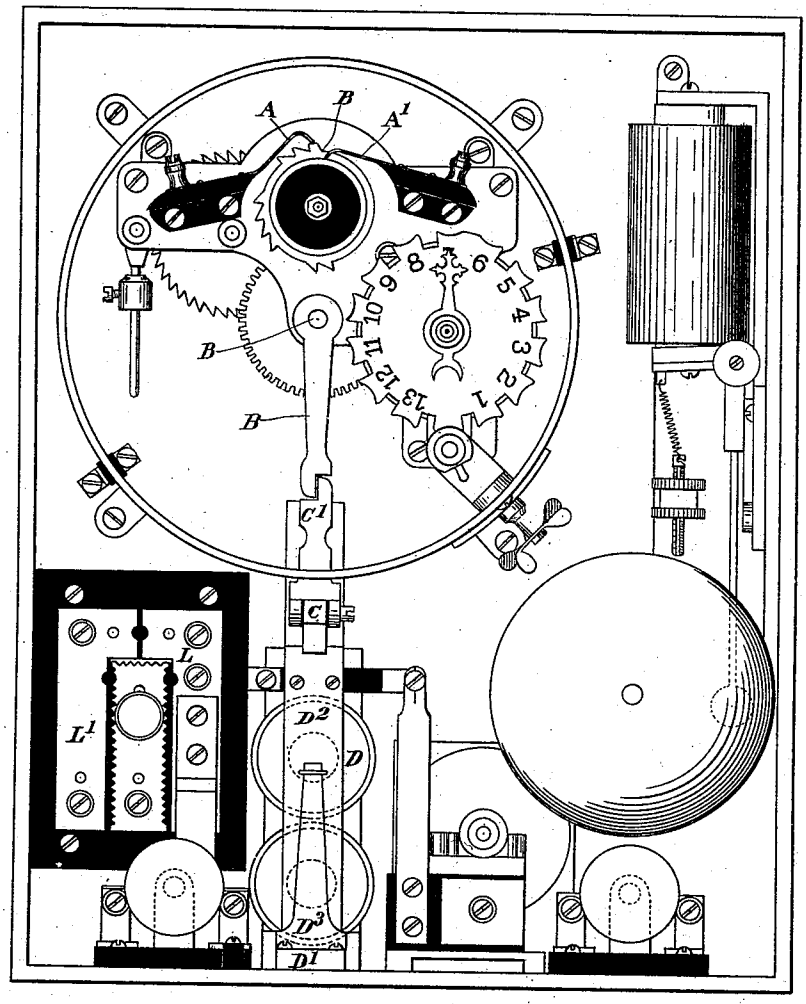
(No Model.) 3 Sheets—Sheet 1.

T. F. GAYNOR.

NON INTERFERENCE SIGNAL BOX MECHANISM FOR FIRE ALARM TELEGRAPHS.

No. 509,219. Patented Nov. 21, 1893.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

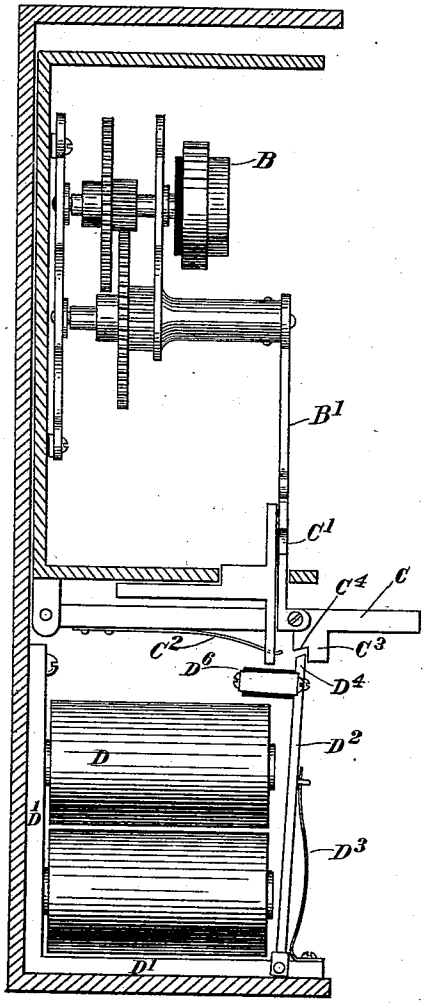


Fig. 3.

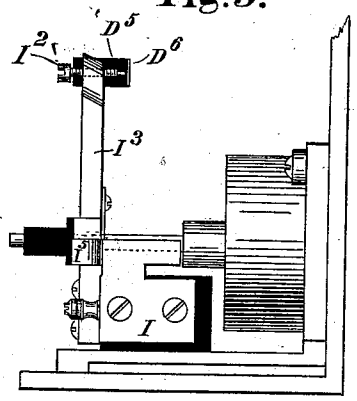


Fig. 4.

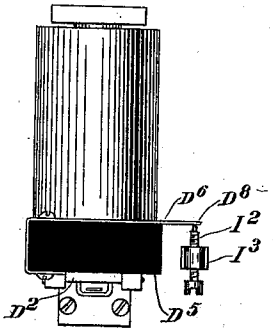
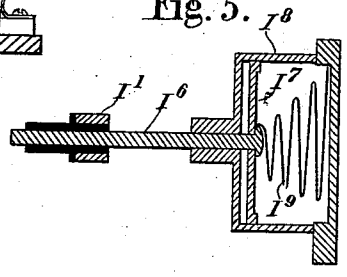


Fig. 5.



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No. 509,219. Patented Nov. 21, 1893.

Fig. 7.

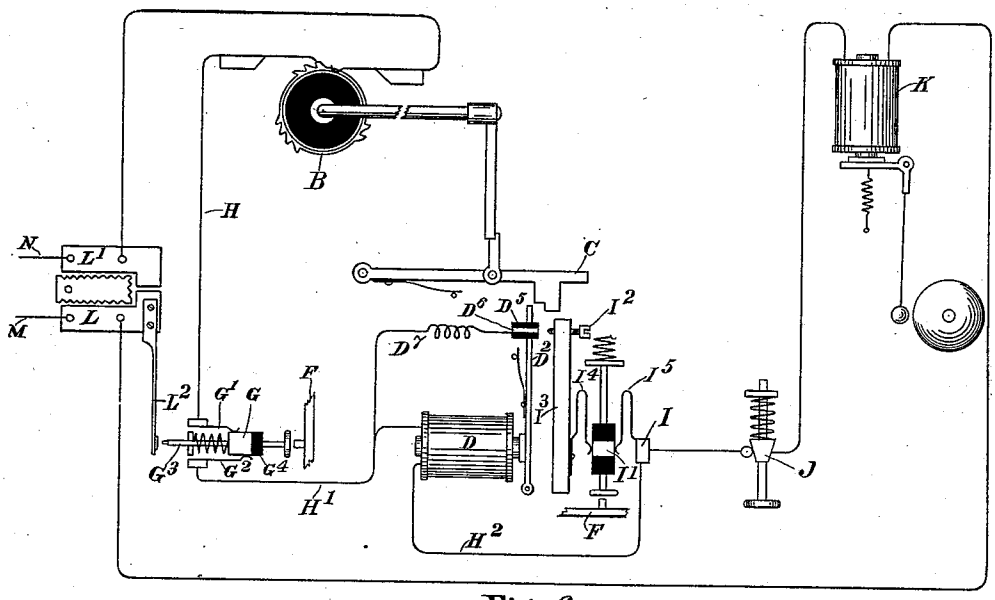
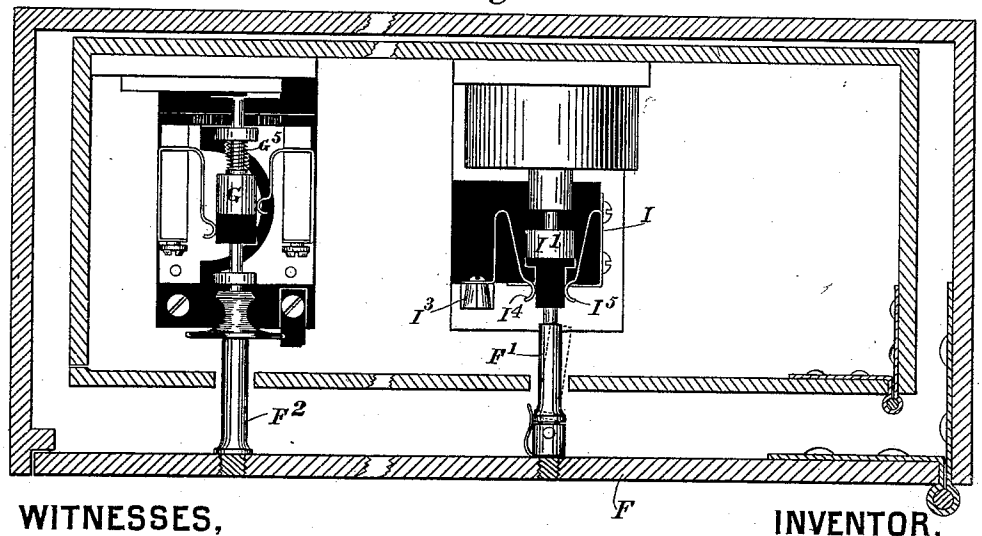


Fig. 6.



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UNITED STATES PATENT OFFICE.

THOMAS F. GAYNOR, OF LOUISVILLE, KENTUCKY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NEW GAYNOR ELECTRIC COMPANY, OF SAME PLACE.

NON-INTERFERENCE-SIGNAL-BOX MECHANISM FOR FIRE-ALARM TELEGRAPHS.

SPECIFICATION forming part of Letters Patent No. 509,219, dated November 21, 1893.

Application filed March 19, 1891. Serial No. 385,694. (No model.)

To all whom it may concern:

Be it known that I, THOMAS F. GAYNOR, of Louisville, county of Jefferson, State of Kentucky, have invented a new and useful Improvement in Non-Interference-Signal-Box Mechanisms for Fire-Alarm Telegraphs, of which the following is a specification, reference being had to the accompanying drawings, forming part of the same, and in which like letters represent like parts.

This invention relates to that class of signal boxes which is known as "non-interference," that is, such boxes as have their mechanism so constructed that when another box of the kind and located in the same circuit is previously "pulled" or operated, any of the other boxes cannot be operated until the first one "pulled" has completed its signal. Various devices for this purpose have been invented. As for instance, one class of mechanisms are constructed upon the principle of short-circuiting the circuit breaking wheel of the box mechanism if another box is operating in the same circuit at the time the second box is "pulled." In another class, the plan of obstructing the movement of the train of the second box for the time being is adopted. In another class, the plan of temporarily disabling the tripping mechanism for the time being, is observed, and so on, and in all cases the non-interference feature is obtained by the movement of an armature of an electro-magnet which is placed in the main circuit which responds to the breaks in the circuit caused by the break wheel mechanism of the first or operating box. In one class of non-interfering signal boxes the armature of the electro-magnet that obstructs the movement of the train or that renders the tripping mechanism inoperative falls away from the poles of the magnet so far that its restoration again is accomplished by a mechanical contrivance connected with the door of the box, the electro-magnet remaining in the circuit all the time but the armature being beyond the influence of the magnetic field.

Now, this invention consists in placing the magnet in the main circuit and in leaving the armature in the magnetic field, but in providing the latter with a short-circuiting device having a connection with an automatic switch that is adapted to be operated by the door of the box, the whole armature device and switch connection being adapted to short-circuit the magnet after the box door shall have been opened, providing another box is already operating in the circuit, so that when the armature once falls away from the magnet it will remain in that position so as to obstruct the movement of the tripping lever mechanism and not be drawn forward again momentarily by the brief closures in the circuit caused by the teeth of the circuit breaking wheel of the operating box passing against the terminal spring, against which it makes contact, and during which it might ordinarily be possible to depress the tripping lever of a second or non-operating box, if not provided with this device.

Other details of construction and operation constituting the invention will be more fully explained hereinafter.

Figure 1. represents a signal box of the usual construction provided with the invention, the wire connections being omitted for purposes of clearness. The drawings show the mechanism in front elevation, with the door of the box omitted. Fig. 2. shows a vertical side sectional view of the non-interfering magnet with relation to the armature and tripping lever mechanism. Fig. 3. shows a side elevation of the automatic switch and armature short-circuiting device. Fig. 4. shows a top view of the armature short-circuiting device. Fig. 5. shows a vertical section of the automatic switch shown in Fig. 3. Fig. 6. shows a top view of the automatic switch and an automatic cut out, adapted to cut the whole box mechanism out of circuit when the door of an outer box or case in which the whole mechanism is placed is closed. It also shows how the operation of the cut out and switch is effected by means of studs in the outer door of the box, one of which has a loose joint therein, to compensate against friction on the end of the switch by reason of the curved path through which a rigid stud in the door would pass, in the act of closing the door. Fig. 7. shows a diagram of the whole box connections in which the circuit wheel mechanism is shown

diagrammatically and in which the principle of the non-interference mechanism is clearly shown, without reference to mechanical construction of the parts.

A. A'. represent the terminal contact springs of a signal box mechanism connected in a fire alarm closed circuit which are adapted to play upon the circuit wheel B. provided with a train of wheel work and motor mechanism of well known construction and having an escapement lever B'. upon one of its shafts B^2. and by means of which the rotation of the circuit wheel B. is controlled.

C. represents a hinged detent lever provided with a detent C'. which is loosely connected therewith and which is adapted to control the movement of the lever B'. having a retracting spring C^2. by means of which the detent C'. is normally held up so as to arrest the movement of the lever B'.

Directly beneath the lever C. the non-interfering electro-magnet D. is placed having an L shaped keeper D'. to which the armature D^2 is trunnioned having a retracting spring D^3. The armature D^2. extends above the magnet so as to bring its end D^4 against a projection C^3. upon the under side of the tripping lever C. when the armature falls away from the magnet.

The projection C^3. is provided with a shoulder C^4. which is adapted to impinge against the end D^4. of the armature in case the latter has fallen away from the magnet and thereby prevent the lever C. from being depressed while the armature is in that position. The projection C^3. however, is of such shape as that when the armature is drawn up to the poles of the magnet it will entirely clear the end D^4. of the armature so as to allow the lever C. to become depressed and to thereby cause the detent C'. to clear the end of the escapement lever B'. and thus allow the circuit wheel mechanism to rotate. By this arrangement of the armature D^2 and the lever C. it can be seen that the depression of the latter or its non-depression is entirely controlled and determined by the position of the armature D^2. according as it may be away from or against the poles of the magnet, as the case may be, and consequently, the operation or non-operation of the box mechanism determined.

The manner in which the movements of the armature D^2. are controlled will now be described. When a signal is about to be given from a signal box the outer door F. of the signal box allows the cut out G. to establish a circuit from the wire H through the springs G'. G^2. over the wire H'. through the magnet D. over the wire H^2. to a terminal I. of the switch I'. and thence through a circuit breaker J. the bell magnet K. to the lightning arrester plate L. and thence to the line M. Now, it will be observed that when the circuit from the line M. through the circuit wheel B. through the lightning arrester plate L'. to the line N. is closed the magnet D. will attract the armature D^2. to its poles and thereby allow the lever C. to be depressed so that the box may transmit a signal in the customary manner. If, however, a break should occur in the line such as is caused by the circuit wheel mechanism of a box, it can be seen that after the first break would occur in the circuit, it would by the demagnetization of the magnet D. cause its armature D^2 to fall away from its poles as shown in Fig. 2. in which position it would remain until the circuit would be closed again, when the armature would again move up to the magnet and in this way the armature D. would respond like any ordinary armature mechanism to the closures made by the teeth of the circuit wheel mechanism of the operating box in the circuit. If therefore, the lever C. should be depressed during any of these momentary closures of the circuit through the magnet D. it would clear the end of the armature D^2. because the latter would be attracted to the magnet and an alarm could be thus sent in from the box, notwithstanding the operation of the box that had been "pulled" previously, and in this way "interference" would be established and a confusion of signals would be given by the alarm mechanism responding to the boxes. To prevent this contingency, the following described mechanism is therefore provided:—Secured upon the upper end of the armature D^2. by means of a rubber block D^5. is a terminal spring D^6. having a wire connection D^7. with the wire H'. In front of the end D^8. of the terminal spring D^6. is a contact screw I^2. which is fitted to the bar I^3. to the lower end of which a contact spring I^4. is secured which makes one of the contacts of the switch I'. the latter having another contact spring I^5. which is secured to the terminal I. The position of the contact screw I^2. with reference to the spring D^6. is such that whenever the armature D^2. falls away from the magnet D. the contact spring D^6 makes a contact with the screw I^2. and thereby establishes a short circuit from the wire H'. around the magnet D. through the bar I^3. the contact spring I^4. the switch I'. the contact spring I^5. to the terminal I. When the armature thus falls back from the magnet and establishes this circuit around the latter it will remain in that position notwithstanding any subsequent closures of the circuit caused by the operation of the circuit wheel mechanism in another box that may be operating at the time, and it will remain in that position until the short circuit is broken between the wire D^7. and the terminal I. as the resistance of the magnet D. is so much greater than that of the short circuit around it, and nearly all the current will take the path of normal resistance, as is well known. When the box door F. is closed it causes the stud F'. to press the switch I'. in so as to break the circuit between the contact springs I^4. I^5. the short circuit around the magnet D. will be broken,

see Fig. 6. and the circuit again established through the magnet D. which will draw the armature D^2. up again as indicated in Fig. 7. and the lever C. can be depressed so as to allow the box mechanism to give the signal. It can be seen therefore, that if no other box in the circuit is working, consequently breaking the circuit, the latter will be normally closed, and if the circuit is through the magnet D. at the time the lever C. is depressed that the latter will pass down clear of the armature, and allow the circuit wheel mechanism B. to give a signal. The breaks occasioned by the circuit wheel B. will, of course, cause the armature D^2. to fall away from the magnet D. just as though another box would do this, but the escapement lever B'. of the circuit wheel mechanism having once cleared the end of the detent C'. it will allow the shaft B^3. to make a complete revolution and thereby transmit the regular number of rounds of the signal, the box mechanism is adapted to give.

It is customary in signal boxes to have a cut out mechanism adapted to cut out the signal box mechanism when not in use, as a matter of protection against lightning and to take out of circuit the resistance of each box magnet, as is well known. This is usually done by the closing of the outer box door F. having a stud F^2. which actuates the cut out mechanism. When the door F. is open, it allows the switch G. to bring the box mechanism into circuit as indicated in Fig. 7. When the door is closed, a short circuit is established from the spring G'. through the circuit closer G. its shaft G^3. and the spring L^2. against which it makes contact thereby establishing a short circuit from the wire H. to the plate L. and opening the local circuit H'. by the spring G^2. resting upon the rubber G^4. Now, when the wire H'. is thus cut out the magnet D. will be out of circuit and the armature D^2. will of course, drop away from the magnet D. as has already been described, and the short circuit established around the magnet D. by reason of the contact spring D^6. resting against the contact screw I^2. and it would naturally follow that this contact would remain permanent when the door F. would be opened which actuates both the cut out G. and the switch I'. at the same time and render the mechanism inoperative. Now, to prevent this, the following described method of construction and operation is provided:— It will be noticed by referring to Fig. 5. that the rod I^6. upon which the switch I'. is secured has a piston I^7. fitted upon its other end and this piston is closely fitted in a cylinder I^8. and its movement is effected by the spring I^9. within the cylinder the tension of which causes the rod I^6. to move forward to the position shown and thereby overcome the friction of the contact springs I^4. I^5. upon the switch I'. but when the outer door F. is closed the rod I^6. becomes pressed inwardly against the spring I^9. (the latter yielding to the pressure of course of the door) as indicated in Fig. 6. Now, by reason of the nearly air tight fit of the piston I^7. in the cylinder I^8. the rod I^6. moves comparatively slow as the air in the cylinder has to pass from one side of the piston to the other between the piston and the cylinder. This piston and cylinder construction therefore of the switch mechanism causes the rod I^6. and consequently the switch I'. to move out comparatively slowly when the door is opened, while the spring G^5. of the cut out G. moves the latter out quickly the instant the door is opened. This arrangement of controlling the movements of the cut out G. and the switch I'. therefore causes a circuit to be closed through the magnet D. the instant the door is opened, which at once causes the armature D^2. to move up to the magnet D. before the switch I'. has time to move out and establish the short circuit around the magnet on account of its sluggish movement occasioned by the air in the cylinder I^8. passing from one side of the piston to the other, and thus leaving the lever C. in a position to be depressed and a signal thereby transmitted. In other words, the quick acting cut out G. sends the current through the magnet D. and thereby draws the armature D^2. with the spring D^6. away from the short circuiting screw I^2. before the switch I'. has time to move out and establish a circuit over the wire D^7. and the short circuit path being once opened between the spring D^6. and the contact screw I^2. remains in that condition until a break occurs in the main circuit, notwithstanding the subsequent closure of the contact between the switch I'. and the springs I^4. I^5. Even if the cut out G. were omitted entirely, and the circuit at all times being normally established through the magnet D. the non-interference feature would be complete, because the armature D^2. would then always be in the position shown in Fig. 7. until a break occurred in the line, or, in other words, some box mechanism had started to give a signal. But when the armature D^2. had once fallen away from the magnet D. and established the circuit around the latter through the screw I^2. that short circuit would become permanent, until broken again by some means. So the means I therefore employ is the switch mechanism I'. which actuated by the closing of the door F. having the stud F'. and the end of which presses the switch I. in, thereby breaks the short circuit, as indicated in Fig. 6. As a matter of fact, I find that it is not even absolutely necessary to have the switch I'. provided with the slow acting piston movement already described, as the difference in time that elapses between the closing of the circuit by the circuit closer G. and the switch I'. even if the latter had a quick acting spring arrangement like that of the circuit closer G. by reason of the gradual outward movement of the door F. away from the two devices, the closing of the circuit by the switch I'. will necessarily come later than the closure made by the cir-

cuit closer G. if the two devices are arranged in the relative position shown in Fig. 6. the mechanism will operate successfully. But if the door F. should be quickly opened providing the switch I′. had a quick acting spring as already mentioned there would be a possibility of the armature D. becoming short circuited, and it is to provide against this possibility that the switch I′. is therefore provided with the slow acting piston movement already described. Any other device, however, such as a clock work mechanism connected with the switch I′. that would give the latter this slow movement would answer the purpose. So also would any mechanism connected with the outer door F. in such a manner as to prevent its being opened rapidly, serve the purpose. I prefer the piston arrangement shown in Fig. 5. however, on account of its simplicity of construction and operation.

The movement of the rod I^6. which carries the switch I′. has been referred to as being slow, but that refers only to a comparison with the movement of the cut out G. as it is only necessary to have an interval of time about a second or so elapse between the closure of the cut out G. and that made by the switch I′. subsequently; or, in other words the length of time it takes to energize the magnet D. and cause it to draw its armature D^2. up to its poles.

The operation of the device may be briefly described as follows:—Assuming that the main circuit M. N. in a fire alarm system is closed and it is desired to give an alarm from the box as shown, the door F. after being unlocked is opened and the circuit is at once sent through the magnet D. which draws the armature D^2. forward as shown in Fig. 7. and the lever C. is then depressed so as to release the lever B′. when the circuit wheel B. revolves and gives the signal in the regular manner. Of course, after the first break occurs in the circuit occasioned by the first notch in the circuit wheel reaching the contact spring under which it passes the armature D^2. will fall away from the magnet, but this occurs after the lever C. shall have been depressed and consequently too late to prevent the rotation of the circuit wheel mechanism, and the regular signal therefore would be transmitted from the box mechanism. Now, this, therefore, is what occurs when it is as a first box "pulled" that the mechanism is actuated, as described, but when it is as a second box that the lever C. is "pulled" the conditions of the mechanism are changed as follows:—Immediately upon the opening of the door F. the breaks occasioned by the first box that is pulled and operating in the circuit at another point in the system cause the magnet D. to remain in a demagnetized condition, and the armature D^2. remains away from the poles of the magnet in the open circuit position shown in Fig. 2. so that in a second or two after the door F. has been opened, the switch I′. closes the short circuit around the magnet D. and then the short circuit is permanently established and the subsequent closures caused by the teeth of the break wheel in the other or operating box will not cause the magnet D. to attract the armature D^2 away from its short circuit position so that when the lever C. is depressed its downward motion is prevented by reason of the shoulder C^4. of the projection C^3. coming against the end D^4. of the armature D^2. so that the escapment lever B′. of the circuit wheel mechanism of the box cannot be liberated and thus cause a confusion of signals.

To start the box after the other box shall have completed its signal it is necessary to open the short circuit around the magnet D. again which is done whenever the door F. is closed and the switch I′. pressed in as shown in Fig. 6. When this is done and the circuit is closed permanently over the main line, the box mechanism is then in a condition to be "pulled" as a first box, as has already been described. Any number of boxes that would be provided with this device would work just the same as a single one would, as has been described, if they were "pulled" as second or subsequent boxes,—that is after some one box in the circuit had previously been started and was in operation at the time the others were subsequently "pulled." Of course, this non-interference principle holds good only when all the boxes are upon the same circuit, but when boxes of this class are placed in different circuits in a system having two or more circuits, it is necessary to have a machine known as a non-interference repeater from which all the circuits converge, to duplicate or repeat over the other circuits the breaks and closures occasioned in the operating box circuit, such for instance, as the machine for which I have made application for Letters Patent of the United States, and bearing Serial No. 383,332, and filed March 2, 1891. It is also desirable when non-interference box mechanisms are used to have a toothed wheel to break the circuit as shown in Fig. 1, as is well known, as this form of construction leaves the circuit in a practically open circuit condition (excepting of course the momentary closures representing the signal) during the operation of a box, and to which the non-interference magnet mechanism is more particularly adapted to respond.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In combination with the tripping mechanism of an electric signal box, an electro-magnet having a connection with the signal box circuit, an armature for the magnet, arranged in such a position with relation to the tripping mechanism as that when it is against the poles of the magnet the tripping mechanism may be actuated, but when it falls away from the magnet it prevents the movement of the tripping mechanism provided with a short cir-

cuit terminal, having a connection with the circuit, another circuit terminal having a connection with the circuit and against which the armature circuit terminal is adapted to make contact when the armature falls away from the magnet so as to thereby establish a short circuit around the magnet, substantially as specified.

2. In combination with the tripping mechanism of an electric signal box, a magnet having a connection with the box circuit, an armature for the magnet arranged in such relation to the tripping mechanism as that when the armature is against the poles of the magnet the tripping mechanism may be actuated but when the armature falls away from the magnet the movement of the tripping mechanism is thereby prevented the armature being provided with a circuit terminal having a short circuit connection with the box circuit, another short circuit terminal against which the armature terminal makes contact when it falls away from the magnet and a switch provided with a spring contact connection with the short circuit terminal against which the armature terminal makes contact, the switch being also provided with another spring contact terminal having a connection with the magnet and also a connection with the box circuit, substantially as specified.

3. In combination with the tripping mechanism of an electric signal box an electro-magnet having a connection with the box circuit, an armature for the magnet adapted to allow or obstruct the movement of the tripping mechanism according as it may be against the poles of the magnet or away from them as the case may be, the armature having a terminal connection with the box circuit and a switch having a connection with a terminal against which the armature terminal makes contact when it falls away from the magnet and also having a terminal connection with the magnet and a connection with the box circuit and being provided with an actuating spring, and the door of the box in which the mechanism is placed provided with a stud that is adapted to cause the switch to open the short circuit established around the magnet by the armature short circuit terminal whenever the door is closed, substantially as specified.

4. In an electric signal box the following combination of elements:—a cut out G. which is adapted to cut out of circuit the magnet mechanism of the signal box whenever the door of the latter is closed and bring it into circuit again when the door is opened, an electro-magnet D. having a connection with one of the terminals G^2. of the cut out G, an armature D^2. for the magnet D. that is adapted to allow or obstruct the movement of the tripping mechanism C. of the box according as it may be against or away from the poles of the magnet D. and being provided with a circuit terminal having a connection D^7. H'. with the terminal G^2. of the cut out G, a terminal I^2. against which the armature terminal D^6. makes contact when the armature D^2. falls away from the magnet D. and also having a spring contact I^4. a switch I'. against which the spring I^4. makes contact and provided with another contact spring I^5. having a connection with the box circuit and a connection H^2. with the magnet D. and being also provided with a slow moving device I^7. I^8. I^9. by which its movement may be governed so as to cause the closure of the short circuit around the magnet D. through the armature short circuiting device D^6. to occur after the closure made by the cut out G. and thereby allow the magnet D. to bring the armature D^2. up to its poles before a complete short circuit is established around the magnet by the armature circuit closing device D^6. and the door of the box having the studs F^2. F'. by means of which the cut out G. and the switch I'. are actuated, substantially as specified.

5. The combination with the door F. of a stud F'. having a loose jointed connection therewith and a switch I'. provided with circuit terminals I^4. I^5. which is adapted to be moved by the stud F'. whenever the door is closed, substantially as specified.

6. In combination with the door F. having a stud F^2. and a cut out device G. adapted to cut out the magnet mechanism of a signal box and a slow acting switch I'. that is adapted to close a short circuit around the magnet mechanism D. whenever the door F. is opened and being controlled in its motion by the stud F'. in the door F., substantially as specified.

7. In a signal box mechanism, the combination of a signal circuit wheel, an escapement lever, and motor mechanism for the wheel, a short circuit through the circuit wheel, a magnet, with its vibrating armature, normally out of said circuit, a switch operated by the opening of the signal box door, throwing said magnet into said circuit, and a shunt around the magnet closed by the vibrating armature when it falls away from the magnet, said armature in the latter position locking said escapement lever, substantially as described.

8. In a signal box mechanism, the combination of a signal circuit wheel, an escapement lever and motor mechanism therefor, a short circuit through said circuit wheel normally closed, a quick-acting switch opening the circuit, a magnet (with its vibrating armature) thrown into the circuit by said switch, the armature being arranged in one of its positions to lock the escapement lever, a shunt around said magnet, and a slow-acting switch closing said shunt, both of said switches being operated by the opening of the signal box door, substantially as described.

9. In a signal box mechanism, the combination of an electric circuit, a signal circuit wheel therein, a magnet, with its vibrating armature, in the circuit, a shunt around the magnet, but not around the circuit wheel, which is in the main circuit, the armature

for the magnet acting as a circuit closer for the shunt, and a second switch for said shunt adapted to be closed by the opening of the signal box door, substantially as described.

10. In a signal box mechanism, the combination of a main circuit in the box, a circuit wheel, and electro-magnet therein, a shunt around the magnet, a quick-acting switch in the main circuit, and a slow-acting switch in the shunt circuit, both operated by the opening of the signal box door, substantially as described.

11. In a signal box mechanism, the combination of a main circuit in the box, a circuit wheel, electro-magnet, and quick-acting switch therein, a shunt around the magnet having two switches, one of which is adapted to be operatively shifted by the armature of the magnet when the quick-acting switch is operated to energize the magnet and the other by a slow-acting switch, both the quick and the slow-acting switches being operated by the opening of the signal box door, substantially as described.

THOMAS F. GAYNOR.

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CHAS. E. WILLEY.