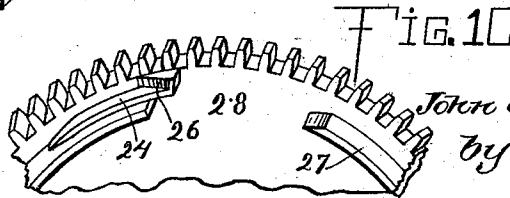
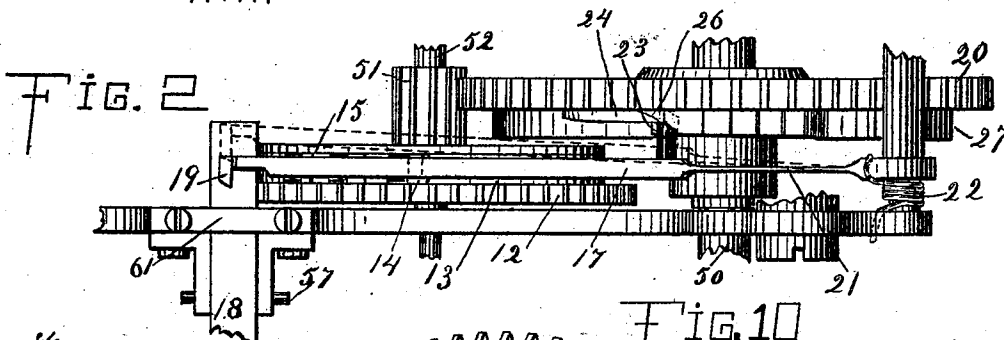
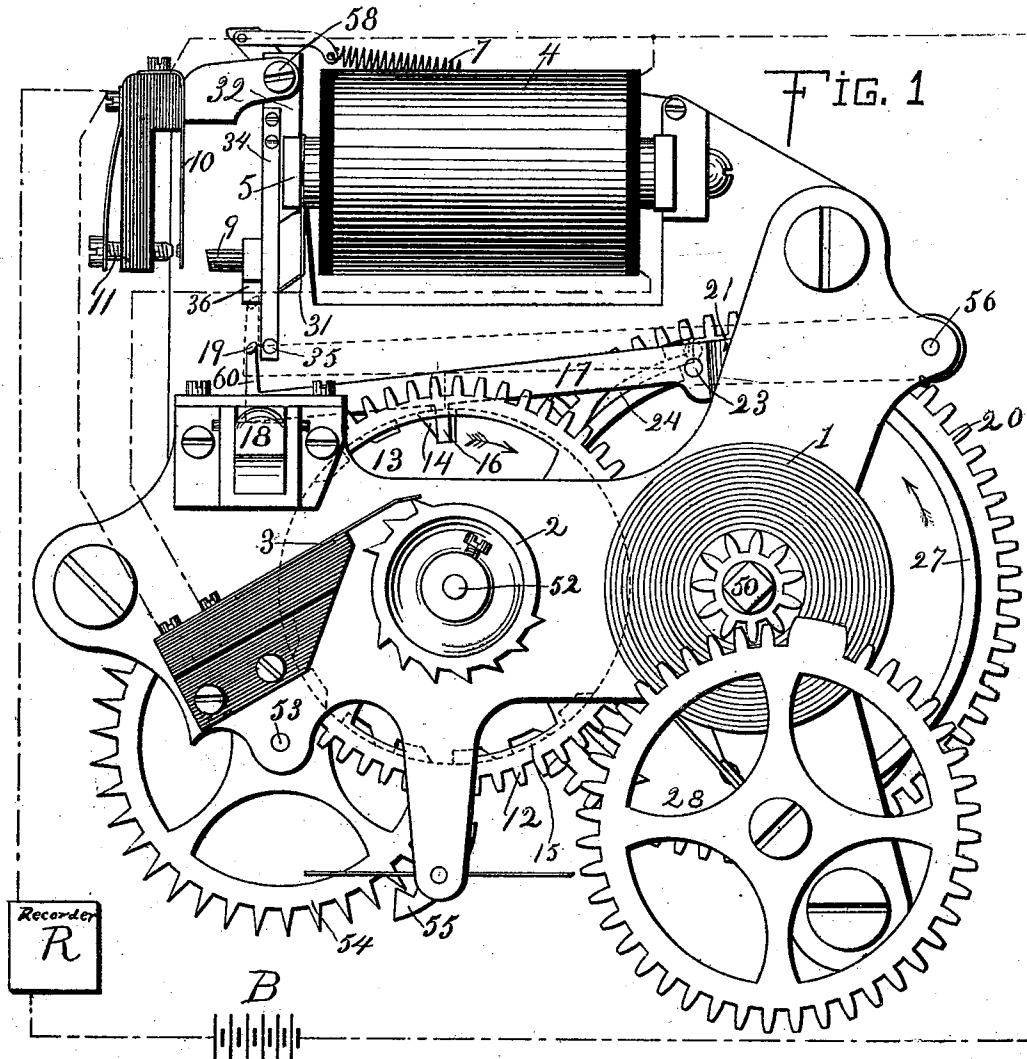


J. J. RUDDICK.
NON-INTERFERING SIGNAL APPARATUS.

No. 553,873.

Patented Feb. 4, 1896.



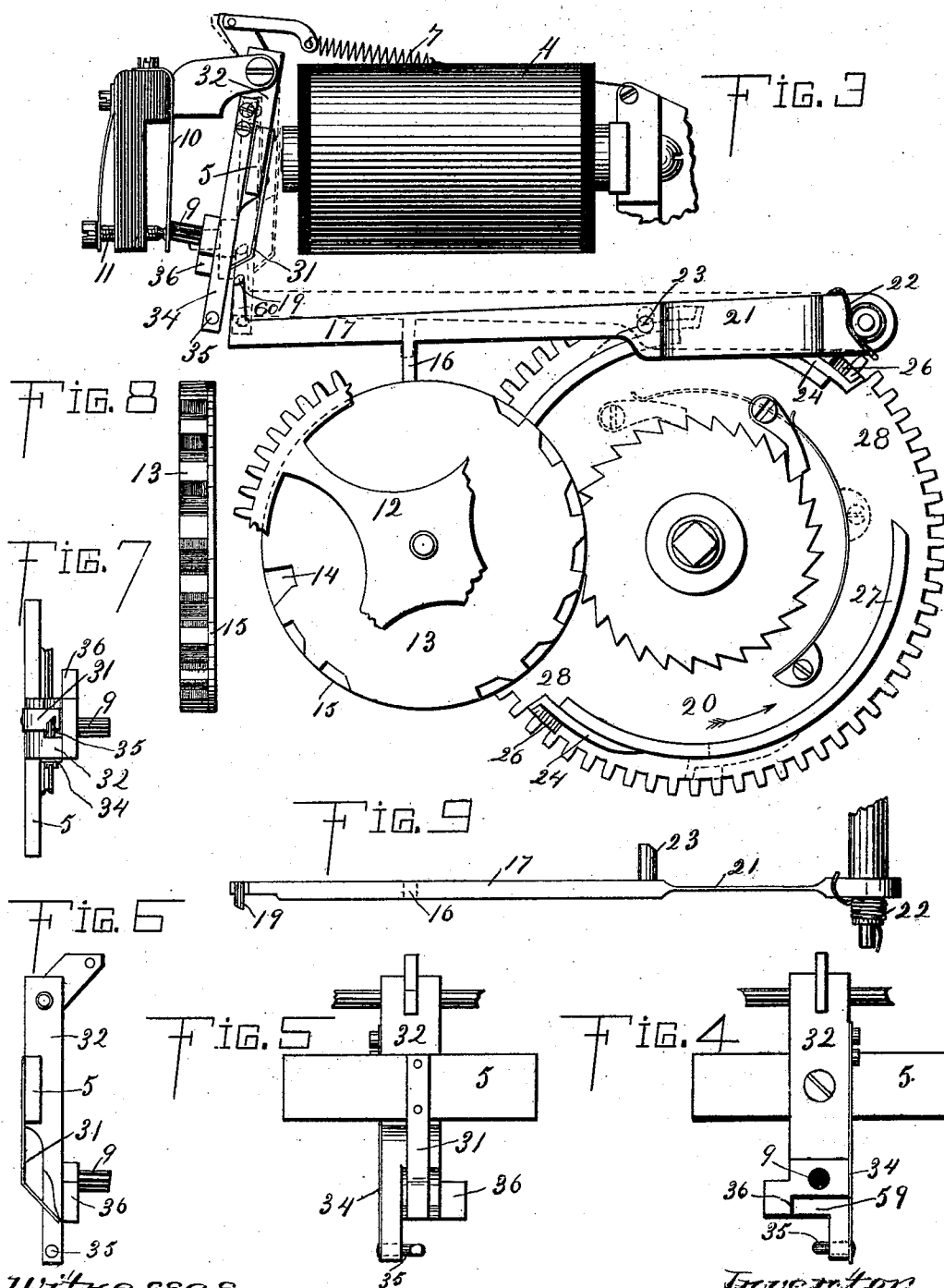
Witnesses.
Edward F. Allen.
Louis M. Howell

Inventor.
John J. Ruddick.
By John L. Edwards,
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UNITED STATES PATENT OFFICE.

JOHN J. RUDDICK, OF RICHMOND, INDIANA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNITED STATES FIRE AND POLICE TELEGRAPH COMPANY, OF PORTLAND, MAINE, AND BOSTON, MASSACHUSETTS.

NON-INTERFERING SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 553,873, dated February 4, 1896.

Application filed June 28, 1890. Serial No. 357,094. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. RUDDICK, a citizen of the United States, residing at Richmond, county of Wayne, State of Indiana, have invented a new and useful Improvement in Successive Non-Interfering Signal-Boxes, of which the following is a specification.

This invention has for its object to construct a successive non-interference signal-box, yet by the elimination of some features a non-interference signal-box is produced which is not successive but which possesses many points of merit.

The signal-transmitting mechanism which is commonly referred to as the "signal-box" comprises a motor mechanism and a box-number circuit-wheel adapted to be driven by it to operate an electric circuit to transmit a signal.

In signal-boxes previously constructed, many different forms of motor mechanisms have been employed, and so far as my present invention is concerned I may employ any well-known or suitable form.

A controlling-lever is provided which is adapted to control the transmission of the signal, and said controlling-lever is governed by a non-interference magnet which is operated by or under the control of the signaling-circuit, so that the said controlling-lever is therefore under the control of the circuit.

The box is so arranged that whenever started, or whenever its signal has been "set," the controlling-lever will be placed under the control of the signaling-circuit for a predetermined length of time before the said circuit is operated or broken for its first time, by the said set signal, and if during such predetermined length of time the normal condition of said signaling-circuit shall be changed, regardless of the cause, the said controlling-lever will at once assume its abnormal position or operate to delay or it may be to prevent the transmission of the signal, according as to whether the box is arranged as a successive non-interference box or simply as a non-interference box.

When a signal is being transmitted from any box the circuit is opened and closed repeatedly, and when the line remains closed

a longer time than the longest closure in any signal, it is evident that no signal is being transmitted, and hence the predetermined length of time during which I desire to place the controlling-lever solely under the control of the circuit is longer than the longest closure in any signal.

In signal-boxes of the so-called "open-wheel" variety the closures are all of the same duration or nearly so, being quite short, while in signal-boxes of the so-called "closed-wheel" variety some closures are of longer duration than the others. For instance, if but a single round is transmitted the longest closure will be between the groups of impulses, or what are commonly termed the "number groups," but if several rounds are transmitted the longest closure is usually between the successive rounds.

The controlling-lever which controls the transmission of the signal, together with the non-interference magnet and its armature, I denominate a "determining device" which determines whether or not the signal once set shall be transmitted promptly or delayed, as will be described.

The means or mechanism employed for placing the controlling-lever solely under the control of the circuit for a longer time than the longest closure in any signal after the said signal has been set and before its first impulse has been transmitted is herein denominated a "retarded operative device," because the operation of the circuit is delayed after the signal has been set.

The locking or releasing lever for the train is herein shown as one having two distinct movements, one of which is controlled or operated manually, as by a pull or starting-lever, and the other of which is controlled or operated by the train in running, the first movement of said lever effecting the release of the train or permitting it to operate, and the second movement of said lever, as herein shown, governing the action of the controlling-lever which controls the transmission of the signal.

Suitable means are provided for holding the controlling-lever whenever the circuit is opened at the home box, and for releasing said lever one or more or all of the times that

the circuit is closed at the home box during a round of the alarm, the home box being understood as the particular box, in circuit with others, which is being operated and described.

5 If, however, the controlling-lever is allowed to assume its abnormal position, as it will be if the normal condition of the circuit is changed during any interval of time that the
10 controlling-lever is released or unlocked, and is therefore held only by the attractive force of the magnet, the signal will not be transmitted, or if the box is designed particularly as a successive box the said signal will be retained to be thereafter transmitted, as will be
15 described. In either event, however, means must be provided for restoring the controlling-lever, or permitting it to be restored, only at a certain time, as at the completion of a round or of a succession of rounds, so that if a set
20 signal has been retained it will be let off or released only at the beginning of a round, in order that a correct signal may be transmitted.

The devices employed for holding the controlling-lever whenever the circuit is opened
25 at the home box, at certain times or every time, if desired, that the circuit is closed at the home box, that it may be moved into or allowed to assume its abnormal position if the line is in use and which allows said lever,
30 when once thrown out, to resume its normal position only at the beginning of a succeeding round of the box-number, constitute a trap for the controlling-lever.

35 When the controlling-lever is restored, which, as before stated, is only at or before the beginning of a round of the box-number, if the box is arranged as a successive box, the said lever is again placed under the control
40 of the circuit for a longer time than the longest closure in any signal by means of the retarded operative device before the first impulse of the round is transmitted, so that if said controlling-lever is once thrown out it
45 will require a closure of the circuit which is longer than the longest closure in any signal before said lever will permit or effect the transmission of the retained signal; but if the box is arranged simply as a non-interference
50 signal-box the said controlling-lever will simply be restored just as or before the box stops running.

In the box herein shown the trap is arranged to carry out the function ascribed to
55 it during the first round of the signal, and if the signal which is being transmitted is not interfered with the co-operation of said trap with the controlling-lever will cease; but if the signal is interfered with the trap will continue its co-operation with the controlling-lever until such time as a correct and uninterrupted round is transmitted; but while
60 such feature has certain special advantages it is unnecessary to provide means especially designed for so discontinuing the co-operation of the trap and controlling-lever.

Figure 1 shows, in front elevation, the op-

erating mechanism of a signal-box, the inclosing case being omitted; Fig. 2, a top view of a portion of the signaling-train shown in Fig. 70 1; Fig. 3, a front view similar to Fig. 1, with several of the parts omitted to uncover certain parts concealed in Fig. 1, the box being shown as operating, yet not transmitting a signal; Fig. 4, a left-hand side view of the
75 controlling-lever shown in Fig. 1 with its attached parts; Fig. 5, a right-hand side view of the controlling-lever shown in Fig. 1 with its attached parts; Fig. 6, a rear side view of the controlling-lever shown in Fig. 1 with its
80 attached parts; Fig. 7, an under side view of the controlling-lever shown in Fig. 1 and its attached parts shown in Fig. 6; Fig. 8, an edge view of the notched wheel which, as hereinafter represented, forms a part of the
85 trap; Fig. 9, a plan view of the locking or releasing lever detached, and Fig. 10 a detail of a portion of one of the wheels to be referred to.

The main framework is of suitable construction to support the operating parts. 90

The signaling-train, herein shown as the actuating mechanism for driving the circuit-wheel 2, consists of a normally wound-up motor mechanism, comprising a main spring 1,
95 mounted on a winding-shaft 50, having mounted on and rotated by it a toothed wheel 20, which engages and drives a pinion 51 on the circuit-wheel shaft 52, said shaft 52 having secured to it a toothed wheel 12, which
100 engages a pinion on the escape-wheel shaft 53, the escape-wheel 54 of which has co-operating with it any suitable pallet 55. Instead of employing this particular form of motor or actuating mechanism for driving the circuit
105 or signal wheel 2, I desire it to be understood that I may employ any other suitable form.

A disk 13 is secured to the shaft 52, which is provided with a deep notch 14, which receives a projection 16 on the under side of a
110 lever 17, pivoted to the framework at 56, said lever being extended toward the left, and normally obstructing the path of movement of a lever 18, pivoted at 57 to the framework. The lever 18 is accessible, to be moved manu-
115 ally or otherwise, to raise the lever 17 against the tension of its depressing-spring 22. A pin 23 projects rearwardly from the rear side of the lever 17, and is adapted to co-operate with the flange 27 on the wheel 20. As the
120 parts are herein arranged, the wheel 20 is designed to make one revolution while the disk 13 makes eight revolutions, and for purposes well known in the art I desire to rotate the circuit-wheel 2 four revolutions and thereby
125 transmit four rounds, and hence the flange 27 on the wheel 20 is divided into two parts, with a wide-open space between each part at the ends.

When the lever 17 is raised into position to
130 release the train, the projection 16 will be removed from the notch 14 in the disk 13, as will be hereinafter described, and the pin 23 will be lifted so as to ride over the top of the

flange 27 on the wheel 20. When the disk 13 completes a single revolution, the lever 17 will not be returned to its normal position by means of the spring 22, because the pin 23 will be brought to bear upon the flange 27, and hence the train will continue to run until such time as the notch 14 of the disk 13 comes beneath the projection 16 at the same time that the pin 23 arrives at one of the open spaces cut or formed in or between the two parts of the flange 27. This lever 17 hence serves as the releasing-lever, whereby the normally wound-up train is let off, and also as a locking-lever for locking the train after it has run a certain length of time.

The lever 17 is made as a steel bar reduced in thickness for a short distance, as at 21, to thereby have a spring-like action in itself, that it may move rearwardly or in a horizontal plane when allowed so to do, it being, however, normally restrained, as will be described.

A non-interference magnet 4 is supported by the framework, the armature 5 of which is secured to an armature-carrying lever 32, pivoted at 58.

7 represents a retractile spring for the armature-carrying lever, which is connected with the upper end thereof by a link. This armature-carrying lever, as herein shown, is arranged to govern or control the transmission of the signal, and hence constitutes the controlling-lever of the box or signaling train.

The controlling-lever 32 has at its left-hand side a block to which is secured a pin 9, which may be of insulating material, and which, when the controlling-lever is moved away from the non-interference magnet, strikes against a contact-pen 10, pressing it into engagement with a contact 11. These contacts 10 11 are secured to a block of insulating material or otherwise supported, and are connected in circuit, as will be hereinafter described, to constitute a shunt for both the non-interference magnet 4 and circuit-wheel 2. The block which supports the pin 9 is cut away or recessed at its under side, (see Fig. 4,) exposing the lower end of the controlling-lever, as at 59, and presenting a shoulder, as 36, at right angles to the surface 59.

On the left-hand end of the locking-lever 17 a projection or upright 60 is formed or secured, on the upper end of which a laterally-extended projection 19 is herein shown, and when the said locking-lever 17 is raised into the dotted-line position shown in Fig. 1, and the controlling-lever is in the full-line position shown in Fig. 1, the said locking-lever is restrained from moving rearwardly by reason of the projection 60 striking against the shoulder 36, and also at such time the controlling-lever is locked in position or restrained from moving away from the magnet 4, by reason of its lower end 59 striking against the upper end of the projection 60.

While a signal is being transmitted from

any box the signaling-circuit is repeatedly opened and closed, but when the circuit has remained closed for a longer time than the longest closure in any signal it is evident that no signal is being transmitted over the circuit. Hence by placing the controlling-lever of a box always under the control of the circuit, for a longer time than the longest closure in any signal, just prior to giving the control of the line to said box, there will be no interference between the signals, unless it should so happen that the circuit is opened by two boxes, each for its first time, simultaneously, and therefore such feature I desire to broadly claim.

Referring to Fig. 1, it will be seen that one side of the notch 14 in the disk 13 has a steep incline, and the signaling-lever or pull 18 is provided with a suitable stop, (herein shown as a strap 61,) which allows said lever when operated to raise the locking-lever 17 only a short distance, or so far as to permit the lower end of its projection 16 to escape from the squared bottom portion of the notch and bear upon the lower part of the steep inclined side wall, and as the train will be let off or released at such time it will in running, by reason of the inclined portion bearing upon the lower end of the projection 16, cause the lever 17 to rise into the dotted-line position shown in Fig. 1. Hence the lever 17 is moved two steps, one of which is controlled or operated manually, and the other of which is controlled or operated by the train in running. Owing to the frictional engagement of the projection 16 with the said steep inclined portion of the notch, the progress of the train will be materially retarded during such engagement of the parts, so that the speed of the train is reduced for a short time, as compared with the normal speed, thereby giving to the train two different speeds.

The contact-pens 3 bear upon the first projection or tooth of the circuit-wheel 2, and are adapted to break said circuit upon leaving said tooth; but as the progress of the train is retarded for a short time at the beginning of the round, as above stated, the said pens will not leave the first tooth, and thereby break the circuit for its first time, until after the train has run a predetermined length of time, which is of longer duration than the longest closure in any signal. Hence I desire it to be understood that the circuit-wheel 2, when rotated by a train in this way or arranged in any other suitable way by which it is moved by the train, and adapted to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, constitutes a retarded operative device for the circuit.

During the time the locking-lever is being slowly raised by the steep inclined side wall of the notch 14 the controlling-lever 32 is held in its normal position, with the armature against the poles of the magnet, by the attractive force of said magnet, as it will be

understood that at such time the said magnet is in the signaling-circuit; but if the signaling-circuit should be broken—as, for instance, by a signal being transmitted from another box—the said armature will be retracted and the controlling-lever thereby moved by the retractile spring 7 into its abnormal position, closing the shunt-contacts 10 11. Hence the said magnet, its armature, the controlling-lever 32, and shunt for the box-number circuit-controller, herein constitute the determining device which determines during a certain length of time whether or not the signal that has been set by the operator shall obtain control of or operate the signaling-circuit; but in lieu of these particular parts any other parts may be employed whereby substantially the same result is produced.

If after the retarded operative device has been started and before the first impulse of the signal has been transmitted the determining device should operate and the shunt 10 11 be closed, then the magnet and contact-pens 3 are shunted out, the train will continue to run, and the circuit-wheel 2 will continue to contact with the pens 3; but no signal will be transmitted unless as herein-after provided. This retarded operative device consisting of a circuit or signal wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and also the determining device comprising a non-interference magnet, its armature, controlling-lever, and shunt for the box-number circuit-controller represents one way of carrying out this part of my invention; but I desire it to be understood that I include within the scope of my invention as a retarded operative device any mechanism by means of which when it is desired to send a box-signal the controlling-lever is always placed under the control of the line for a longer time than the longest closure in any signal just prior to giving the control of the line to the box, thereby delaying the operation of the circuit for a predetermined length of time after the signal has been set, that the determining device may determine whether or not a signal may be correctly transmitted; and furthermore I desire it to be understood that I include within the scope of my invention as a determining device any group of mechanism or parts which are controlled or operated by a change in the normal condition of the circuit to prevent the transmission of the signal or retain it temporarily.

The disk 13 in addition to having the deep notch 14 with the steep inclined side wall, as shown, has a series of shallow notches, each having one slightly-inclined side wall, and an unnotched disk or plate 15 of substantially the same diameter as the diameter of the disk 13 is secured to the rear side of said disk 13, so as to present side by side a notched and an unnotched or smooth-surfaced rim.

The notches of the disk 13, as herein

shown, correspond in number and position to the closures of the circuit-wheel, and as the disk is secured to the circuit-wheel shaft it necessarily revolves synchronously with said circuit-wheel.

With the parts at rest the lever 17 is restrained from transverse motion by the pin 16 bearing against the front face of the disk 15, which disk it will be observed forms the rear side wall of the notches or recesses.

When the lever 17 has been raised by the steep inclined portion of the notch 14, so that the projection 16 bears upon the periphery of the disk or portion 13, and the controlling-lever 32 still remains in its normal position, as shown in Fig. 1, the upper end of the projection 60 will bear against the shoulder 36, owing to the spring action of the lever, and said shoulder is so located that the lever 17 cannot at such time move transversely, and furthermore the upper end of the projection 60, bearing against the controlling-lever at 59, holds said lever against retraction or movement into its abnormal position, and as the disk continues to revolve the said projection 16 soon drops into the next notch, releasing the controlling-lever, while the rear side wall of said notch holds the lever 17 against its transverse motion by its own spring action.

The slightly-inclined side walls of the shallow notches permit continuous operation of the train.

The notches in the disk 13, being arranged to correspond with the closures of the circuit-wheel 2, it will be seen that when the lever 17 is depressed and its pin 16 enters one of said notches the signaling-circuit is closed at the home box, and hence the controlling-lever will be held at such time in its normal position solely by the attractive force of the magnet, and when the lever 17 is raised, so that its pin 16 bears on the periphery of the disk 13 between the notches, the circuit is opened by the circuit-wheel 2, and the said controlling-lever will be held in its normal position by the upper end of the projection 60, so that the said controlling-lever is alternately held electrically and mechanically, according as the circuit is opened and closed at the home box, and the lever 17 is restrained from transverse motion alternately by the disk 15 and the shoulder 36. It will be seen that the arm or lever 17 thus vibrates to correspond with the makes and breaks of the box-number, engaging and holding the controlling-lever on the breaks and releasing it on the makes.

When the lever 17 is in its normal position, as shown in Fig. 1, the parts being at rest, and the controlling-lever is likewise in its normal position, the pin 19 on the upper end of the projection 60 obstructs the path of movement of a spring-pressed pin 35, which projects laterally from the lower end of the said controlling-lever, thereby holding the armature mechanically against retraction.

As soon, however, as the lever 17 is lifted ever so little—as, for instance, when starting the box—the pin 19 passes out of the path of the pin 35, and at such time the controlling-lever is held only by the attractive force of the magnet. During the time that the lever 17 is being moved from the position shown by full lines, Fig. 1, (where the controlling-lever is held by the pin 19,) into the position shown by dotted lines, Fig. 1, (where the controlling-lever is held by the upper end of the projection 60, engaging the lower end 59 of said lever,) the latter is held only by the attractive force of the magnet, and if during this time the condition of the circuit should be changed the said controlling-lever immediately assumes its abnormal position, closing the shunt-contacts 10 11.

If the controlling-lever should be moved into its abnormal position during the time the lever 17 is being lifted as described, as soon as the projection 16 on said lever 17 arrives at the periphery of the disk 13, between the notches thereof, no obstruction is present to hold said lever, and it will be at once moved transversely or rearwardly by its own spring-like action, so that the said projection 16 will bear upon the unnotched periphery of the disk 13, and when in such position it will not be vibrated as the disk revolves.

When the controlling-lever 32 assumes its abnormal position, shunting out the circuit-wheel, and also as herein shown shunting out the non-interference magnet, a restoring device, provided for the purpose, operates to restore said lever to its normal position at the completion of an ineffectual attempt to send in an alarm, which it will be understood is after the train has run a certain length of time, during which it would have sent in a complete alarm if it had not been prevented from so doing by being shunted out.

As herein shown, the restoring device consists of the following instrumentalities, viz: On the right-hand side of the controlling-lever 32 a spring 31 is secured, the lower end of which is bent or turned toward and rests upon the lever, and the lever itself is cut away or recessed at this point, as best shown in Fig. 6, to thereby form a channel or curved passage having one yielding side wall, the yielding movement being provided for the purpose of permitting the escape or removal of the pin 19 on the lever 17, as will be described.

A cam 24 is arranged at the end of the flange 27 on wheel 20 and is represented as a short rib which is made about one-third the width of said flange, and which overlies the space between the parts of the flange for a short distance.

The cam 24 is formed at one end as an incline rising from the flange 27, and when the pin 23 on the rear side of the lever 17 arrives at said inclined portion of the cam (the lever being in its rearmost position, as just described) the said pin will ride up upon the

top of said cam 24, and thereby lift the lever 17 still higher into the dotted-line position shown in Fig. 3. When said lever 17 is thus raised, the pin 19 comes opposite the channel or space between the spring 31 and lever 32, but at the remote side thereof.

A block 26 having an inclined side is placed or secured on the extreme end of the cam 24, and when the pin 23 arrives at said block and passes over the inclined or cam face thereof the lever 17 is moved forward against the tension of its normal spring-like action, so that the pin 19 enters the space between the spring 31 and the lever 32.

The cam or inclined face of the block 26 terminates a short distance before the extreme edge of the block, and as soon as the pin 23 reaches the termination of said cam-face the depressing-spring 22 throws said lever 17 downwardly, and the pin 19, following along the channel or space which receives it, positively moves the lever 32 on its pivot from the full to the dotted line position shown in Fig. 3, permitting or causing the shunt-contacts 10 11 to separate.

It will be seen that the pin 23 will at such time enter the wide space 28 between the parts of the flange 27, and also that the notch 14 of the disk 13 will arrive beneath the projection 16, so that the lever 17 may return to its normal position to lock the train unless otherwise provided.

The notch 14 of the disk 13 is so positioned with relation to the wide space 28 between the parts of the flange 27 that just as soon as the pin 23 drops into said space by passing by the end of the flange the pin 16 will enter the notch 14 and stop the train; but the cam-faced block 26 overlies said wide space 28 for a short distance, so that when the pin 23 rides up on the top of the cam 24 it will not enter the wide space 28 until the notch 14 has passed a little farther to the left than it does when the pin 23 slips off the end of the flange 27; and in such event when the lever 17 falls its projection 16 will strike the lower end of the steep inclined side wall of said notch 14, instead of bottoming in the notch, and hence will not operate to stop the train, but, on the contrary, will permit the train to run for another series of revolutions or predetermined length of time.

As the train continues to run the same operation will be repeated as the first operation, viz: The lever 17 will be slowly lifted until the upper end of the projection 60 arrives at the left-hand side of the controlling-lever 32, and if during the time that said lever is being lifted the circuit remains in its normal condition the said controlling-lever will remain in its normal condition, that such operation of parts may take place. Hence the controlling-lever when moved into its abnormal position, shunting out or otherwise preventing the transmission of the signal, serves to retain the set signal while the train continues to run. The restoring device for the

controlling-lever, or means for opening said shunt or otherwise placing the apparatus into signaling condition, together with means for preventing the locking-lever from locking the train at the completion of an ineffectual attempt to transmit a signal or alarm, and also together with the retarded operative device, constitute the signal-controlling mechanism, whereby the retained signal is released only upon the closure of the signaling-circuit of longer duration than the longest closure in any signal and next preceding the beginning of a round; but I do not desire to limit my invention to a signal-controlling mechanism comprising these particular instrumentalities, as it is obvious that other elements may be combined to subserve the same ends—viz., to release a retained signal by mechanism controlled or operated by the train in running only upon a closure of the signaling-circuit of longer duration than the longest closure in any signal next preceding the beginning of a round.

The notched wheel 13, disk 15, vibrating lever 17, and short circuit for the non-interference magnet, as herein shown, constitute a trap for the controlling-lever which holds the said controlling-lever whenever the circuit is opened at the home box, and releases it one or more of the times that the circuit is closed at the home box during each number group of a round, that it may assume its abnormal position if the circuit is open at another point, and also to allow said lever to resume its normal position when once thrown out only at the beginning of a round of the box-number.

The controlling-lever 32 is represented as a shunt-lever for the box-number circuit-controller; but its co-operation with the trap will be the same whether it is a shunt-lever or not, and as it is the intention to construct a trap for the controlling-lever which shall be co-extensive with a round of the box-number and which shall hold said lever in a definite or fixed position when the circuit is opened at the home box, and shall place it under the influence of the armature of the non-interference magnet at certain times when the circuit is closed at the home box during a round of the box-number, I do not desire to limit my invention to any particular form or construction of trap, whether made of the parts herein shown or other suitable parts, so long as the results above specified are accomplished.

By means of the particular trap herein shown the controlling-lever is held each and every time that the circuit is opened at the home box, and is released each and every time that the circuit is closed at the home box during a round of the box-number, and when thrown out returns to its normal position just before the beginning of a round or at the completion of an ineffectual attempt to transmit the signal.

I further desire it to be understood that I do not desire to limit my invention to the par-

ticular form of restoring device herein shown, as it is obvious that the controlling or shunt lever may be restored in many different ways and at the proper time.

The trap herein shown is arranged to co-operate with the controlling-lever 32 and carry out the functions ascribed to it during the first round of the signal, and if the signal is not interrupted during said round further co-operation of the trap and controlling-lever is deemed unnecessary, and hence I have arranged the notch 28 of a suitable width to correspond with a single round of the alarm, and thereafter the pin on the locking-lever bears upon the flange 27; but such feature is not of material importance, as the trap might continuously co-operate with the controlling-lever.

The operation of the box is as follows: The operator by pulling the signaling-lever 18 raises the releasing-lever 17 a short distance until the pin 16 engages the lower end of the steep inclined side of the notch 14. The train thus released runs slowly while the lever 17 is being lifted by said inclined side portion, the time required for lifting the lever 17 being longer than the longest closure in any signal, the controlling-lever 32, it will be seen, is placed under the sole control of the circuit during such length of time. If the said controlling-lever remains in its normal position during this time, it will be held by said lever 17 when the circuit is opened to transmit its first impulse. As soon as the circuit is again closed the said controlling-lever will be released, and thereby again placed under the control of the circuit. These operations will be repeated until the alarm has been transmitted, when the pin 23 of the lever 17 will slip off the end of the flange 27 into the wide notch 28 just as the notch 14 arrives beneath the projection 16, and the lever 17 being depressed by the spring 22 will cause the projection 16 to enter said notch 14 and thereby stop the train.

Such will be the operation of the box if not interfered with. If, however, during the time the lever 17 is being lifted by the steep inclined portion of the notch 14, the controlling-lever 32 should be moved into its abnormal position, the contacts 10 11 would be closed, thereby shunting out the circuit-wheel and also the non-interference magnet, and the obstruction or holder which is employed to restrain the lever 17 from moving rearwardly when its projection 16 arrives at the periphery of the disk is also removed, so that when said projection arrives at the periphery of the disk the lever 17 will be moved rearwardly and the parts will occupy these respective positions until the completion of a round of the signal-wheel or the completion of an ineffectual attempt to send in the alarm, when the lever 17 will be moved forward and thereafter depressed, positively moving the controlling-lever 32 toward or into its normal position opening the shunt-contacts 10

11, and if the box is arranged as a non-interference signal-box simply, the projection 16 will bottom in the notch 14 and thereby stop the train; but if the box is arranged as a successive box; the said projection 16 will strike the lower end of the steep inclined side of the notch 14 instead of bottoming therein, so that the train may continue to run and repeat the above operation.

10 I claim—

1. In a non-interference signal-box, a signaling-train, a signaling-lever, a non-interference magnet in the signaling-circuit, combined with a box-number circuit-controller
15 and shunt-lever therefor, a trap for the said shunt-lever coextensive with a complete round of the signal and having notches corresponding in number and position with a round of the box-number for holding the shunt-lever at each and every time the circuit is opened
20 at the home box and releasing it at each and every time the circuit is closed at the home box to enable said lever to assume its abnormal position if the circuit is open at another
25 point, said trap being also constructed and arranged to allow said lever to resume its normal position when once thrown out only at the beginning of a round of the box-number, substantially as described.

2. A successive non-interference signal-box containing the following instrumentalities, viz: a windable signaling mechanism, a non-interference magnet and its armature, means for setting the signal, a controlling-lever
35 which controls the transmission of the signal, and a trap coextensive with a complete round of the box-number for said controlling-lever, constructed and arranged to release the controlling-lever when the circuit is closed at the
40 home box and opened at a distant point, that it may retain the set signal, and also allow the controlling-lever to resume its normal position and permit or effect the transmission of the retained signal only at the beginning
45 of a succeeding round of the box-number, substantially as described.

3. In a successive non-interference signal-box, a signaling-train, and a controlling-lever for controlling the transmission of the signal,
50 a non-interference magnet and its armature governing the position of the said controlling-lever, combined with a trap coextensive with a round of the box-number with which the said controlling-lever also co-operates, said trap,
55 comprising a movable plate having notches corresponding in number and position to the closures of the signaling-circuit during a round of the box-number, holding the controlling-lever mechanically when the circuit
60 is opened at the home box and releasing it when the circuit is closed at the home box to enable it to assume its abnormal position if the circuit is open at a distant point, said trap however permitting the controlling-lever
65 to resume its normal position when once thrown out only at the beginning of a succeeding round, substantially as described.

4. In a successive non-interference signal-box, a signaling-train, a controlling-lever which controls the transmission of the signal,
70 a non-interference magnet and its armature, combined with a trap coextensive with a round of the box-number which positively holds the controlling-lever at each and every time the circuit is opened at the home box and releases
75 said controlling-lever at each and every time that the circuit is closed at the home box, to enable said lever to assume its abnormal position if the circuit is open at another point, and which allows said lever to resume its normal
80 position when once thrown out only at the beginning of a round of the box-number, substantially as described.

5. In a non-interference signal-box, a signaling-train, a hand-operated signaling-lever
85 for setting the signal, a non-interference magnet and its armature, and a controlling-lever governed by said armature, which, when moved into its abnormal position, retains the set signal, a trap coextensive with a round of
90 the box-number for said controlling-lever which holds it when the circuit is opened at the home box, and releases it to place it under the influence of the non-interference magnet when the circuit is closed at the home box,
95 to thereby enable it to be moved into its abnormal position if the line is in use, and which also prevents it from returning to its normal position when once thrown out until the beginning of a succeeding round of the
100 box-number, substantially as described.

6. In a signal-box, a signaling-train, a non-interference magnet and its armature, combined with a controlling-lever that controls the transmission of the signal, and a trap co-
105 extensive with a round of the box-number for the controlling-lever, notched to correspond in number and position to a round of the box-number to hold the controlling-lever at each and every time the circuit is opened at the
110 home box and release it at each and every time the circuit is closed at the home box, and also to enable said lever to assume its normal position when once thrown out only at the beginning of a round of the box-number, sub-
115 stantially as described.

7. In a successive non-interference signal-box, a signaling-train, a controlling-lever which controls the transmission of the signal, a non-interference magnet and its armature,
120 combined with a trap coextensive with a round of the box-number which holds the controlling-lever whenever the circuit is opened at the home box and releases said controlling-lever one or more of the times that the circuit
125 is closed at the home box during each number group of a round to enable said lever to assume its abnormal position if the circuit is open at another point, and which allows said lever to resume its normal position when
130 once thrown out only at the beginning of a round of the box-number, substantially as described.

8. In a successive non-interference signal-

box, a signaling-train, a controlling-lever which controls the transmission of the signal, a non-interference magnet and its armature, combined with a trap coextensive with a round of the box-number which holds the controlling-lever whenever the circuit is opened at the home box and releases said controlling-lever the first and last times that the circuit is closed at the home box during each number group of the round, to enable said lever to assume its abnormal position if the circuit is open at another point, and which also allows said lever to resume its normal position when once thrown out only at the beginning of a round of the box-number, substantially as described.

9. In a successive non-interference signal-box, a signaling-train, a controlling-lever which controls the transmission of the signal, a non-interference magnet and its armature, combined with a trap coextensive with a round of the box-number which holds the controlling-lever whenever the circuit is opened at the home box and releases said controlling-lever one or more of the times that the circuit is closed at the home box during each number group of a round, to enable said lever to assume its abnormal position if the circuit is open at another point, and a restoring device for the controlling-lever which engages and moves it only at the beginning of a round, substantially as described.

10. In a successive non-interference signal-box, a signaling-train, a non-interference magnet and its armature, combined with a box-number circuit-controller, a shunt-lever therefor, a trap for the shunt-lever coextensive with a round of the signal which holds said shunt-lever whenever the circuit is opened at the home box and releases it one or more of the times that the circuit is closed at the home box during each number group of a round, that it may assume its abnormal position and shunt the circuit-controller if the circuit is open at any other point, and also to break said shunt if closed only at the beginning of a round of the box-number, substantially as described.

11. In a non-interference signal-box, a motor, means for operating it, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and a determining device comprising a non-interference magnet, its armature, and a controlling-lever governed by said magnet, which acts during said lapse of time to prevent an interfering signal being sent, substantially as described.

12. In a non-interference signal-box, a motor, means for operating it, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and a determining device comprising a non-interference

magnet, its armature, and a shunt-lever governed by it, which is free to act during said lapse of time to prevent an interfering signal being sent, substantially as described.

13. In a non-interference signal-box, a motor, means for operating it, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and a determining device comprising a non-interference magnet, its armature, and a controlling-lever governed by it, which is free to act during said lapse of time, and a locking-lever for the train also governed by said armature, substantially as described.

14. In a non-interference signal-box, a motor, means for operating it, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and a determining device comprising a non-interference magnet, its armature, and a shunt-lever governed by it, which is free to act during said lapse of time to prevent an interfering signal being sent, and a locking-lever for the train also governed by said armature, substantially as described.

15. In a non-interference signal-box, a motor, means for operating it, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and a determining device comprising a non-interference magnet, its armature, and a controlling-lever governed by it, which is free to act during said lapse of time to prevent an interfering signal being sent, and a locking device for said controlling-lever, substantially as described.

16. In a successive non-interference signal-box, a motor, means for operating it, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, a non-interference magnet, and its armature, and a controlling-lever governed by said armature which is free to act during said lapse of time, to retain the set signal, and signal-controlling mechanism governed by the train in running, of which the retarded operative device forms a co-operative part, which operates to release the said retained signal upon a closure of the signaling-circuit of longer duration than the longest closure in any signal, next preceding the beginning of a round, substantially as described.

17. In a non-interference signal-box, a motor, means for operating it, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and a determining device comprising a non-interference magnet, its armature, and a controlling-

lever governed by said magnet, which is free to act during said lapse of time to prevent an interfering signal being sent, and a trap for the said controlling-lever coextensive with a round of the signal which holds said controlling-lever whenever the circuit is opened at the home box and releases it one or more of the times that the circuit is closed at the home box during each number group of a round, that it may assume its abnormal position if the circuit is open at another point, and which allows said lever, when once thrown out, to resume its normal position only at the beginning of a round, substantially as described.

18. In a signal-box, a signaling-train, a circuit-controller, a non-interference magnet and its armature, combined with a controlling-lever governed by said armature which controls the transmission of the signal, and an arm which vibrates to correspond with the makes and breaks of the circuit-wheel which engages said controlling-lever on the breaks and releases the same on the makes, substantially as described.

19. In a signal-box, a signaling-train, a circuit-controller and shunt for it, a non-interference magnet and its armature, combined with a vibrating arm for said shunt, and means for vibrating said arm to correspond with the contacts of the circuit-controller during a round of the signal transmitted, substantially as described.

20. In a signal-box, a signaling-train, a circuit-controller, a shunt for it, a non-interference magnet and its armature, combined with a vibrating arm that holds the operating member of said shunt, and means for vibrating said arm to correspond with the contacts at the circuit-controller during a round of the box-number, substantially as described.

21. In a signal-box, a signaling-train, a circuit-controller, a non-interference magnet and its armature, combined with a lever that controls the transmission of the signal, and a vibrating arm, as 17, for holding said lever at intervals corresponding with the contacts of the signaling-circuit closer, substantially as described.

22. In a signal-box, a signaling-train, a circuit-controller, a non-interference magnet and its armature, combined with a controlling-lever governed by said armature which controls the transmission of the signal, and a releasing-lever for the train which is moved to release the train and is thereafter vibrated to lock and release the controlling-lever during the transmission of the signal, substantially as described.

23. In a signal-box, a signaling-train, a circuit-controller, a non-interference magnet and its armature, combined with a controlling-lever governed by said armature which controls the transmission of the signal, and a vibrating arm which engages said controlling-lever when the circuit is open at the home box and releases the same one or more of the

times that the circuit is closed at the home box, substantially as described.

24. In a signal-box, a signaling-train, a circuit-controller, a non-interference magnet and its armature, combined with a controlling-lever governed by said armature which controls the transmission of the signal, and an arm which engages and holds the said controlling-lever when the circuit is opened at the home box and releases said controlling-lever one or more of the times that the circuit is closed at the home box during each number group of the round, substantially as described.

25. In a signal-box, a signaling-train, a circuit-controller, a non-interference magnet and its armature, combined with a shunt-controlling lever governed by said armature which controls the transmission of the signal, and an arm which engages and holds the said shunt-controlling lever when the circuit is opened at the home box and releases said shunt-controlling lever one or more of the times that the circuit is closed at the home box during each number group of the round, substantially as described.

26. In a signal-box, a signaling-train, a non-interference magnet and its armature, combined with a controlling-lever governed by said armature which controls the transmission of the signal, and a vibrating arm which normally holds the controlling-lever and which engages and disengages said controlling-lever during the transmission of the signal according to the position of said arm, substantially as described.

27. In a signal-box, a signaling-train, a non-interference magnet and its armature, combined with a controlling-lever which controls the transmission of the signal, and an arm vibrating to correspond with the makes and breaks of the circuit-wheel, said controlling-lever being alternately held by said armature and vibrating arm, substantially as described.

28. In a non-interference signal-box, a signaling-train, and locking-lever for it, combined with a non-interference magnet, its armature, and a controlling-lever which controls the transmission of the signal, and means for vibrating said locking-lever to alternately lock and release the controlling-lever during the transmission of the signal, substantially as described.

29. In an electric signaling apparatus, the combination with a signal-wheel, and contacts therefor, of an actuating-train for said wheel, a releasing-lever for the train adapted to be moved two steps, one manually controlled to release the train, and the other controlled by the train in running, to enable the signaling-contacts to operate the signaling-circuit, substantially as described.

30. In an electric signaling apparatus, the combination with a signal-wheel and contacts therefor, of an actuating-train for said wheel, a releasing-lever for the train adapted to be

moved two steps, one manually operated to release the train, and the other controlled by the train in running to enable the signaling-contacts to operate the signaling-circuit, substantially as described.

31. In an electric signaling apparatus, the combination with a signal-wheel and contacts therefor, of an actuating-train for said wheel, a releasing-lever for the train adapted to be moved manually, and an operative connection between said train and releasing-lever whereby the latter is moved a second step after a predetermined length of time, substantially as described.

32. The combination in a signaling apparatus, of a signal-wheel and its contacts and actuating-train, a non-interference magnet in the circuit, controlling a shunt-circuit around the signal-wheel and magnet, a spring tending to hold the armature of said magnet away therefrom, a releasing device for the said train normally holding the armature against the force of said spring, and a stop on said releasing device for holding the said armature to the poles of the magnet when said lever is in its abnormal position, substantially as described.

33. In a non-interference signal-box, a signaling-train, a locking-lever for it, a non-interference magnet and its armature, said locking-lever normally locking both the train and armature and adapted to be moved two steps, one manually controlled to release both the train and armature, and the other controlled by the train in running, to lock the armature at the beginning of a round of the box-number, substantially as described.

34. In a non-interference signal-box, a signaling-train, a locking-lever for it, a non-interference magnet and its armature, said locking-lever normally locking both the train and armature and adapted to be moved two steps, one manually controlled to release both the train and armature, and the other controlled by the train in running, to lock the armature after the train has run a longer time than the longest closure in any signal, at the beginning of a round of the box-number, substantially as described.

35. In a non-interference signal-box, a signaling-train, a locking-lever for it adapted to be moved two steps, one manually controlled and the other controlled by the train in running, combined with a non-interference magnet, and its armature, which is locked in its attracted position by said locking-lever when at rest and again locked at the completion of its second step, substantially as described.

36. In a non-interference signal-box, a signaling-train, a locking-lever for it, adapted to be moved two steps, a non-interference magnet, and its armature, combined with a controlling-lever which controls the transmission of the signal, which lever is locked in one or another position upon the comple-

tion of the second step of the locking-lever, substantially as described.

37. In a non-interference signal-box, a signal-wheel and contacts therefor, and an actuating-train for said wheel, combined with a releasing-lever for the train adapted to be moved two steps, one manually controlled to release the train and the other controlled by the train in running, and a shunt-circuit for the contacts of the signal-wheel, the operating member of the shunt-switch being held from closing the shunt by said releasing-lever when moved its second step, substantially as described.

38. In a non-interference signal-box, a signal-wheel and contacts therefor, and an actuating-train for said wheel, combined with a releasing-lever for the train adapted to be moved two steps, one manually controlled to release the train and the other controlled by the train in running, and a non-interference magnet and its armature which is locked by said releasing-lever when moved its second step, substantially as described.

39. In a non-interference signal-box, a signaling-train, and a non-interference magnet and its armature, combined with a releasing-lever for said train adapted to be moved two steps, one manually controlled to release the train and the other controlled by the train in running, and a controlling-lever which controls the transmission of the signal which is engaged and held by the releasing-lever when the train is running only after the train has run a longer time than the longest closure in any signal, substantially as described.

40. In a non-interference signal-box, a signaling-train, a locking-lever for it, a non-interference magnet and its armature, and a controlling-lever which controls the transmission of the signal, said locking-lever normally locking both the controlling-lever and armature and adapted to be moved two steps, one manually controlled to release both the train and controlling-lever and the other controlled by the train in running, substantially as described.

41. In a non-interference signal-box, a signaling-train, a locking-lever for it, a non-interference magnet and its armature, and a shunt-lever which controls the transmission of the signal, said locking-lever normally locking both the shunt-lever and the train and adapted to be moved two steps, one manually controlled to release both the train and shunt-lever and the other controlled by the train in running, substantially as described.

42. In a non-interference signal-box, a signaling-train, a locking-lever for it, a non-interference magnet and its armature, and a controlling-lever which controls the transmission of the signal, said locking-lever normally locking both the controlling-lever and armature and adapted to be moved two steps, one manually controlled to release both the

train and controlling-lever, and the other controlled by the train in running after said train has run a longer time than the longest closure in any signal at the beginning of a round of the box-number, substantially as described.

43. In a non-interference signal-box, a signaling-train, a locking-lever for it, a non-interference magnet and its armature, and a shunt-lever which controls the transmission of the signal, said locking-lever normally locking both the shunt-lever and the train and adapted to be moved two steps, one manually controlled to release both the train and shunt-lever, and the other controlled by the train in running after said train has run a longer time than the longest closure in any signal at the beginning of a round of the box-number, substantially as described.

44. The combination in an electrical signaling apparatus of a signal-wheel, and contacts therefor, actuating mechanism for said wheel, a non-interference magnet in the main line, its armature, pivoted to the frame and a locking-lever for the train pivoted to said frame but independent of the armature, said locking-lever normally holding the said armature against retraction, a normally-open shunt-circuit around said signal-wheel adapted to be closed by the retraction of said armature, and a releasing and restoring connection between the said locking-lever, and said armature, whereby the latter is released on the starting of said mechanism, and thereafter restored and normally held by said locking-lever when the box is at rest, substantially as described.

45. In a non-interference signal-box, the combination with a signaling-train, a locking-lever, a non-interference magnet, its armature, and armature-carrying lever adapted to be restored when retracted by said locking-lever, substantially as described.

46. In a non-interference signal-box, the combination with a signaling-train, a locking-lever, a non-interference magnet, its armature, and armature-carrying lever adapted to be restored when retracted by said locking-lever, and held in its attracted position by said locking-lever when the latter is in its locking position, substantially as described.

47. In a non-interference signal-box, a signaling-train, a locking-lever for it, a non-interference magnet and its armature, a controlling-lever governed by the armature which controls the transmission of the signal, said locking-lever when in two different positions engaging and locking the controlling-lever, between which positions the said controlling-lever is unrestrained, substantially as described.

48. In a non-interference signal-box, a signaling-train, a non-interference magnet, its armature, and armature-carrying lever, combined with a locking-lever for the train, made independent of said armature-carrying lever and held alternately by the said armature-carrying lever and by a moving part of the

train, according to the condition of the circuit, substantially as described.

49. In a non-interference signal system, the combination with the motor, of circuit-wheel and springs normally maintaining the circuit closed, the locking-lever 17, and notched wheel 13, having a continuous edge or rim 15, the pivoted armature or armature-support and plate 36 carried thereby, against which hook 19 on lever 17 bears when raised while the armature is attracted, whereby said lever 17 is prevented from moving over to the continuous rim of wheel 13, substantially as described.

50. In a non-interference signal system, the combination with the motor, the circuit-wheel and springs in circuit with the magnet 4, of wheel 13, having notches corresponding in number and arrangement to the teeth on the circuit-wheel, the locking-lever 17 having a pin which co-operates with the notched wheel whereby the lever is raised and lowered, and the short-circuiting mechanism controlled by the magnet and the hooked end of lever 17, substantially as described.

51. The combination with armature 5, its pivoted support and spring 31, the lower end of which bears against said support, of the movable hook 19 adapted to pass behind and under the spring, thus moving the armature toward its magnet, substantially as described.

52. The combination with armature 5, its pivoted support and spring 31, the lower end of which bears against said support, of the movable hook 19 adapted to pass behind and under the spring, thus moving the armature toward its magnet, and a short circuit held closed by the armature in its retracted position but opened by the forward movement thereof, substantially as described.

53. The combination, in a non-interference signal system, of a circuit-wheel and springs, mechanism for driving the said wheel, wheel 20, driven by the same mechanism, provided with flange 27 and cam 24, the detent-lever with pin 23 co-operating with said flange and cam, notched wheel 13 having continuous rim 15, and short-circuiting mechanism, substantially as described.

54. In a non-interference signal-box, a signaling-train, a non-interference magnet, and its armature, and a controlling-lever governed by said armature, which controls the transmission of the signal, combined with a locking-lever for said train which is also governed by said armature, and is adapted to lock the train after the signaling-circuit has been closed for a longer time than the longest closure in any signal and a correct signal has been transmitted, substantially as described.

55. In a successive non-interference signal-box, a signaling-train, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and a determining device comprising a controlling-

lever, and a non-interference magnet, which acts during said lapse of time to prevent an interfering signal being sent if the normal condition of the circuit is changed during such length of time, combined with a locking-lever for said signaling-train which is under the control of said determining device, whereby the train will be stopped only after the signaling-circuit has been closed for a longer time than the longest closure in any signal, and a correct signal has been transmitted, substantially as described.

56. The combination in an electric signaling apparatus, of a retarded operative device consisting of a signal-wheel moved by the actuating-train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, a non-interference magnet in the main line having its armature normally held against retraction, a normally-open shunt-circuit around said magnet, adapted to be closed by the retraction of its armature, and a releasing and restoring connection between said mechanism and said armature, whereby the latter is released on the starting of said mechanism and restored at the completion of an ineffectual attempt to give an alarm, substantially as described.

57. A successive non-interference signal-box containing the following instrumentalities, viz: a windable signaling mechanism, a non-interference magnet, its armature, means for setting a signal, means for retaining the set signal when the line is in use, and signal-controlling mechanism operated by the train in running, and governed by said armature,

and constructed and arranged to effect or permit the transmission of the retained signal on a closure in the signaling-circuit of longer duration than the longest closure in any signal, substantially as set forth.

58. In a successive non-interference signal-box, a motor, means for operating it, a retarded operative device consisting of a signal-wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, a non-interference magnet, and its armature, and a controlling-lever governed by said armature to act during said lapse of time to retain the set signal, and a restoring device for said controlling-lever which is operated just prior to the beginning of a round of the signal, that the retained signal may be released upon a closure of the signaling-circuit of longer duration than the longest closure in any signal, substantially as described.

59. The combination with a signal-wheel and actuating-train therefor, of a non-interference magnet in circuit therewith, a mechanical stop normally holding the armature of said magnet in its attracted position, and means for releasing said armature automatically on the starting of the train, to allow the armature freedom of action during a time longer than the longest closure in any signal.

This specification signed and witnessed this 24th day of June, A. D. 1890.

JOHN J. RUDDICK.

Witnesses:

JOSEPH ROTHGERY,
M. G. NORTON.