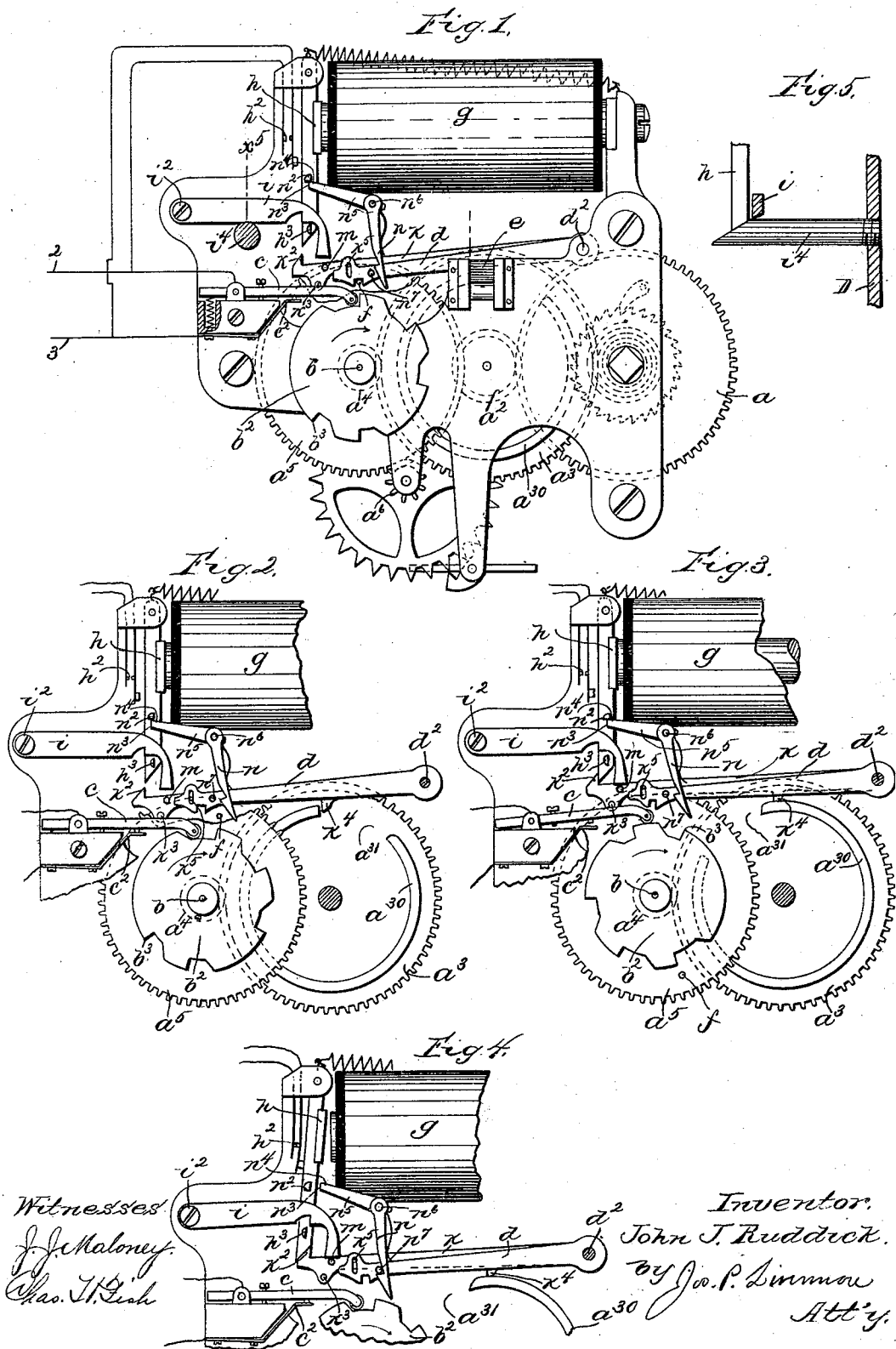


2 Sheets—Sheet 1.

No. 562,034.

Patented June 16, 1896.



(No Model.)

2 Sheets—Sheet 2.

J. J. RUDDICK.
FIRE ALARM SIGNAL BOX.

No. 562,034.

Patented June 16, 1896.

Fig. 6.

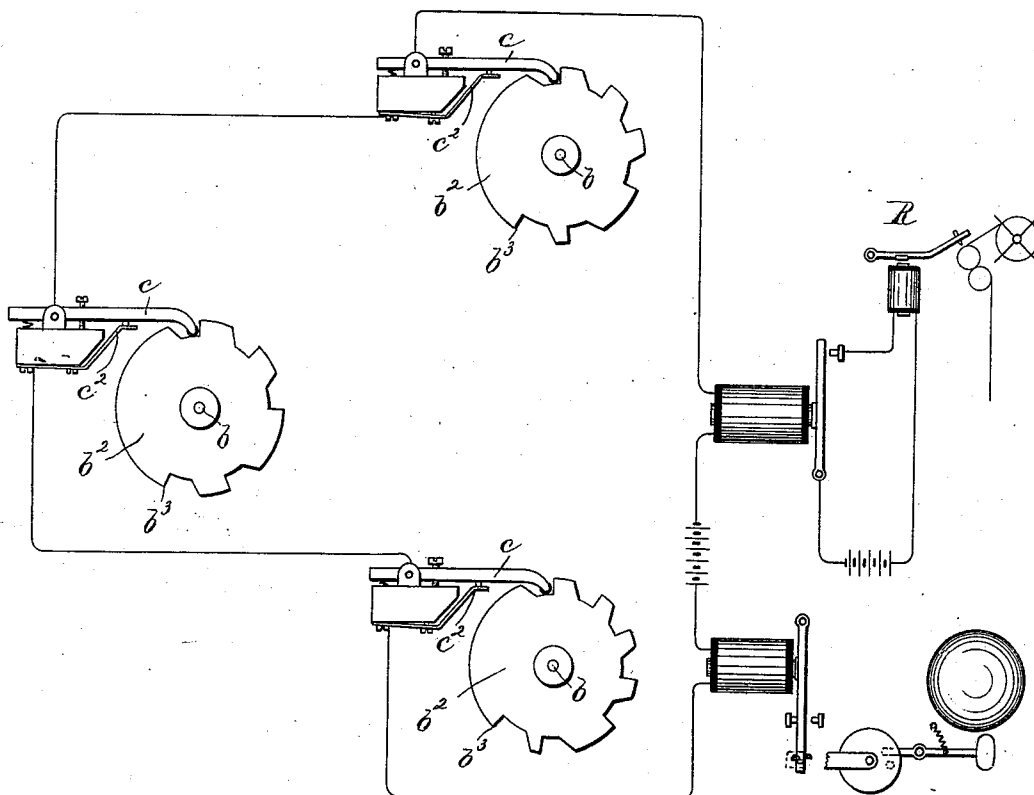
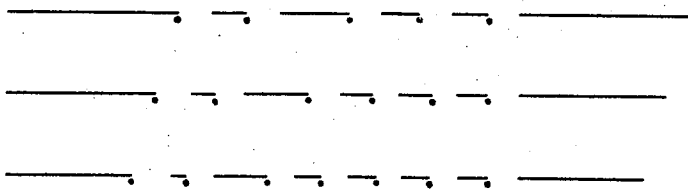


Fig. 7.



Witnesses

Jas. J. Maloney
H. H. Fisher

Inventor,

John J. Ruddick,
by J. P. Simmons
Atty.

UNITED STATES PATENT OFFICE.

JOHN J. RUDDICK, OF NEWTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF
TO MOSES G. CRANE, OF SAME PLACE.

FIRE-ALARM SIGNAL-BOX.

SPECIFICATION forming part of Letters Patent No. 562,034, dated June 16, 1896.

Application filed October 8, 1894. Serial No. 525,228. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. RUDDICK, of Newton, county of Middlesex, State of Massachusetts, have invented an Improvement in Fire-Alarm Signal-Boxes, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

The present invention relates to fire-alarm signal-boxes, and is embodied in a non-interference box intended for use in a system where a number of boxes are arranged in series in a circuit.

A leading feature of novelty of the box embodying the present invention consists in the means employed for insuring absolute non-interference between the signal-boxes on the same circuit in case two or more are set in operation at the same time, the said means involving a construction of the break-wheels or break-circuit devices in the different boxes such that each causes the first break in the circuit produced by it to be of different time duration from that produced by any other box on the same circuit. This feature of construction not only coöperates with the mechanism for insuring non-interference, but may also be employed as a means for distinguishing the messages. The said messages are composed primarily of a certain number and arrangement of alternate breaks and closures by which gongs or similar instruments are caused to produce a number of taps, which may be grouped so as to represent different decimal places in the number-signal as is usually practiced. Such gongs as commonly constructed respond only at the termination of one phase of a circuit change, usually responding the moment the circuit breaks, and during the ensuing open-circuit phase and following closure being simply restored to condition to respond again at the next break that terminates said closure, so that the relative length or duration of the break and closure intervening between the moment when the circuit is once broken and the moment when it is next broken (after having in the meantime been closed) does not affect the reading of the gong-taps. As shown in the box forming the subject of the present inven-

tion, the gongs and similar instruments respond at the beginning of the closed phase of the message instead of at the beginning of the open phase, as more commonly practiced; but they indicate nothing as to the relative length of the closure and break intervening between the beginning of one closure and the next.

An instrument in the nature of the Morse register, however, included in the circuit will show the relative lengths of the closures and breaks by marks of different lengths, such as dots and dashes, and inasmuch as the first break produced by the break-wheel at each box is of different length from that produced by any other box the dash-mark produced by the register in response to said first break will be of different length for each box on the circuit and consequently constitutes a distinguishing mark by which the box may be identified as soon as the first break is completed, without waiting for the whole number to be tapped out. If necessary, the length of the second or possibly of more breaks may be similarly varied, so that by the appearance of the first mark or combination of marks of the registered message distinctive signals may be produced for the several boxes on the given circuit. Two distinct means are thus provided for identifying the box-signal, both of which will be commonly observed, although the distinction afforded by the length of the first break or breaks is made known in less time, so that the preparations of the firemen may be begun before even one round of the message is completed, and, furthermore, the said first mark or marks of the message might be relied upon in case the complete message was not given, as might occur if the circuit were accidentally ruptured at some point shortly after the signal was begun.

The non-interference mechanism comprises an electromagnet and armature responsive to the circuit changes, which armature when in retracted position renders the box inoperative in any suitable or usual manner, as herein shown by closing a shunt around the break-wheel, so that the circuit cannot be opened by the break-wheel while the armature is in retracted position. Means are also provided whereby the said armature when once re-

tracted is retained in retracted position, or so that it cannot be subsequently moved up by the attraction of the magnet, said means being herein shown as a latch which catches the armature when retracted and prevents subsequent movement toward attracted position until said latch is mechanically released in some way.

Normally, as the apparatus stands ready for use with the box-door closed, the said latch is prevented from engaging with the armature by a projection operated by the door of the box, which the instant the said door is opened leaves the said latch in position to catch the armature when retracted and retain it so until the box-door is closed again.

To prevent the armature from being retracted and caught and held there in response to the break produced by its own box in sending the message, a locking device is provided which is operated to engage and lock the armature in attracted position just before the circuit is opened by the break-wheel. This lock for holding the armature in attracted position, instead of being operated by the "pull" or starting-lever of the box, as has heretofore been done in non-interference boxes, is in accordance with this invention operated by the circuit-closer or otherwise in harmony with the break-wheel or break-circuit devices of the box, being carried into engagement with and so as to lock the armature just before the circuit is broken, and being again disengaged from the armature just after the termination of the first break and during the second closure, just before the end of which it is again engaged with the armature and is then preferably retained in engagement therewith until the desired number of complete rounds of signals has been transmitted.

The break-wheel is so constructed and arranged that after the box is pulled it runs a short time before it causes the lock to engage the armature and the circuit to be first broken, such travel occupying an interval of time equal to the length of any closed-circuit phase of the message, all of which closed-circuit phases are of substantially uniform length in all the boxes on the circuit, and inasmuch as the latch for holding the armature retracted is made operative the moment the box-door is opened it follows that if any other box is already running the armature of the box in question will certainly be retracted and render its box inoperative, for if the door were opened on the open-circuit phase of the message being transmitted by the previously-started box the armature would be at once retracted and caught, and if it were opened on the closed-circuit phase of some other message that would be completed and the armature retracted and caught at the termination thereof before it could be locked in attracted position. If, however, two boxes were started simultaneously, or so that both arrived at the point of locking their armatures and breaking

the circuit substantially simultaneously, the armatures would at the beginning of the first break be locked in attracted position, and both boxes would be started in condition to transmit the message; and if, as has been heretofore commonly practiced, the armature-locking device were operated once for all at the pulling of the box or at the beginning of the signal interference would ensue. In accordance with this invention, however, the lock is mechanically withdrawn at the end of the first break, and inasmuch as the said break is of different duration at the different boxes it will be withdrawn first at the one having the break of shorter duration of the two or more simultaneously started, and inasmuch as the circuit will still remain broken at the other the armature of the box producing the shorter break will be retracted and caught in position to disable the box by shunting the break-wheel and thus closing the circuit through the box.

At the box having the first break of longest duration of those started simultaneously the circuit will be closed at the termination of the break just before the armature is unlocked and as it will find the circuit closed externally (the break-wheels being already shunted, as just stated, at the other boxes which were started at the same time) its armature will remain attracted and this box will thus control the line for the remainder of its operation. At the end of the first closure it will again break the circuit, but in the act of so doing will previously lock the armature in attracted position, and control of the line by this box thus being established its armature may now remain locked during the remainder of the signal, a function which is performed by an appropriate part of the mechanism.

The invention further consists in devices for causing the signals of any one or more boxes that may be started or running while another box is transmitting a signal to be transmitted consecutively each one after the previously-started signal has been completed. This mechanism for insuring succession of signals comprises a restarting device, which operates to start the motor a second time if when first started it was caused to run without affecting the line, owing to the fact that some other box had previously acquired control of the line, and it also comprises means for releasing the armature from retracted position at the completion of an idle or non-signaling round of movements, so that it can be locked in attracted position when the box is restarted to thereby enable the box when restarted to operate efficiently to transmit its signal.

Figure 1 is a front elevation of the operative parts of a signal-box embodying this invention, said parts being shown in the normal position in which they stand when the box-door is closed and the box is not in use; Fig. 2, a similar view showing the parts controlling the starting of the box and non-in-

interference devices in the position occupied after the box has been started and just before the break-wheel operates to lock the magnet-armature and open the circuit; Fig. 3, a similar view showing the parts in the position occupied when the box is started and is in operation to transmit a signal; Fig. 4, a similar view showing the box running, but with the armature caught and held in retracted position, so that the circuit-closer operated by the break-wheel is shunted and the box produces no effect on the external circuit; Fig. 5, a sectional detail on line x^5 , Fig. 1; Fig. 6, a diagram view showing the relative construction and arrangement of the different break-wheels in the same circuit and a portion of the receiving instruments coöperating therewith, and Fig. 7 a diagram showing the nature of the recorded messages and indicating the manner in which they are distinguished from one another by the first mark or stroke of said message.

The signal-box mechanism comprises the usual actuating-train of wheelwork $a^1 a^2 a^3 a^4 a^5 a^6$ for rotating the break-wheel shaft b at uniform speed, said shaft carrying the break-wheel b^2 , the periphery of which is properly formed to produce definite breaks and closures in the circuit controlled by it as it rotates, said break-wheels at different boxes having different surfaces and thus producing each a definite collocation of breaks and closures constituting or producing a message by which the box is characterized. As shown in this instance the signaling-surface of the break-wheel is in the nature of a cam which operates the movable member c of a circuit-breaker (shown as a pivoted lever connected with a circuit 2) leading from one side of the box and coöperating with an anvil c^2 , connected with the circuit 3, leading from the other side of the said box. When the end of the lever c rests in the notches or recesses in the periphery of the wheel b^2 , the members c and c^2 are connected and the circuit closed there-through; but when the lever c is raised by the teeth or projections of said surface its contact is lifted off from the anvil c^2 and the circuit is broken. The anvil is yielding and follows up the circuit-breaker c a short distance as it rises under the action of the wheel b^2 , so that the circuit is not broken until after the end of the lever c has traveled a certain distance outward from the axis of the wheel b^2 . Thus the outermost portion of the periphery of the wheel b^2 in passing the circuit-breaker c produces breaks in the circuit, the time duration of which corresponds to the time occupied by said portions of the surface in passing the end of the circuit-breaker lever, and thus corresponds to the circumferential length of such portions in view of the uniformity of movement of the said wheel, and as appears from Fig. 1 the said portions on the periphery of the wheel (which rotates in the direction of the arrow marked thereon) are of different length, while the notches or

recesses between them which correspond to closed-circuit phases of a transmitting message are of substantially uniform length, with one exception, the nature and purpose of which will be hereinafter explained.

It further appears that the first projecting portion or tooth of the wheel has the longest surface, while the others (with an exception to be referred to later) are of substantially uniform length to produce strokes or taps at uniform intervals of time, except that one of said surfaces is of greater length than the others, thus forming a greater interval which separates the taps into two groups corresponding to the tens and units places of the number counted by the wheel, the signal of which, so far as it is responded to by the gongs or strikers, begins when the point b^3 passes the end of the circuit-breaker c and the gongs sounding as the end of each tooth passes the circuit-breaker, and the latter drops into a notch or recess, so that the wheel shown in Fig. 1 produces two taps followed by a short interval, and then three taps at each rotation of the wheel, and there being a longer interval between the last tap produced at one rotation and the first tap produced at the next than any other interval in the transmission of a signal, which is understood as representing the number "23."

The break-wheels of the different boxes on a single circuit, as indicated in the diagram, Fig. 6, are not only distinguished from one another by producing different numbers of taps, (the time arrangement of which with relation to one another is represented by the round dots in Fig. 7,) as is usual in signal-boxes of this kind, but are also distinguished from one another by having the first break produced in the rotation of the signal-wheel of different lengths in the different boxes, as clearly shown in Fig. 6, so that the indications of a register (indicated in diagram R, Fig. 6) in the form of dots and dashes, as represented in Fig. 7, have the first dash corresponding to the first break of different length for each box, so that the recorded message of every box has its first dash distinguishable from that of every other box, and consequently the recorded message of the first stroke may be relied upon to designate the box from which it was received.

The box-motor may be set in operation in the usual manner by lifting a starting-lever d , pivoted at d^2 by means of the finger-hook or pull e , and thereby disengaging the said starting-lever from a stop-pin f on the wheel a^5 of the train that travels in unison with the break-wheel b^2 . The said starting-lever d constitutes no part of the non-interference mechanism and need have no connection therewith, although, as shown in this instance, it is in fact connected with the locking device for the armature of the non-interference mechanism in a manner and for a purpose that will be hereinafter described.

In order to secure non-interference between

the different boxes or to give one box complete control of the line in case two or more are running at the same time, each box contains an electromagnet g , included in the circuit and provided with an armature h , which, when retracted, closes a normally open circuit-closer h^2 in a shunt around the circuit-breaker c c^2 , as shown in Fig. 1.

Means are provided for preventing attractive movement of the armature in response to the closed-circuit phase of a message transmitted from some other box on the line after it has once been retracted in response to a break in the circuit, said means being herein shown as a latch i or gravitating hook pivoted at i^2 and cooperating with a projection h^3 on the armature-lever, falling over said projection in case the armature is retracted, as shown in Fig. 4, and preventing any subsequent attractive movement of the armature until said latch is mechanically disengaged therefrom. Normally when the box is closed the said latch is prevented from engaging with the projection h^3 by an independent support i^4 , controlled by the door D of the box (see Fig. 5) and being removed from position to support the said latch as soon as the box-door is opened. Thus if the circuit of the magnet is broken after the box-door is opened its armature will be retracted and caught by the latch and held in retracted position, thus shunting and disabling the box unless such retraction of the armature is prevented. In order to prevent the armature from thus being retracted and disabling the box when the circuit is broken by the break-wheel of the same box in sending its message, a locking device is provided (shown as a lever k) fulcrumed at d^2 independently of the starting-lever d and provided with a finger k^2 , which, when raised, may engage with the armature-lever and lock the same in attracted position, as shown in Fig. 3. The said lever is operated by the break-wheel b^2 or in harmony therewith, being shown in this instance as provided with a projection k^3 , which rests on the circuit-breaker c , so that as the latter is raised to break the circuit at c c^2 the said locking-lever is also raised, and these parts are so proportioned that the finger k^2 of the locking-lever rises far enough to engage with the armature-lever before the circuit-breaker rises far enough to open the circuit, so that unless the circuit is opened at some external point (such as another box on the same circuit) before the break-wheel operates to break the circuit the said locking device will lock the armature in attracted position, as shown in Fig. 3, thus leaving the circuit-closer c c^2 in control of the circuit to transmit the message under control of the break-wheel.

It will be observed that when the break-wheel is released by the starting-lever d the break-wheel will travel the length of a notch from the position shown in Fig. 1 to that shown in Fig. 2 before it will operate to lock the armature and break the circuit, as shown in Fig. 3,

and inasmuch as the latch i is released immediately upon the opening of the door, and thus before the pull e can be operated and the box started, there is an interval of time in which the armature can be retracted and caught by the hook greater than the longest closed-circuit phase of any message transmitted in the circuit. Thus if a box is pulled while another one is already running it is inevitable that the armature will be caught in retracted position, disabling the box and preventing it from interfering with the signal of the box already running. If, for example, the door is opened during the open-circuit phase of a message being transmitted over the line, the armature will be instantly retracted and caught, and if it is opened and the box pulled on a closed-circuit phase of such message that phase will be completed and the armature retracted and caught before the locking device k k^2 operates to lock it in attracted position. If, however, two or more boxes were started simultaneously, or so that the circuit-breakers c were first lifted substantially simultaneously, the armatures of all such boxes would be locked in attracted position and they would all start in proper condition to transmit a signal. Inasmuch, however, as the first long projection of the break-wheel, corresponding to the first break produced in the message, is of different length in all the different boxes of the circuit, the one or more having shorter breaks will permit the corresponding circuit-breakers c to drop before the one having the longest break does so. In so dropping the circuit-breakers first operated connect their own contacts and complete the circuit so far as their own box is concerned; but it is still open at the box having the longer tooth, so that all the magnets remain demagnetized, and inasmuch as the locking devices k^2 are disengaged from the armature at the first dropping of the corresponding circuit-breakers the armatures will be mechanically as well as electrically released at those boxes having the shorter breaks and will thus be retracted and caught by the respective latches i , thus shunting the break-wheels and retaining the circuit closed at such boxes. When, however, the box having the longest break completes the said break, the circuit-breaker in falling closes the circuit (which is now closed at all points external to this box) and thus causes this magnet to be energized and to retain its armature by magnetic attraction, although released mechanically by the lock, and thus this box that produced the longest first break as a part of its message will acquire control of the line and will transmit its message undisturbed by the other box or boxes that were started simultaneously therewith.

Inasmuch as some one box acquires control of the line to the exclusion of all others by the time that the first break is ended, by thus having the locking device under control of the break-wheel at the beginning and end of this first break it is unnecessary that the lock-

ing device should longer remain responsive to the break-wheel, and after it has been lifted to lock the armature just before the second break in the same manner as has been described for the first break it may be retained in locking position during the remainder of the signal, which is done by the action of a flange a^{30} on the wheel a^3 of the train, which makes one rotation for a complete round of signals and has a recess a^{31} , (best shown in Fig. 2,) which leaves the locking-lever k under control of the break-wheel while the said recess is traveling past the projection k^4 , that thereafter coöperates with the flange a^{30} to retain the locking device in engagement during the completion of the message.

Inasmuch as the break-wheel and stop-pin f are commonly required to make three or four turns or repetitions of the signal, the starting-lever d must be prevented from engaging with the stop-pin until the proper number of turns have been completed. This has usually been done by the coöperation, with the starting-lever, of a flange similar to the one a^{30} , but, as shown in this instance, the locking-lever k is provided with a projection k^5 , that engages with the lever d , as shown, so as to produce lost motion between the two, it being possible to lift the lever d by the pull e from the position shown in Fig. 1 enough to release the pin f without lifting the lever k , which is controlled wholly by the movement of the train, as has been described. When, however, the lever k is lifted, as by the teeth of the break-wheel and flange a^{30} , it also lifts the lever d , and thus holds it up from the path of the stop-pin f , as shown in Fig. 3, after the signal is once started until the recess a^{31} in the flange of the wheel a^3 arrives in position to release the locking-lever, when the latter drops, and with it the starting-lever, which thus engages the pin f as it completes its rotation and thereby stops the break-wheel at the proper point for the beginning of the next operation of the box, except when the starting-lever is acted upon by the restarting device of the succession mechanism to be hereinafter described.

It is obvious that the time duration of the break in the circuit produced by the action of the periphery of the break-wheel depends not only upon the length of the teeth or projections on the periphery, but on the speed of movement of the motor, and the statement that the break-wheels have the first tooth or projection of different lengths in the different boxes on the circuit is to be understood as meaning that they are of different length, assuming that the speed of rotation is uniform, or of such length with relation to their actual speed of rotation as to produce breaks of different length when the boxes are running at proper or normal speed. It might happen, however, that the timing of the motors or some of them was out of proper adjustment, so that (referring to Fig. 7 for convenience) the box producing the first of the series of the recorded messages there

shown ran just enough faster than normal to make its first break of the same length as that produced by the box producing the second message, so that if the two were started simultaneously they would make the first break simultaneously and might therefore start on the second closure with the armatures of both attracted. Under such circumstances, however, inasmuch as the first box runs at more than normal speed the duration of its first closure would be correspondingly shortened and it would begin the second break in advance of the second box and might therefore cause the armature of the second box to be released and caught in retracted position before the locking device of the second box rose in response to the second tooth of the break-wheel, so as to retain it in attracted position, so that even under such abnormal running non-interference would be effected. In order, however, to increase the time margin sufficiently to absolutely insure non-interference under the circumstances just stated, and also to afford more perfect means for distinguishing the recorded messages, the boxes are shown in this instance as having the second break also of varying length, being shortened in the different boxes with a corresponding addition to the length of the intervening closure. The arrangement is as indicated in Figs. 6 and 7, the box having the longest break having the shortest intervening closure between the first and second breaks. Thus if the first box runs too fast, so that its first break is too short, its first closure will be relatively far shorter than any of the others, so that, even assuming that it completed its first break simultaneously with some other box, it would begin its second break enough in advance of such box to insure the locking out of the armature of the second box. In other words, any defect in the speed of the motors that tends to make the first break in two or more boxes more nearly uniform tends to exaggerate the difference in length of the following closures, or of the time intervening between the termination of the first break and the beginning of the second, so that if two boxes should begin and end their first break simultaneously, or so nearly so as not to affect the armature of either box, one would certainly begin its second break enough in advance of the other to cause the armature of the latter to be retracted and locked in retracted position before its break-wheel began the second break. This construction also facilitates the reading of the recorded message produced by the first two marks, as it affords variation in the length and position of said marks with relation to one another, as well as affording a variation in the absolute length of the marks produced by different boxes when running at normal speed.

To avoid misunderstanding, it may be stated that Fig. 7 represents the first complete round of each message, together with the first register-mark of the second round.

The devices thus far described, operating as stated, are sufficient to insure absolute non-interference of signals, so that if the line is in working order the complete message or round of signals of one box, and of one box only, will be transmitted. It is sometimes deemed desirable, however, in case two or more boxes are pulled simultaneously, or in case one or more are pulled while another is in effective operation, but before it has completed its message, to have the signals of all the boxes thus started or set in operation transmitted. To provide for such succession of the signals of boxes which are pulled or have their motors running while any given box is operating to transmit a signal, and which themselves have their armatures locked in retracted position, as shown in Fig. 4, as long as said first box continues to send its signal, as before explained, it is necessary that after the box in control of the line has finished its signal the remaining box or boxes that have been started while it was running, or that were started simultaneously therewith and were thrown out of control of the line, should be restarted or continue running for a second round and the armature thereof brought to attracted position before the first break produced by the break-wheel of the box which has thus been restarted. The instrumentalities for accomplishing this result of restarting the box while its armature is in attracted position are as follows:

The locking-lever k that locks the armature in attracted or retracted position, as it may be, just before the first break is made is provided with an armature-unlatching device (shown as a pin m) which raises the latch or hook i when the said locking-lever k , by its projection k^2 , has acquired control of the armature-lever, so as to lock it either in the position shown in Fig. 3 or that shown in Fig. 4. When the motor completes its operation, so that the lever k is permitted to drop by the arrival of the gap a^{31} in the flange a^{30} under it, the armature, if it has been locked in position to shunt the box, as shown in Fig. 4, is thus permitted to respond to the attraction of its magnet, and if the line is closed externally to the box, as is the case if the other message that was being sent is completed, the said armature will be attracted and will follow the rear inclined surface of the locking-finger k^2 as the lever k drops over the edge of the flange a^{30} , and the projection h^3 of the armature will pass the shoulder of the hook i before that drops far enough under the control of the pin m to catch said projection h^3 . Thus the armature is permitted to come back to attracted position independently of the action of the releasing device or support i^4 on the box-door. The restarting of the motor under these conditions is effected by the action of a catch n for the starting-lever d , which catch is controlled by the armature, being in position to engage with and retain said starting-lever d raised, only when the

armature is retracted, as shown in Fig. 4. Thus when the locking-lever k is dropped at the completion of a non-signaling round to permit the attractive movement of the armature, as has just been described, the hook n retains the starting-lever d in unlocked position, as shown in Fig. 4, so that it does not fall and stop the motor, as would be the case if the armature had remained in attracted position while the box was running, as takes place in a box which is operated to transmit the signal. The armature controls the locking-hook n through the action of a projection n^2 on the armature-lever, which coöperates with a shoulder having surfaces $n^3 n^4$ at the end of an arm n^5 of the hook n , which is made in the form of an elbow-lever, pivoted at n^6 .

When the armature is in fully-attracted position, as is the case with a box that gets started, so as to control the line and transmit its signal, the projection n^2 lies over the surface n^4 at the end of the arm n^5 and holds the said arm with the hook n in such position as not to coöperate with the projection n^7 on the starting-lever d , and consequently if the box has been running to transmit its signal—that is, with the armature retained in attracted position—the hook n does not coöperate with the starting-lever and the latter drops and stops the motor when its signal is completed. In case, however, the box is started or is running while another box is in control of the line, its armature will be locked in retracted position, as has been explained, and projection n^2 will be clear of the locking-hook n , and the latter will engage with and hold up the starting-lever d , as shown in Fig. 4, and consequently the latter will not engage with the stop-pin f and stop the motor when the round of movement of the motor is finished and the locking-lever k is released by the flange a^{30} .

The release of the locking-lever k permits the armature to be moved toward attracted position and beyond the point of engagement of the latch i , and in this movement the pin n^2 brings up on the surface n^3 of the restarting-hook n without affecting the latter, but before the armature has quite arrived at attracted position. The motor having thus been permitted to pass the usual stopping position or restarted, (owing to the stopping and restarting lever d being held up, as described,) immediately after passing this position and before it has moved far enough to make the first break by its action on the break-circuit device c will, by its stop-pin f , or otherwise, engage with the end of the restarting-hook n and throw it out of engagement with the pin n^7 and by the same operation will depress the shoulder $n^3 n^4$, so that the projection n^2 on the armature-lever will pass over it, allowing the said armature to come to fully-attracted position, so that it will be properly engaged and held in attracted position by the locking-finger k^2 and at the same time will hold the restarting-hook n out of position to

again engage the starting-lever *d*, so that the box will run and send its message and at the completion thereof will be stopped by the action of the starting-lever *d*, as has been before described.

If two or more boxes should be restarted, as has been described, simultaneously or substantially so, one of them will acquire control of the line to the exclusion of the others the same as if they had been originally started by different operators, as has already been described, and after the one which thus assumed control completes its signal the other will be restarted in operative condition, as has been described, the result being that the several boxes will send their signals successively each after the preceding signal has been completed.

As the closing of the box-door raises the latch *i* and thus prevents it from cooperating with the armature, it is desirable when the door is once opened and the motor started that the door should not be closed again until the operation of the box is completed. This may be effected by having the door controlled by a lock of the kind commonly used, which, when unlocked by the key provided for that purpose in order to send an alarm, remains with its lock in such condition as to retain the key and prevent the spring-bolt from yielding, so as to permit the door to close until the proper official having a second releasing-key arrives and releases the first-mentioned unlocking-key and closes the box-door; or in the absence of such construction it would be merely necessary to provide an obstruction to the closing of the door depending upon the position of the starting-lever and operating to prevent the door from being closed until said starting-lever had dropped into position to engage the stop-wheel, an event which occurs only after the box has completed its effective signal-transmitting operation.

The invention is not limited to the specific mechanisms herein shown, as it is obvious that the details thereof might be varied widely without departing from the essential characteristics of construction and mode of operation. The succession mechanism, for example, comprising the restarting device or means for preventing the motor from stopping at the end of its usual or normal run, in case it has been running idle or without transmitting a signal, does not depend upon the specific construction of the devices for effecting non-interference, it being essential only so far as the cooperation of these two mechanisms is concerned that the restarting shall be effective only when the non-interference mechanism has acted to prevent effective operation of the signaling mechanism, and that upon such restarting the non-interference mechanism shall have an opportunity to resume its normal condition, so that the signaling mechanism will not be prevented from operating in the movement ensuing upon its restarting.

By the term "non-interference mechanism"

is included the armature, the shunt operated by it, the latch for retaining the armature retracted, and the lock for retaining the armature in whichever position it may be just before the first break produced by the signaling mechanism of the box in question, or any substantial equivalent for this mechanism, in those combinations where it may be regarded as constituting a single element, and similarly any motor-actuated devices for varying the condition of the circuit to transmit signals or messages is regarded as an equivalent for the signaling mechanism comprising the motor, break-wheel, and break-circuit devices operated by the latter herein shown.

I claim—

1. A fire-alarm signal-box comprising a break-wheel or signaling device and an actuating-motor therefor, with an electromagnet included in the circuit and an armature therefor and means whereby the box is rendered inoperative to transmit the signal when said armature is in retracted position and a latch which engages said armature when retracted and retains the same in retracted position, and a lock operated by the actuating-motor to engage with and lock the armature after the motor is started and before the circuit is broken in response to the operation of said motor, substantially as and for the purpose described.

2. A fire-alarm signal apparatus comprising two or more signal-boxes in a single circuit, each containing a break-wheel or signaling device and an actuating-motor therefor, said break-wheels having the portion of the surface that produces the first break in the circuit of different length in the different boxes; an electromagnet and armature therefor included in the circuit at each box and means whereby said armature when once retracted is retained in retracted position when the magnet is subsequently energized; and a lock operated by the actuating-motor in harmony with the portion of the signaling-surface that produces the breaks in the circuit, said lock being moved to engage with the armature and mechanically retain it in attracted position if it be so just before the beginning of the first break produced by said signaling device, and releasing said armature just after the said first break is completed and again engaging it with said armature before the second break, substantially as and for the purpose described.

3. The combination of the break-wheel or signaling device and actuating-motor therefor; and the stopping and starting lever for said motor; with an electromagnet included in the circuit, and armature therefor; and means whereby the box is rendered inoperative for transmitting the signal when the said armature is in retracted position; the restarting device consisting of a catch for said starting and stopping lever engaging with said armature as described, being held out of engagement with said starting-lever

when said armature is attracted and being caused by the retraction of the armature to engage with and hold said starting-lever in position to prevent the same from stopping the motor when running with the armature in retracted position; and means operated by said motor to disengage the said restarting device from the stopping and starting lever, and reengage it with said armature after the motor has passed the position at which it normally stops; and means for mechanically locking the armature against movement while the motor is running, substantially as described.

4. A fire-alarm signal-box comprising a break-wheel or signaling device and an actuating-motor therefor, with an electromagnet included in the circuit and an armature therefor and means whereby the box is rendered inoperative to transmit the signal when said armature is in retracted position and a latch which engages the said armature when retracted and retains the same in retracted position, and a lock operated by the actuating-motor to engage with and lock the armature in attracted or retracted position as it may be before the circuit is broken in response to the operation of said motor, said lock engaging with said latch and disengaging the latter from the armature after the said motor-actuated lock acquires control of the armature, substantially as and for the purpose described.

5. The combination of the signaling mechanism and starting-lever therefor, with non-interference mechanism comprising an electromagnet and armature and a lock for the latter operated by the signaling mechanism to engage said armature and be disengaged therefrom at the end of the normal run of said signaling mechanism; a restarting device for said starting and stopping lever cooperating with said armature as described; and means operated by the signaling mechanism when restarted to disengage the restarting device from the stopping and starting lever and place the said restarting device under control of the armature, substantially as and for the purpose described.

6. The combination of the motor and break-wheel and a starting and stopping lever there-

for, with an electromagnet and armature; a latch to catch the armature when retracted and a locking-lever operated by the break-wheel and engaging with the armature and latch, as described; and a restarting device cooperating with said stopping and starting lever and with the armature, substantially as and for the purpose described.

7. A fire-alarm signaling apparatus comprising two or more signal-boxes in a single circuit each containing a break-wheel or signaling device and actuating-motor therefor, the said break-wheels having the portion of their surfaces that produces the first break in the circuit of different length relative to the normal speed of movement of said break-wheel in the different boxes on the circuit, combined with non-interference mechanism comprising an electromagnet and armature responsive to said break-wheel, and a lock for said armature operated in harmony with the portion of the signaling-surface that produces the first break in the circuit, substantially as and for the purpose described.

8. A fire-alarm signaling apparatus comprising two or more signal-boxes in a single circuit each containing a break-wheel or signaling device and actuating-motor therefor, the said break-wheels having the portion of their surfaces that produces the first break in the circuit of different length relative to the normal speed of movement of said break-wheel in the different boxes on the circuit, and the interval between the termination of the first break and beginning of the second break also of different length in the different boxes, combined with non-interference mechanism comprising an electromagnet and armature responsive to said break-wheel, and a lock for said armature operated in harmony with the portion of the signaling-surface that produces the first and second breaks and intermediate closure of the circuit, substantially as and for the purpose described.

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

JOHN J. RUDDICK.

Witnesses:

JOS. P. LIVERMORE,

JAS. J. MALONEY.