the operation of the first box has been completed, at which time the second box will assume control of the circuit and will send in its corresponding signal.

It is a further object of our invention to provide an auxiliary system which is particularly adapted to be employed in conjunction with a system of this kind which contains suitable devices by means of which a signal from a building or from points removed from the box may be sent in through the latter, and it is a further object to provide devices for automatically resetting the boxes and the controlling devices in the auxiliary system.

To these and other ends the invention consists in certain improvements and combinations of parts all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings: Figure 1 is a front elevation of a fire alarm box constructed in accordance with our invention, the doors or closures being opened. Fig. 2 is a detail view with the parts in section of a portion of the mechanism removed from the box. Fig. 3 is a fragmentary view on an enlarged scale showing the circuit controlling means and the contiguous parts. Fig. 4 is a fragmentary sectional view of the press button for releasing the box and the time controlled device for resetting the button. Fig. 5 is a detail view partly in section showing the switch which is operated by the press button. Fig. 6 is a sectional view through the box or casing showing the cut-out which is controlled by the door of the box. Fig. 7 is a central vertical sectional view of the actuating train and the releasing mechanism showing the circuit controlling devices attached thereto. Figs. 8 and 9 are detail views of a spring setting device which may be employed in establishing operative relation between the actuating train and the break wheel, Fig. 8 being a section on the line 8—8 of Fig. 7. Fig. 10 is a sectional view of a device which may be employed in connection with a mechanism of this kind for sending a preliminary signal over the circuit independently of the break wheel. Fig. 11 is a sectional view through the mechanism on the line 11—11 of Fig. 3. Fig. 12 is a vertical sectional view on the line 12—12 of Fig. 7. Fig. 13 is a fragmentary view showing the mechanism for connecting and disconnecting the break wheel. Figs. 14 and 15 are views in elevation of an automatic cut-out for use in connection with the auxiliary circuit, the parts being shown respectively in their normal and released positions. Fig. 16 is a side elevation of the cut-out, the parts being in section. Fig. 17 is a detail view of a thermostatic switch which is particularly adapted for use in the auxiliary system for closing the circuit therein to send in the signal and for restoring the circuit to normal condition automatically after the lapse of a predetermined interval of time, and Fig. 18 is a diagram showing the method of connecting up two or more boxes in the system and the manner of connecting the auxiliary circuits to one of the boxes.

Similar reference numerals in the several figures indicate similar parts.

The fire alarm system constructed in accordance with our invention is adapted to all of the requirements which render the proper reception of the signals in such a manner that the simultaneous operation of two or more of the boxes on the same circuit, or the releasing of two or more of the boxes in immediate succession, will prevent the interference of one signal with the other, the circuits and the mechanism employed being such as to insure the complete con-

trol of the line by only one box at a time, as well as to insure a complete signal from each of the boxes that may have been released.

The present embodiment of our invention which accomplishes these results comprises generally the usual box or casing 1 which is usually inclosed in a suitable manner within an outer protective casing 2, upon the inner side of which is attached a spring 3 upon which is carried a button 4 which is accessible from the exterior of the outer casing. The inner end of the button 4 is arranged to coöperate with a longitudinally movable plunger 5 which is mounted transversely of the oppositely arranged supports 6, a spring 7 being employed which normally operates to move the plunger 5 toward the button 4. This plunger 5 carries a switch blade 8 which projects on opposite sides thereof and coöperates with the contact 9 at one side and the contacts 10 and 11 at the opposite side of the plunger. This plunger operates through the switch members just described to control the circuits through the box, and for preventing the permanent depression of the plunger, through accident or otherwise, it is preferable to employ an automatic resetting device which embodies, in its present form, a lever 12 which is pivoted at 13 and attached at one end to the plunger 5, and at its opposite end it is formed to coöperate with a detent 14 which operates under the action of the spring 15 to retain the said lever in a predetermined position when the plunger 5 has been operated, and to this lever 12 is attached a finger 16 which cooperates with a slide 17, the latter being movable longitudinally in ways 18 and provided with an abutment 19 in which the bolt 20 having an abutment 21 on its adjacent end is slidingly mounted. The opposite end of this bolt 20 is connected to a rack bar 22 which is movable longitudinally in ways 23 and coöperates with a pinion 24 which is connected through the pawl 25 with a train of gears 26, the latter being regulated in its motion by a brake or governor 27 which may be adjusted to retard the operation of the train to any desired degree. Resting between the abutment 19 of the slide 17 and the relatively fixed portion of the bolt 20 is a spring 28 which is set under compression by the operation of the slide 17 through the fingers 16, the latter being operated by the longitudinal movement of the plunger 5, it being obvious that the action of the spring 28 will tend to operate the rack bar 22 so as to set the train into operation through the pawl 25, and this motion will continue until the projection 29 of the rack bar engages the detent 14 to cause the latter to disengage from the corresponding end of the lever 12. The spring 7 which normally operates to move the plunger 5 toward the button 4 will cause the lever 12 to be returned to its normal position when the latter has been disengaged from the detent 14. The slide 17 which is operatively connected to the said lever through the finger 16 will be simultaneously reset, and in moving into its normal position the abutment 19 thereon will engage the projection 21 of the bolt 20 to cause the latter and the rack 22 to be retracted, and this is permitted to take place independently of the train 26 by the operation of the pawl 25.

Between the oppositely arranged supports 6 are mounted the wheels of the actuating train which comprises the operating spring 30 which is connected to the main driving wheel 31, the latter meshing with the pinion 32 which is connected through suitable gearing to the escapement wheel 33 with which coöperates the escapement 34 which is mounted on the oscillatory shaft 35 and provided with a radial arm 36 upon which is adjustably mounted a weight 37 which serves to regulate the speed of the train in a well known manner. To the shaft 35 is attached a laterally projecting finger 38 and this finger is arranged to coöperate with an arm 39, the latter being pivotally mounted in the support 40 and provided with a lateral projection 41 which coöperates with a corresponding projection 42 which is formed on the armature 43. A similar projecting arm 44 is mounted to move with the arm 39 and is employed for a purpose that will be hereinafter explained. The armature 43 is pivoted at 45 and arranged to coöperate with the magnets 46, an extension 47 being provided upon this armature to which an actuating spring 48 is attached, the normal tendency of this spring operating to move the armature away from the magnets 46. The free end of the armature 43 is arranged to coöperate with the shoulder 49 of the arm 50, the latter being pivoted at 51 to the supports 6 and provided with a spring 52 which normally operates to retain the arm 50 in cooperative relation with the corresponding portion of the armature 43, and this arm is provided with a finger 53 which is arranged to engage the lateral projection 54 of the shaft 55 during the rotation of the latter to move the arm 50 laterally against the action of its spring 52 and cause the shoulder 49 thereon to permit the coöperating portion of the armature 43 under the action of the spring 48 to rise. The shaft 55 is movable longitudinally within the supports 6, and is normally operated upon by the spring 56 which tends to move it into the position indicated by dotted lines in Fig. 13. This spring 56 is pivotally mounted upon the supports 6 at 57 and its upper free end is arranged to coöperate with an inclined projection 59 on the arm 50, and this construction is preferable for it is obvious that under normal conditions the shaft 55 will occupy

the position shown in full lines in Fig. 13, and the spring 56 will be substantially inactive and the arm will occupy the position shown in full lines in Fig. 7, but when the arm 50 is released by the armature 43 which is attracted by the magnets 46, the said arm will be shifted into the position shown in dotted lines in Fig. 7 under the action of its spring 52, and as the inclined projection 59 is carried by this arm it will coöperate with the upper end 58 of the spring 56, causing the latter to be flexed, and this will increase the pressure exerted by the lower free end of this spring upon the shaft 55 which tends to move the latter into the position shown in dotted lines in Fig. 13. The shaft 55 is provided with a collar 60 which coöperates with the arm 44 which is operated by the projection 41, and as the latter is under the control of the armature 43 it will be obvious that the motion of the latter relatively to the magnets will cause the arm 44 to swing laterally and through the coöperative relation of this arm 44 and the collar 60 the shaft 55 will be shifted axially against the action of the spring 56, the motion of this arm 44 in the opposite direction permitting the spring 56 to move the shaft 55 in the opposite direction.

When the shaft 55 occupies its normal position as shown in full lines in Figs. 11, 12 and 13, the lateral projection 54 thereon will be held out of coöperative relation with the finger 53 of the arm 50, and this will permit the armature 43 which is actuated by the spring 48 to engage and disengage the shoulder 49 of the arm 50 without interference of the finger 53 of the latter and the projection 54 of the shaft 55. Fixed to the shaft 55 and movable axially therewith is a gear wheel 61 which is adapted to be moved into and out of coöperative relation with the corresponding wheel 62 which is in turn fixed to the shaft 63 which is driven by the pinion 32, the longitudinal motion of the shaft 55 in the manner hereinbefore described serving to connect and disconnect these gears 61 and 62. In the supports 6 is journaled the shaft 64 to which is fixed a pinion 65 of sufficient width to remain continuously in mesh with the gear 61, and this shaft 64 also carries the signal or break wheel 66 which may be of the usual construction having groups of contact points arranged to represent a given number which is used to designate each box and coöperating with the break wheel are the usual brushes 67 and 68, the former being arranged to coöperate with the spaced projections during the rotation of the wheel to interrupt the circuit at prearranged intervals, the latter forming a continuous contact with the wheel, all in the well known manner. Between the gear 61 and the adjacent support 6 is mounted a stop 69 which is carried by an arm 70 which is carried by the rock shaft 71 and provided at its opposite end with an offset projection 72, and to the shaft 71 is attached a finger 73 which is arranged to coöperate with the periphery of the collar 60 when the shaft 55 has been shifted into the position shown by the dotted lines in Fig. 13. The normal position of the parts, however, will permit the finger 73 to swing freely, and this will allow the stop 69 to rest between the wheel 61 and the adjacent support to prevent the said wheel from being moved into engagement with the corresponding wheel 62. On the shaft 74 to which is fixed the escapement wheel 33 is formed a spiral cam 75, and with this cam is arranged to coöperate the free end of the arm 76, the latter being pivoted at 77 to permit it to swing laterally while the free end thereof is traversing the spiral cam, and it is supported by the armature 78 which coöperates with the magnet 79, a spring 80 being employed which normally operates to return the coöperating portion of the arm 76 to the beginning of the spiral cam 75 when the latter and the arm 76 are disengaged by the oscillation of the armature 78 about its pivot 81. Near the end of the cam 75 is arranged the offset portion 72 of the arm 70 which carries the stop 69. The armature 78 is operated upon by the spring 82 which acts to disengage the cam 75 and the arm 76, it being obvious that interruption of current flowing through this magnet will demagnetize the same and permit the armature 78 by the action of the spring 82 to move upwardly, consequently causing the arm 76 to disengage from the cam 75 and return to the beginning of the latter under the action of the spring 80. A clapper 83 may be attached to this armature 78, if desired, and arranged to strike the bell 84 for the purpose of giving an audible signal each time the armature 78 is attracted by the magnet 79. The offset portion 72 of the arm 70 is arranged to coöperate with the adjacent end of the arm 76 as the latter approaches the end of the cam 75, the arrangement being such that the arm 70 will be tilted, causing the stop 69 to disengage from the wheel 61, and this will permit the latter and the shaft 55 to be moved laterally under the action of the spring 56, thereby establishing operative connection between the wheel 61 and the corresponding wheel 62. The stop 69 is held out of engagement with the wheel 61 by the arm 73, which at this time will rest upon the periphery of the collar 60, the motion of the shaft 55 in the opposite direction against the action of the spring 56 serving to disconnect the wheels 61 and 62 and permitting the arm 73 to disengage from the collar 60, to permit the stop 69 to return to its normal position between the wheel 61 and the adjacent portion

of the stop. It is preferable to employ gearing of a given ratio between the shafts 55 and 64 in order that the break wheel may complete a given number of revolutions to a single rotation of the shaft 55, the gears 61 and 65 being properly proportioned for accomplishing this purpose.

If the break wheel alone is employed, the regular round of numbers representing a given signal will be sent over the line and repeated a given number of times, but sometimes it is desirable to have a preliminary signal sent over the line in advance of the regular numeral signal, and for this purpose a device similar to that shown in Figs. 10 and 11 may be employed which comprises a plunger 85, the inner end of which is arranged to engage the adjacent end of the arm 76 to cause a longitudinal motion of the plunger within its support 86, a spring 87 being employed for normally retaining the head 88 of the plunger in contact with the oppositely arranged insulated plates 89 and 90 to serve as an electrical connection between the latter,—the operation of the plunger against the action of the spring 87 by the arm 76 causing the head 88 to disengage from the plates 89 and 90 and thereby break the electrical connection between them, the return of the plunger by the spring 87 serving to reëstablish the electrical connection between the plates 89 and 90 through the head 88. Projecting laterally from the casing 86 of this circuit interrupter is an arm 91 which is arranged directly beneath the path of the adjacent end of the arm 76, while the latter is traversing the spiral 75, a recess or cut away portion 92 being provided for permitting the arm 76 to disengage from the spiral at a predetermined point, and as the arm 76 leaves the spiral it will disengage from the inner end of the plunger 85, causing the latter to be returned to normal position under the action of the spring 87. The purpose of this arm 91 is to retain the arm 76 in cooperative relation with the spiral 75 to enable the arm 76 to freely traverse the spiral after reaching the predetermined point, even though the magnet 79 which retains it in cooperative relation is demagnetized by the interruption of current, for it will be hereinafter understood that the operation of the plunger 85, while the arm 76 is traversing the spiral 75, will cause a temporary interruption of the current flowing through the magnet 79, and the arm 91 is employed to retain the spiral and the arm 76 in coöperative relation until the arm 76 has moved sufficiently to depress the offset portion 72 of the arm 70 to permit the stop 69 to disengage from the wheel 61 and thereby allow the latter to be shifted into coöperative relation with the corresponding wheel 62 under the action of the spring 56.

On the relatively fixed portion of the supports 6 is mounted an insulating base 93 which is provided with a slide 94, the said slide being operatively connected to the swinging arm 50 by the finger 95 which bears upon one side of this arm and serves to move the slide in one direction when it occupies the position shown in dotted lines in Fig. 7, and to this slide 94 is also attached a bell crank 96 which is operated by the rod 97 which carries a stop 98 which rests upon the upper side of the armature 43, the operation of the latter by the spring 48 serving to elevate the rod 97 through the stop 98 and operating upon the bell crank 96 will shift the slide 94 back to its normal position after being operated by the arm 50. This slide 94 is operatively connected to the double switch arms 99 and 100, the free ends of which are arranged to bear alternately upon the contacts 101 and 103 and 102 and 104.

The mechanical devices which we employ in the auxiliary system include an automatic cut-out through the operation of which the circuits which may be extended through the buildings as a continuation of the main circuit may, in case of fire, or other circumstances which would tend to disturb the system, be short circuited to complete the main circuit, and a cut-out of this kind constructed in accordance with our invention comprises a suitable base 105 to which is fixed the magnet 106 with which coöperates an armature 107 which is pivoted at 108 and is normally held out of engagement with the magnet by the compression spring 109. The free end of this armature is provided with a lateral projection 110 which coöperates with a corresponding recess of a pivoted arm 111 which operates as a detent to limit the motion of the armature 108 under the action of the spring 109, and bearing upon the free end of this armature is a lever 112 which is weighted at one end and pivoted at its opposite end to the insulated base 113, the armature 107 normally acting as a support to retain this lever 112 in an elevated position. However, when the magnet 106 is energized it will attract its armature 107, causing the projection 110 thereon to disengage from the recessed portion of the detent portion 111, permitting the latter to swing from the position shown in Fig. 14 to that shown in Fig. 15, and when the magnet is demagnetized the armature 107 under the action of the spring 109 will swing from beneath the lever 112 permitting the latter to drop into the position shown in Fig. 15. In the insulated base 113 is mounted a slide which is operatively connected with the lever 112, and to this slide are connected a series of switch points 114, 115 and 116, the free ends of which are arranged to engage alternately with the contact points 117, 119 and 121 and the contacts 118, 120 and 122, these points 114, 115 and 116 bearing upon

the contacts 117, 119 and 121 while the lever 112 occupies its normal elevated position, as shown in Fig. 14, and when the latter has been depressed these switch points will bear respectively upon the contacts 118, 120 and 122.

Any suitable device may be employed in the auxiliary circuit which is capable of being operated to so arrange the circuits as to release the corresponding box, the usual manually operated switches shown in Fig. 18 being employed if desired, which comprise generally a movable switch blade 123 which is adapted to establish electrical connection alternately between the contact 124 and the contacts 125 and 126, the said switch blade being retained in operated position by the detent 127, but as this requires the resetting of the switch before the circuit through the building can be again connected with the main line, it is desirable to employ a device which will automatically reset itself after the lapse of a predetermined period of time, and instead of using the manually operated devices, such as are usually employed, it is desirable to employ a device which is controlled in its action by comparative temperature, and in Fig. 17 we have shown a device of this character which will automatically release at a predetermined degree in temperature and which will automatically reset itself so as to reëstablish the normal connections in the auxiliary circuit after the expiration of a given time, and it comprises generally the casing 128 within which is mounted the longitudinally movable rack 129 which coöperates with the gear train 130, the latter being provided with a governor 131 which operates to retard the speed of the train, and to the rack 129 is attached a bolt 132 which is provided with an abutment 133, and between this abutment and the relatively fixed portion of the casing 128 is interposed an actuating spring 134. On the casing 128 is pivoted a switch blade 135 which is operated upon by the spring 136, one end of this switch blade being arranged to coöperate alternately with the contact points 137 and 138, the opposite end of the blade being provided with a lateral projection 139 which is arranged in the path of the abutment 133 of the rack 129. Arranged transversely of the path of the abutment 133 of the rack 129 is a stem 140 which is fixed to the casing 128 and is adapted to receive a removable shell 141 which, when in position, will project across the path of the abutment 133 to normally retain the rack 129 inoperative against the action of the spring 134, and upon the opposite side of this shell is arranged to bear the projection 139 of the pivoted switch member 135. Any suitable device may be employed in place of the shell 141 which is capable of being displaced when subjected to a temperature of a predetermined degree, a blank cartridge being conveniently employed in the present instance which contains an explosive compound which will ignite at a given temperature and discharge the shell from the stem 140, and when this has occurred the switch member 135 will be moved into the position shown in dotted lines in Fig. 17 under the action of the spring 136 shifting the free end thereof from the contact 138 to the contact 137 and the discharge of the shell 141 will simultaneously release the rack 129, permitting it to move longitudinally against the action of the train 130 so that the time required by the rack 129 in completing its motion may consume a given period of time. When the switch member 135 has been released by the discharge of the shell 141, the projection 139, at the adjacent end thereof, will move into engagement with the abutment 133 of the rack 129, and as the latter is operated by the spring 134 the abutment 133 will coöperate with the projection 139 to gradually move the switch member 135 against the action of the spring 136 into the position shown in full lines in Fig. 17 when the free end thereof will rest upon the contact 138, thereby reestablishing the normal condition of the circuit.

The electrical circuits for connecting up the mechanical devices of this system hereinbefore described, is illustrated in diagram in Fig. 18 wherein we have shown two boxes connected to the main line, to one of which are connected two independent auxiliary circuits containing manually operated devices by means of which the corresponding box may be released. In this view 142 and 143 designate the conductors of the main line in which the boxes designated A and B are connected through the binding posts 144, 145, 146 and 147. From the binding post 144 of box A is extended the conductor 148 which leads to the movable switch blade 99, and from the contact 101 leads the conductor 149 which is connected to the brush 67 of the break wheel. The brush 68 of the break wheel is connected by the conductor 150 to the magnet 79, and from the latter it extends to the contact point 103 of the controlling switch. The movable switch blade 100 is connected by the conductor 151 to the binding post 145, and in case there is no auxiliary circuit connected to the box, as is the case with the box A in the diagram, a bridging conductor 152 is employed to connect the binding post 145 with the post 147, the latter in turn being connected to the conductor 153 which connects with the binding post 144 of the box B. This circuit made up of the conductors 148, 149, 150, 151 and 152, with the brushes 67 and 68 and the movable switch members 99 and 100, completes the signaling circuit which in-

cludes the break wheel and the magnet 79. The contact point 102 is connected by the conductor 154 to the contact plate 9 and through the movable switch member 8 which is controlled by the operation of the button 5 the circuit is normally completed through the contact point 10, the latter being connected by the conductor 155 to the movable switch point 156 of the switch 157, the latter being provided with a slide 158 which is normally held in one position by the door of the box, and when released will be reversed by the spring 159. When the switch 157 occupies its normal position with the door of the box closed, the movable switch member 156 will rest upon the contact point 160, the latter being connected by the conductor 161 to the contact point 162 upon which the movable switch member 163 at this time rests, and the latter is connected by the conductor 164 to the binding post 147, an ordinary key or interrupter 165 being usually inserted in this part of the circuit to enable the proper officials to send special calls directly over the line without disturbing the mechanical devices of the particular box. When the door of the box is open the slide 158 will be operated upon by the spring 159 to throw the switch members 156 and 163 upon the contact points 166 and 167 respectively, and the latter are connected respectively by the conductors 168 and 169 upon opposite sides of the magnet 79 so as to include the latter within the circuit with the key 165. To the contact 11 of the switch 8, which is under the control of the button 4, is connected the conductors 170 and 171, the former of which is connected with the contact 104 of the controlling switch, forming a train-releasing and circuit-controlling circuit, which includes the release magnet 46 within the circuit, the conductor 171 being connected to the binding post 146 and leading directly to the contact point 11.

In connecting the auxiliary systems to any of the boxes the circuits of the latter remain intact, except that the bridging conductor 152 is removed or omitted when the auxiliary system is employed. In the diagram of Fig. 18 two independent auxiliary systems are shown connected to the box B, these systems being of the kind which employ a neutral or return wire which is connected to the binding post 146 of the box and branches of each circuit are formed by the conductors 172 and 173 which include the magnets 106 and 106[a] respectively which are in turn connected to the movable switch member 115 and 115[a] of their respective cut-outs. These movable switch members will normally rest upon the contact points 119 and 119[a] respectively, and these contact points are connected by the conductors 174 and 174[a] to the contacts 126 and 126[a] of the respective circuit controlling devices of the respective systems, and under normal conditions the return circuit will be open through all of the controlling devices. To the binding post 145 of this box is connected a conductor 175 which connects with the movable switch point 116[a], the latter normally resting upon the contact point 121[a] and the latter is connected by the conductor 176 to the contact point 125[a]. Under normal conditions the movable switch member 123[a] of each circuit controller will rest upon the contact point 125[a] and the contact point 124[a] and through the conductor 177 the circuit will be completed through each of the circuit controllers and by the conductor 178 the circuit will be completed to the contact point 117[a], and as the movable switch member 114[a] normally rests upon this latter contact, it will complete the circuit with the conductor 189 which leads to the movable switch member 116 of the cut-out for the other system, the said switch member normally resting upon the contact 121 which in turn is connected by the conductor 190 to the contact plates 125 of the circuit controlling devices passing through the movable member 123 thereof and the contact point 124 and returning through the conductor 191 to the contact point 117 of the cut-out, and the latter point is normally in contact with the movable switch member 114 which in turn is connected by the conductor 192 to the binding post 147 of the box. To the contact points 118 and 122 and 118[a] and 122[a] of the respective cut-outs are connected the signals 193 and 193[a] which are capable of giving a suitable signal or alarm, and the signal device 193 is connected in the circuit by the movable switch points 114 and 116 of the cut-out when the latter has been operated and occupies the position shown in Fig. 18, the controlling devices and the remaining circuit through the auxiliary system being cut out by the cut-out devices, while the magnets 106 and 106[a] which release the cut-outs and are connected in the neutral circuit by the conductors 172, 173 will also be cut out by the operation of the movable switch members 115 and 115[a] which will leave their respective contact points 119 and 119[a] when the cut-outs have been operated to break the neutral circuit.

Should the automatic circuit controlling device shown in Fig. 17 be employed in the auxiliary circuit for controlling the latter, the contact 137 will be connected to the neutral conductor 174, or 174[a], as the case may be, and the contact 138 will correspond to the contact points 125 and 125[a] and will be connected to either the conductor 190 or the conductor 177, the conductors 178 or 191 being connected to the base as at 138[a].

Under normal conditions the various boxes on the line circuit will be connected in a man-

ner similar to that hereinbefore described and the actuating spring 30 will be set by a key or other suitable device so as to be in readiness to operate the train of gearing which is controlled by the escapement 34, and under normal conditions the armature 43 will be held in elevated position by the spring 48 and the swinging arm 50 will be held back into the position shown in full lines in Fig. 7, and the arresting arm 39 at this time will coöperate with the finger 38 of the escapement to prevent operation of the latter, for it will be obvious that the armature 43 while in its elevated position will cause a projection 42 thereon to raise the projection 41 which will move the arm 39 to the right as shown in Fig. 12. The rod 97 which is provided with a stop 98 will also be held in elevated position by the armature 43 and the bell crank 96 will operate upon the movable switch members 99 and 100 to retain them in contact respectively with the contacts 102 and 104. Prior to releasing the boxes the plunger 5 will occupy such a position that the movable switch member 8 therein will rest upon the contacts 9 and 10 and consequently the line current from the binding posts 144 and 147 will, under normal conditions, traverse the conductor 148, switch member 99, contact points 102, conductor 154, switch members 9, 8 and 10 of the releasing switch, conductor 155, switch member 156, contact point 160, conductor 161, contact points 162, switch member 163, conductor 164 and key 165 to the binding post 147, the normal circuit thus established being entirely free from magnets or other devices which would offer considerable resistance to the line current. It will be obvious, however, that the armature 43 will be normally held in elevated position by the spring 48 because of the fact that the magnet 46 is not at this time included in this circuit. It will also be obvious that the break wheel and the magnet 79 will also be out of the circuit at this time. However, when the button 4 is operated against the action of the spring 3 it will move the plunger 5 longitudinally against the action of the spring 7, causing the movable contact member 8 to leave the contact point 10 and rest upon the contact point 11. This will interrupt the normal circuit just described, and instead will cause the line current to traverse the conductor 148 from the binding post 144 traversing the movable switch member 99, conductor 154, switch members 9, 8 and 11, conductor 170, magnet 46, switch member 100, conductor 151 to the binding post 145, passing from the latter over the bridge conductor 152 to the binding post 147 in case no auxiliary system is employed in connection with the box. As the magnet 46 is included in this circuit, the line current will energize it, causing it to attract the armature 43 against the action of the spring 48, and as the armature 43 is thus depressed, it will cause the arm 39 to release the finger 38 of the escapement, thus setting the actuating train in motion, and at the same operation the swinging arm 50 will be released by the disengagement of the corresponding portion of the armature 43 permitting the shoulder 49 of the said arm to rest above the armature and thereby retain it in depressed position, and consequently preventing the arm 39 from interrupting the operation of the actuating train by engagement with the finger 38. As the arm 50 is thus operated by its spring 52, its coöperative relation with the slide 94 by the connection 95 will cause the switch members 99 and 100 to be shifted over from the contacts 102 and 104 respectively to the contacts 101 and 103 respectively.

By referring to the diagram in Fig. 18, it will be understood that the line current will pass from the binding post 144 through the conductor 148, switch member 99, contact point 101, conductor 149, brush 67, through the contact points of the break wheel, through the brush 68, conductor 150, magnet 79 to the contact point 103 and passing through the switch member 100 and the conductor 151 it reaches the binding post 145, and traversing the bridging conductor 152 will complete the circuit with the line through the binding post 147. The circuit thus established will cause the line current to energize the magnet 79 and causing it to attract its armature 78, and this will move the arm 76 into coöperative relation with the spiral 75, which is mounted to rotate with the escapement wheel 33, and as the latter is in operation at this time, the operation of the spiral 75 will cause the arm 76 while traversing the spiral to move laterally while the armature 78 is still attracted by the magnet 79, and a moment after a projection upon the arm 76 has passed above the arm or rest 91, it will have engaged the free end of the plunger 85, causing the head 88 thereon to break the circuit between the contact plates 89 and 90, and as the latter are connected in the main line circuit at this time, a preliminary signal will be sent over the line by the momentary interruption of the circuit, and while the spring 82 normally operates upon the armature 78 to disengage the arm 76 from the spiral 75, and thus permit the arm 76 to return to its normal position under the action of the spring 80, which would be the case when the interruption of current through the magnet 79 takes place,—this is prevented by the rest 91 which insures the proper coöperative relation between the spiral 75 and the arm 76 so that the latter may move sufficiently far to depress the offset portion 72 of the arm

70 to thereby cause the stop 69 to disengage from the wheel 61 to allow the latter to be moved into coöperative relation with the corresponding gear wheel 62 of the actuating train under the action of the spring 56 to set the break wheel into operation, and when this has occurred, the extremity of the arm 76 will have reached the cut-away portion 92 of the rest 91, permitting the said arm to move out of coöperative relation with the spiral 75 under the action of the spring 82, and this may take place at this time, as the connection between the contact plates 89 and 90 will be interrupted until the return of the plunger 85, which occurs after the arm 76 has passed through the cut-away portion 92, and consequently the magnet 79 will be deënergized. The moment the arm 76 passes through the cut-away portion 92 the plunger 85 will spring back into normal position and the head 88 thereon will reestablish the connection between the plates 89 and 90. The signaling circuit will now be complete for transmitting the signal from the break wheel or circuit breaker over the line circuit, and as the break wheel rotates, the circuit will be successfully interrupted in predetermined groups of intervals in the well known manner, and the modified or interrupted current thus transmitted over the line is received upon the responsive devices such as are usually employed.

When the signaling circuit has control of the main line the controlling switch embodying the movable switch members 99 and 100, in being shifted from the contacts 102 and 104 to the contacts 101 and 103 respectively, will have cut out the magnet 46 and the releasing switch, and as the magnet 79 preferably remains connected in the signaling circuit, it will be of course obvious that the alternate closing and opening of the signaling circuit through the break wheel or circuit breaker, will cause the armature 78 to oscillate correspondingly, and the clapper 83 which is carried thereby will therefore produce a corresponding signal upon the bell 84 for each signal that is sent over the line. This feature is an advantageous one as it enables the officials of the police or fire department to readily interpret the signal which happens to be passing over the main line either from the box which has been released and assumed entire control of the line, or from a box which has been released immediately before the release of another box on the same circuit, for in this case the second box to be released cannot obtain control of the line, for while the actuating train will be set in operation, the interruptions of the circuit through the magnet 79 will prevent the arm 76 from traversing the spiral 75 sufficiently to establish operative connection between the break wheel and the actuating train.

The break wheel, after being set into operation, will continue to rotate a predetermined number of times to repeat the signal as often as may be desirable, this being varied of course by the ratio of the gearing which is employed to connect the break wheel with the shaft 55. After the break wheel has completed the predetermined number of revolutions, the lateral projection 54 on the shaft 55 will operate upon the finger 53 of the arm 50 to move the latter outwardly, thereby disengaging the shoulder 49 thereon from above the armature 43 to permit the latter to be elevated under the action of the spring 48, and as the armature 43 is thus elevated the projection 42 thereon will operate upon the corresponding projection 41 to simultaneously swing the arms 39 and 44 to the left as shown in Figs. 12 and 13, the arm 39 when thus operated coöperating with the finger 38 of the escapement to interrupt the operation of the actuating train, and simultaneously the arm 44 will operate upon the collar 60 to shift the shaft 55 longitudinally, thereby disengaging the gear 61 from the corresponding gear 62 to interrupt the operative connection between the break wheel and the actuating train, and at the same operation the finger 73 will disengage from the periphery of the shoulder 60 to permit the stop 69 to engage between the wheel 61 and the adjacent portion of the support 6 to lock the break wheel in a given position, and preventing the operative connection between the latter and the actuating train to be reëstablished, except through the operation of the arm 76 upon the offset portion 72 of the arm 70 to which the stop 69 is attached, the parts thus being reset in readiness for the next succeeding operation. As the armature 43 is elevated in a manner above described, the stop 98 of the rod 97 will be operated upon by the armature to oscillate the bell crank 96, and operation of the latter will cause the slide 94 to be operated and this will cause the switch members 99 and 100 to be shifted from the contact points 101 and 103 to the points 102 and 104 respectively, thereby cutting out the signaling circuit which includes the break wheel and the controlling magnet 79 and reestablishing the normal circuit which is under the control of the button 4. When it is desirable to send special signals over the line independently of the mechanical devices of the box, the door for the latter is opened in the usual way and the spring 159 operating upon the slide 158 will cause the movable switch members 156 and 163 to be shifted from the contacts 160 and 162 to the contacts 166 and 167, causing the controlling magnet 79 to be connected into the normal circuit, which will be included by the conductor 148 leading from the binding post 144 to the switch point 99 and the conductor

154 leading to the contact point 9 which is connected by the movable switch member 8 to the contact point 10 and from the latter the conductor 155 extends to the movable switch member 156 which rests upon the contact point 166, the conductor 168 forming a connection between the latter and one terminal of the magnet 79, the other terminal thereof being connected by the conductor 169 to the contact point 167 upon which the movable switch member 163 rests, and through the conductor 164 and the key 165 the normal circuit is completed to the main line through the binding post 147. Under normal conditions the key 165 will remain closed, but when it is desirable to send a given signal over the line, said key is manipulated manually to interrupt the circuit any number of times which may correspond to given signals, the successive making and breaking of the circuit causing the impulses through the magnet 79 to alternately attract and release its armature 78, and as the armature oscillates in a manner corresponding to the impulses passing through the magnet, the clapper or hammer 83 will produce a corresponding audible signal through the bell 84.

When the press button 4 has been operated to release the box, the plunger 5 in being moved inwardly against the action of the spring 7 will cause the lever 12 to be operated about its pivot 13 and as the finger 16 of this lever is operatively connected with the slide 17 which bears upon one end of the spring 28, it will be obvious that as the rack 22 and the bolt 20 remain substantially at rest while the slide is operated, the spring 28 will be set under compression to operate the rack, the motion of which is retarded by the train 26 which is controlled by the governor 27, the latter being so adjusted that a predetermined period of time lapses before the motion of the rack 22 under the action of the spring 28 is completed. When the lever 12 is operated under the action of the button 4 and the plunger 5, the detent 14 will cooperate with the free end thereof to lock it and the slide 17 in operated position, these parts being held in such a position until the abutment 29 on the rack 22 engages the detent 14 to release the lever 12 as the said rack approaches the limit of its motion. The spring 7 will then operate to return the plunger 5 to normal position against the button 4, causing the lever 12 attached thereto to return the slide 17, the abutment 19 of the latter coöperating with the head 21 of the bolt 20, to return the rack 22 to normal position and this may take place without operating the train 26 through the use of the pawl 25 which serves as an operative connection between the train and the rack only while the latter is operating in one direction.

While we do not limit ourselves to the use of a releasing device of this character which is adapted to automatically reset itself, we prefer to employ such a device for it will be obvious that should it be desirable to release a second box while a signal is being sent over the line from another box, the successive interruptions in the line current which constitutes the signal being transmitted, will pass through the releasing magnet 46 of each box after it has been released and the switch member 8 connects the contact points 9 and 11, and consequently should the second box be released by a momentary closing of the circuit through the magnet 46, there would be a possibility that this magnet would not be energized to attract the armature 43 for the reason that it may occur at a time when the line current was interrupted, but when this circuit through the magnet 46 is held closed for a prolonged period before being reset, the next impulse will energize this magnet to attract the armature 43 and thereby release the actuating train in the manner hereinbefore described. Moreover, the resetting of the button is accomplished automatically, and therefore the services of an official will not be required to restore the box to proper condition after it has been released to send in an alarm, nor will the box remain released in case the main line circuits are broken or otherwise disturbed, for after the expiration of a given period the box will be restored to normal condition without the annoyance of sending in a delayed signal. However, those boxes which have been released subsequently to the release of the first box cannot possibly interfere with the signal being transmitted over the line from the first box until the operation of the latter has been completed, for it will be understood that the interruptions in the current passing over the line through the operation of the break wheel of the first box will be at such close intervals as to cause the magnets 79 of each box which has been released subsequently to attract their armatures 78 for a very short period at a time, the spring 82 returning the armature each time that the current is interrupted. Therefore it will be obvious that the arm 76, which is controlled by this armature 78, will only follow the spiral 75 for a short distance before it is disengaged therefrom by the action of the spring 82 each time the current through the magnet 79 is interrupted, and for this reason the arm 76 cannot move far enough to establish connection between the wheels 61 and 62 until the circuit has been closed over the line by the resetting of the first box. When the operation of the first box has been completed and the normal circuit has been reëstablished therethrough, the line current will not be interrupted, and therefore the magnet 79 will be energized for a sufficient period to enable the arm 76 to completely traverse the spiral

75 causing the preliminary signal to be sent in by the operation of the plunger 85 and also causing the break wheel to be operatively connected to the actuating train by the disengagement of the stop 69 from the wheel 61 and the engagement of the latter with the wheel 62 of the train. Of course the temporary interruption of the circuit through the magnet 79 by the operation of the plunger 85 will not prematurely disengage the arm 76 from the spiral 75, for it will be understood that the moment that the circuit is interrupted by the plunger 85, the free end of the arm 76 will coöperate with the arm 91, which will hold it in engagement with its spiral 75 until its motion has been completed.

When it is desirable to employ one or more auxiliary circuits in connection with one of the boxes, as before stated, the bridging connection 152 will be removed and the neutral conductor, in case such a system is employed, will be connected to the binding post 146 while the terminals 175 and 192 are connected to the binding posts 145 and 147 respectively, it being obviously unnecessary to alter the circuits within the box. Assuming that the switch member 123 of one of the controlling devices of one auxiliary circuit has been operated, as shown in Fig. 18, the main line current will pass from the binding post 144 of the corresponding box, traversing the conductor 148, passing over the switch point 99 and contact 102, traversing the conductor 154 over the switch members 9, 8 and 10, conductor 155, switch members 156 and 160, conductor 161, switch members 162 and 163, conductor 164, key 165, to the binding post 147, and from the latter it will traverse the conductor 192 passing over the switch members 114 and 117, traversing the conductor 191 to the switch point 124 of the controlling device for the circuit, and as the latter has been operated it will pass over the movable switch member 123 to the contact point 126, switching off to the neutral return 174 through the contact point 119, passing over the movable switch member 115 of the cut-out and traversing the magnet 106 which controls the latter, and traversing the conductor 172 the current reaches the binding post 146 of the box, passing on over the conductor 171, passing through the releasing magnet 46 of the box, traversing the conductor 170 until it reaches the contact point 104 of the controlling switch, passing over the movable switch member 100 of the latter and traversing the conductor 151 which is connected to the binding post 145, which is connected in the main line circuit. A current sent over the circuit thus established will cause the releasing magnet 46 of the corresponding box to be energized, attracting its armature 43 to release the actuating train of the box and allowing the arm 50 to operate the slide 94 of the controlling switch to cut out the magnet 46 and establish the signaling circuit through the magnet 79. As the magnet 106 of the cut-out also receives the current through this circuit, it will attract its armature 107 (see Figs. 14, 15 and 16), and this will cause the projection 110 thereon to disengage from the detent 111, the weighted lever 112 being temporarily held from operating the cut-out switch while the magnet 106 remains energized. However, when the releasing magnet 46 has been energized to attract its armature 43, the operation of the arm 50 which is released thereby will cause the slide 94 of the controlling switch to be operated to transfer the movable switch members 99 and 100 from the contacts 102 and 104 to the contacts 101 and 103 respectively, thereby causing the circuit which includes the releasing magnet 46 upon the box and the releasing magnet 106 of the cut-out to be interrupted and the signaling circuit established through the break wheel and the controlling magnet 79 of the box in a manner similar to that described in explaining the operation of the box A. As the circuit through the magnets 46 and 106 is interrupted in this manner, they will both fail to attract their respective armatures and therefore the armature 107 of the cut-out magnet 106 will be operated under the action of the spring 109 to release the lever 112, and as the latter drops into the position shown in Fig. 15, the movable switch members 114, 115 and 116 will be transferred from the contacts 117, 119 and 121 to the contacts 118, 120 and 122. As the magnet of the signal device 193 which is under the control of the cut-out, has its terminals connected to the contact points 118 and 122, it will be obvious that the line current will pass through the said magnet as soon as the released box has sent in its rounds, and the controlling switch has been reset, the line current then passing through the auxiliary cut-out and its signal, thus setting the signal into operation and the neutral circuit which is completed through the contact 119 and the switch member 115 will be broken as the switch member 115 leaves the said contact. Of course if desired, the signal 193 may be of any desired form and may be either connected in the line circuit or may be operated by a separate local circuit, but it is preferable to operate it by the line current immediately after the box has completed its signal, through the controlling switch, which is automatically restored to normal position by the operating train.

After the box B has been released in this manner by the controlling device in an auxiliary circuit, it will send in its signal and

reset itself to restore a normal circuit in readiness for subsequent operations, and the circuit will be completed through the cut-out of the auxiliary circuit which has been operated, provided that the controlling devices thereof have not been reset, or that the circuit is otherwise disturbed, the cut-out being reset manually in the present instance, by elevating the lever 112 to engage the armature 107 as a support, the latter being locked by the projection 110 thereon which coöperates with the recess in the detent 111, the latter operating preferably by gravity when it has been released by the disengagement of the projection 110.

Instead of using the manually controlled devices for the auxiliary circuits, it may be found desirable to employ the automatic device which is capable of being set into operation when the temperature reaches a predetermined limit and which is also capable of restoring normal circuit conditions after the expiration of a given time, so that the auxiliary circuit, unless it has been otherwise disturbed, would be restored to normal condition so that the cut-out may be reset without the necessity of inspecting each of the controlling devices individually to restore it to normal operative position, as would be the case should the manually operated devices be employed, and in case this automatic device is employed, the neutral conductor 174 or 174[a] would be connected to the contact 137 thereon and the conductor 176 or 190 would be connected to the contact 138 thereon. Obviously when the temperature reaches a predetermined limit the combustible or explosive compound contained by the shell 141 will be ignited causing the latter to be projected or discharged from the stem 140. When this has occurred the switch member 135 will be thrown by the spring 136 from its normal position on the contact 138 to the contact 137 as the projection 139 upon the opposite end thereof, which was previously held by the shell 141, is now free to move past the stem 140 and engage the abutment 133 of the rack 129, and as the abutment 133 of the rack was also held from operating under the action of its spring 134, while the shell 141 was in position, it will also be released and moving in opposition to the projection 139 of the switch member 135 which is under the action of the spring 136, it will cause the switch member 135 to be slowly returned to its normal position so that the free end thereof finally rests upon the contact 138. The governor 131 of the train 130 may be so adjusted as to retard the operation of the rack 129 which is actuated by the spring 134, and therefore the time required in restoring the switch member 135 may be varied to the desired degree. Of course the time required in restoring the switch member 135 will be sufficient to retain the circuit through the releasing magnet 46 of the box closed until it is energized to release the box in case there should be another signal being transmitted over the line from another box, and this would insure the proper transmission of the signal from the second box, although it would be delayed until the signal of the first box was completed in a manner similar to that described in connection with the box A.

A fire alarm or other signaling system embodying our improvements eliminates all possibility of interference between two or more boxes or instruments on the same circuit which happens to be released or set into operation in immediate succession, and by the use of the novel devices hereinbefore described, the first instrument to obtain control of the line will retain control to the exclusion of all the other instruments until the first instrument has completed its signal, notwithstanding the possibility of other boxes or instruments being released at very close intervals, and instead of suppressing the signal from the instrument which is released subsequently, it will be delayed only a sufficient time to permit the instrument, which has control of the line at the time, to complete the transmission of its respective signal, and immediately after the complete signal from the previous instrument has been transmitted, the next succeeding instrument will immediately assume control of the line to the exclusion of all of the other instruments in the circuit until it has transmitted its complete signal. Therefore it will be obvious that even though a plurality of boxes or instruments may be released in rapid succession, each box or instrument will obtain control of the line in succession and to the exclusion of all others, and consequently the individual signals from the different instruments cannot possibly interfere or become confused, nor will any of the signals from any of the instruments, which happen to be released either simultaneously or in immediate succession be suppressed or lost.

Another advantage is secured by the use of the automatic resetting device which operates upon the releasing button of the box or instrument to restore the circuits of the latter to normal condition after the expiration of a given period of time, for, by the use of such a device each box will be reset irrespective of the fact whether the main line circuit is broken or otherwise disturbed, and this will preclude the possibility of sending in an alarm or other signal when the circuit is repaired or otherwise restored to normal operative condition, and this is accomplished without requiring the services of an attendant. These advantages are also

secured when the automatic devices are employed in the auxiliary systems for restoring the circuit controlling devices thereof, and in this instance considerable labor would be saved as it avoids the necessity of examining each one of the numerous controlling devices which are usually distributed throughout all parts of a building, and therefore the only operation necessary to reëstablish the connection between the box and the corresponding auxiliary system would be to reset the cut-out switch which is usually located upon the exterior of the building provided of course that the auxiliary circuit through the building is otherwise intact.

In each of these time-controlled devices, the period of time which elapses before the respective circuits are reëstablished is sufficiently prolonged to insure the release of the corresponding box even though the line current may be intermittently interrupted during the transmission of a signal over the line, thereby insuring the proper transmission of both signals in succession.

The thermostatically released device for controlling the auxiliary circuit automatically may be found desirable in many instances, for it will be understood that an abnormally high temperature prevailing in proximity thereto will cause the discharge of the shell, or other device which is influenced by temperature, thereby releasing the controlling device to transmit the signal entirely automatically, and by the use of the time-controlled circuit restoring device in conjunction with a thermostatically released device of this character, it will accomplish the automatic restoring of the circuit without requiring another fuse or shell to be substituted. Our system also enables us to so connect the magnetically controlled devices that the normal circuit through each box will be of a comparatively low resistance, as there are no magnets or other devices of comparatively high resistance in the circuit under normal conditions, and therefore the aggregate resistance of the entire system is comparatively low, and this is especially desirable as the instruments are connected in series in the present instance. Moreover, we are enabled to employ a system the circuits and connections of which are comparatively simple, and thus the liability of disarrangement and confusion is minimized, rendering the operation of the system positive and reliable.

Of course it will be understood that various mechanical devices may be employed in place of those shown in carrying our invention into practice, and therefore we do not limit ourselves to the use of the particular devices herein shown and described, and it will be understood as well that some of the novel devices are capable of being used separately or in conjunction with others, and for this reason we do not limit ourselves necessarily to the use of the particular combination of devices which we have shown and described.

We claim as our invention:

1. In a signaling system, the combination with a line circuit having a source of current in connection therewith, of a signaling instrument embodying a signaling device adapted to be connected in the line circuit, an actuating train therefor, a device for releasing the train to set the instrument in signaling condition, and a controlling device, responsive to the line current and independent of the train releasing device for setting the signaling device into signaling operation after the expiration of a period of time sufficient for the transmission of a complete round of signals from another instrument in the line circuit.

2. In an electric signaling system, the combination with the line circuit, and a source of current in connection therewith, of a plurality of signaling instruments connected to the line circuit each embodying a signaling circuit capable of being connected in the line circuit, a signaling device connected in the signaling circuit operating to interrupt the line current at prearranged intervals in transmitting a signal, operating means for the signaling device, and a device responsive to the line current for controlling the mechanical connection between said operating means and the signaling device.

3. In a fire-alarm system, the combination with the line circuit, and a source of current in connection therewith, of a plurality of signaling instruments connected in the line circuit each embodying a signaling circuit having a signaling device connected therein, an actuating train for operating the signaling device, a magnetically controlled releasing device for normally retaining the train inoperative, a controlling circuit capable of being connected in the line circuit and including the releasing device in circuit therewith, a circuit controller under the control of the releasing device for connecting the signaling and line circuits, and a device responsive to the line current for connecting the signaling device and its actuating train.

4. In a fire-alarm system, the combination with the line circuit, and a source of current in connection therewith, of a plurality of signaling instruments connected in the line circuit each embodying a signaling circuit having a break wheel connected therein, an actuating train for operating the signaling device, a controlling circuit having a releasing device connected therein for normally retaining the actuating train inoperative, a circuit controller capable of being operated through the controlling circuit for connecting the signaling and main line circuits, and an electro-magnetically operated device re-

sponsive to the line current for establishing operative connection between the break wheel and the actuating train.

5. In a fire-alarm system, the combination with the line circuit, and a source of current in connection therewith, of a signaling instrument connected in the line circuit embodying a signaling circuit having a signaling device connected therein, a controlling circuit adapted to receive the line current and having a circuit controller connected therein responsive to a current over the controlling circuit for connecting the signaling and line circuits, and an auxiliary circuit connected in the controlling circuit and having devices for closing the line circuit through the controlling and auxiliary circuits.

6. In a fire-alarm system, the combination with the line circuit, and a source of current in connection therewith, of a signaling instrument connected in the line circuit embodying a signaling circuit having a signaling device connected therein, a controlling circuit including devices for connecting the signaling and line circuits and setting the signaling device into operation, an auxiliary circuit connected in the controlling circuit of the instrument and having devices for closing the line circuit through the controlling circuit, and a cut-out for automatically short circuiting the line current around the auxiliary circuit after one of the circuit closing devices of the latter has been operated.

7. In a fire-alarm system, the combination with the line circuit and a source of current in connection therewith, of a signaling instrument connected in the line circuit embodying a signaling circuit having a signaling device connected therewith, a controlling circuit adapted to receive current from the line circuit, and having electrically controlled devices for releasing the signaling device, an auxiliary circuit connected in the controlling circuit of the instrument and having devices for sending the line current over the controlling circuit, and a circuit controller under the control of the controlling circuit for connecting the signaling and line circuits and interrupting the controlling circuit.

8. In a fire-alarm system, the combination with the line circuit, and a source of current in connection therewith, of a signaling instrument connected in the line circuit embodying a signaling circuit having a signaling device connected therein, a controlling circuit having devices connected therein for controlling the operation of the signaling device, an auxiliary system, circuit controlling devices connected in the auxiliary system for closing the circuit between the latter and the controlling circuit, and a cut-out for short circuiting the circuit-controlling devices of the auxiliary system.

9. In a fire alarm system, the combination with the line circuit, and a source of current in connection therewith, of a plurality of signaling instruments having signaling devices for interrupting the current of the line in prearranged intervals to transmit a signal, and a circuit closer controlling the operation of each signaling device having means for retaining it in operated position for a period of time longer than the longest interruption of the line current during the transmission of a signal.

10. In a fire alarm system, the combination with the line circuit, and a source of current in connection therewith, of a signaling instrument having a signaling device adapted to be connected in the line circuit, a releasing device for controlling the operation of the signaling device, and means for resetting the releasing device from operated position before the instrument has completed the transmission of its complete signal.

11. In a fire alarm system, the combination with the line circuit, and a source of current in connection therewith, of a signaling instrument embodying a signaling circuit having a signaling device connected therein, a releasing device for controlling the operation of the signaling device and connecting the signaling circuit in the line circuit, and means for resetting the releasing device after the expiration of a period of time less than that required for the transmission of a complete signal from the instrument.

12. In a fire alarm system, the combination with the line circuit, and a source of current connected therein, of a signaling instrument embodying a signaling circuit having a signaling device connected therein, actuating means for operating the signaling device, and electro-magnetically operated devices responsive to the line current for operatively connecting the signaling device and the actuating means.

13. In a fire alarm system, the combination with the line circuit, and a source of current connected therein, of a signaling instrument embodying a signaling circuit having a signaling device connected therein, actuating means for operating the signaling device, devices for operatively connecting the signaling device and the actuating means, and electro-magnetically operated devices responsive to the line current for controlling the connection between the signaling device and the actuating means.

14. In a fire alarm system, the combination with the line circuit, and a source of current connected therein, of a signaling instrument embodying a signaling circuit having a signaling device connected therein, actuating means for operating the signaling device, means for establishing operative connection between the signaling device and the

actuating means, and electro-magnetically operated devices connected in the signaling circuit and responsive to the line current for controlling the connection between the signaling device and the actuating means.

15. In a fire alarm system, the combination with the line circuit having a source of current in connection therewith, of a signaling instrument embodying a signaling circuit adapted to be connected in the line circuit, a normally inoperative signaling device connected in the signaling circuit, actuating means for operating the signaling device, cam controlled devices operated by the actuating means for establishing operative connection between the latter and the signaling device and electro-magnetically operated devices responsive to the line current for controlling the operation of the cam controlled devices.

16. In a fire alarm system, the combination with the line circuit having a source of current in connection therewith, of a signaling instrument embodying a signaling circuit adapted to be connected in the line circuit, a normally inoperative signaling device connected in the signaling circuit, actuating means for operating the signaling device, cam controlled devices operated by the actuating means capable of being engaged and disengaged for connecting and disconnecting the actuating means and the signaling device, and electro-magnetically controlled devices responsive to the line current for connecting the cam controlled devices when the line current is continuous and disconnecting them when the said current is interrupted.

17. In a fire alarm system, the combination with the line circuit having a source of current in connection therewith, of a signaling instrument embodying a signaling circuit adapted to be connected in the line circuit, a normally inoperative signaling device connected in the signaling circuit, actuating means for operating the signaling device, a spiral cam operated by the actuating means, an arm arranged to coöperate with said cam, devices operated upon by said arm for establishing operative connection between the actuating means and the signaling device, and a device responsive to the line current for controlling the coöperative relation between the cam and the said arm.

18. In a fire alarm system, the combination with the line circuit having a source of current in connection therewith, of a signaling instrument embodying a signaling circuit adapted to be connected in the line circuit, a normally inoperative signaling device connected in the signaling circuit, actuating means for operating the signaling device, a spiral cam operated by the actuating means, an arm arranged to coöperate with said cam, means normally operating to disengage said arm and cam, devices arranged to be operated upon by said arm when the latter traverses the cam a predetermined distance for establishing operative connection between the signaling device and the actuating means, and an electrically controlled device operating upon said arm to retain it in coöperative relation with the cam while a continuous current is passing over the line.

19. In a fire alarm system, the combination with the line circuit having a source of current in connection therewith, of a signaling instrument embodying a signaling circuit adapted to be connected in the line circuit, a normally inoperative signaling device connected in the signaling circuit, actuating means for operating the signaling device, a spiral cam operated by the actuating means, an arm arranged to coöperate with said cam, means normally operating to disengage the cam and arm and return the latter to the beginning of the cam, devices arranged to be operated upon by said arm when the latter traverses the cam a predetermined distance for establishing operative connection between the signaling device and the actuating means, and a device controlled by the line current for retaining the said arm and cam in coöperative relation to establish operative connection between the signaling device and actuating means during the continuity of the line current, and permitting the said arm and cam to disengage when the line current is interrupted.

20. In a fire alarm system, the combination with the line circuit having a source of current in connection therewith, of a signaling instrument embodying a signaling circuit adapted to be connected in the line circuit, a normally inoperative signaling device connected in the signaling circuit, actuating means for operating the signaling device, a spiral cam operated by the actuating means, an arm arranged to coöperate with said cam, a circuit-breaker having a portion arranged in the path of said arm when it has traversed the cam for a predetermined distance for momentarily interrupting the signaling circuit, devices operated upon by said arm for operatively connecting the signaling device and the actuating means, means normally operating to disengage the cam and arm, a projection or support arranged to coöperate with the said arm after the latter has traversed the cam a predetermined distance for preventing the disengagement of the cam and arm before the latter has completed its motion, and a device responsive to the line current for controlling the operation of the said arm.

21. In a fire alarm system, the combination with the line and controlling circuits, a circuit controller for connecting them, a sig-

naling device for transmitting signals over the line circuit, and operating means for the signaling device, of a magnet connected in the controlling circuit and having a movable armature and an operating arm for the circuit controller having a shoulder arranged to hold the circuit controller in one position when said armature is in retracted position and serving to permit operation of said circuit controller arm when the said armature is attracted.

22. In a fire alarm system, the combination with the line and controlling circuits, a circuit controller for connecting them, a signaling device for transmitting signals over the line circuit, and operating means for the signaling device, of a magnet connected in the controlling circuit and having a movable armature, and a resetting member for the circuit controller having a projection coöperating with said armature when the latter is retracted to reset the circuit controller.

23. In a fire alarm system, the combination with the line and controlling circuits, a circuit controller for connecting them, a signaling device for transmitting signals over the line circuit, and a motor for operating said signaling device, of a stop for controlling the operation of the motor, an operating arm for said circuit controller, and a magnet connected in the controlling circuit having an armature arranged when attracted, to operate the stop to release the train, and to release the circuit controller arm, the latter coöperating with said armature to retain it in attracted position.

24. In a fire alarm system, the combination with the line circuit, and a source of current in connection therewith, of a signaling instrument embodying a signaling circuit, a break wheel connected in the signaling circuit, an actuating train for operating the break wheel, gearing capable of being operated to connect and disconnect the break wheel with the actuating train, and devices responsive to the line current for controlling the connection between the break wheel and actuating train.

25. In a fire alarm system, the combination with the line circuit, and a source of current in connection therewith, of a signaling instrument embodying a signaling circuit adapted to be connected in the line circuit having a break wheel connected therein, an actuating train for operating the break wheel, devices for releasing the actuating train, devices for connecting and disconnecting the break wheel and the actuating train, and devices responsive to the line current for controlling the connection between the break wheel and the actuating train.

26. In a fire alarm system, the combination with the line circuit having a source of current connected therein, of a signaling instrument embodying a signaling circuit having a signaling device connected therein, actuating means for operating the signaling device but normally disconnected from the latter, a controlling circuit having devices therein for releasing the actuating means, and a device responsive to the line current for establishing operative connection between the signaling device and the actuating means when the line current is continuous and for retaining the signaling device inoperative while the line current is being interrupted.

27. In a fire alarm system, the combination with the line circuit having a source of current in connection therewith, a signaling device for sending signals over the line circuit, and electrically-controlled means for placing the signaling device in signaling condition, of an auxiliary circuit connected to and adapted to operate said electrically-controlling means for placing the signaling device in signaling condition, and time-controlled devices connected in the auxiliary circuit for setting the signaling device of the instrument into operation.

28. In a fire alarm system, the combination with the line circuit having a source of current in connection therewith, a signaling device adapted for sending signals over the line circuit, and a magnetic releasing device for the signaling device, of an auxiliary circuit electrically connected to the magnetic releasing device for the signaling device, circuit controllers connected in the auxiliary circuit, and automatically-timed restoring means for returning said circuit controllers to normal condition.

29. In a fire alarm system, the combination with the main line circuit having a source of current in connection therewith, a signaling device adapted for sending signals over the main line circuit, of an auxiliary circuit arranged to carry the line current, means connected to the auxiliary circuit for controlling the operation of the signaling device, and a cut-out for automatically closing the line circuit and excluding the auxiliary circuit.

30. In a fire alarm system, the combination with the main line circuit having a source of current in connection therewith, a signaling device for sending signals over the line circuit, and a controlling circuit having devices for placing the signaling device in signaling condition, of an auxiliary circuit, a cut-out connecting the auxiliary circuit with the controlling circuit, circuit closing devices connected in the auxiliary circuit, and a magnet introduced into the auxiliary circuit by the circuit controlling devices for operating the cut-out to short circuit the auxiliary circuit.

31. In a fire alarm system, the combination with an instrument embodying a signaling circuit having a signaling device con-

nected therein and suitable operating devices for the signaling device, of an auxiliary circuit for setting the instrument in signaling condition, circuit controllers connected therein, and a device for automatically cutting out the auxiliary circuit embodying a magnet placed in the circuit by the circuit controllers, a switch for connecting the auxiliary and instrument circuits while in normal position, and for closing a short circuit around the auxiliary circuit when in operated position, and an armature for said magnet serving to retain the switch in normal position and acting to permit operation of the switch after its magnet has been energized.

32. In a fire alarm system, the combination with a signaling instrument embodying a signaling circuit having a signaling device therein, operating means for the signaling device, and a controlling circuit having devices for placing the signaling device in signaling condition, of an auxiliary circuit having suitable circuit controlling devices therein, a switch for connecting the auxiliary and controlling circuits when in normal position, and serving to introduce a short circuit across the auxiliary circuit when in operated position, a device for retaining said switch in normal position, and a magnetically-controlled device energized when one of the circuit controlling devices of the auxiliary circuit has been operated to release the said switch and permit it to move into operated position.

33. In a fire alarm system, the combination with a signaling instrument embodying a signaling circuit having a signaling device therein, operating means for the signaling device, and a controlling circuit having devices for placing the signaling device in signaling condition, of an auxiliary circuit having suitable circuit controlling devices therein, a signal device for the auxiliary circuit, a switch adapted to connect the auxiliary and controlling circuits when in normal position, and serving to close the circuit through the auxiliary signal device when in operated position, and devices controlled by the circuit controlling devices of the auxiliary circuit for controlling the operation of said switch.

34. In a fire alarm system, the combination with a signaling instrument embodying a signaling device, operating means therefor, and signal-controlling devices for placing the signaling device in signaling condition, of an auxiliary circuit having circuit controlling devices connected therein, a switch for connecting the auxiliary circuit with the signal controlling devices of the instrument when in normal position, and serving to short-circuit the auxiliary circuit when in operated position, means for normally operating said switch toward operated position, an armature for normally preventing operation of said switch-operating means, a detent for holding said armature and operating means in coöperative relation, and a magnet controlled by the circuit controlling devices of the auxiliary circuit and coöperating with the said armature to release said detent and permit operation of the switch.

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Witnesses:
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