

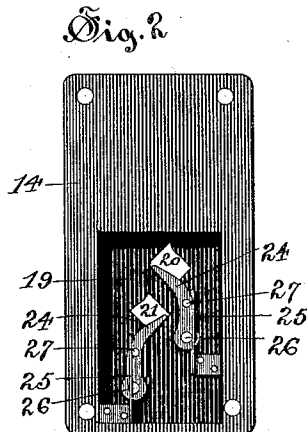
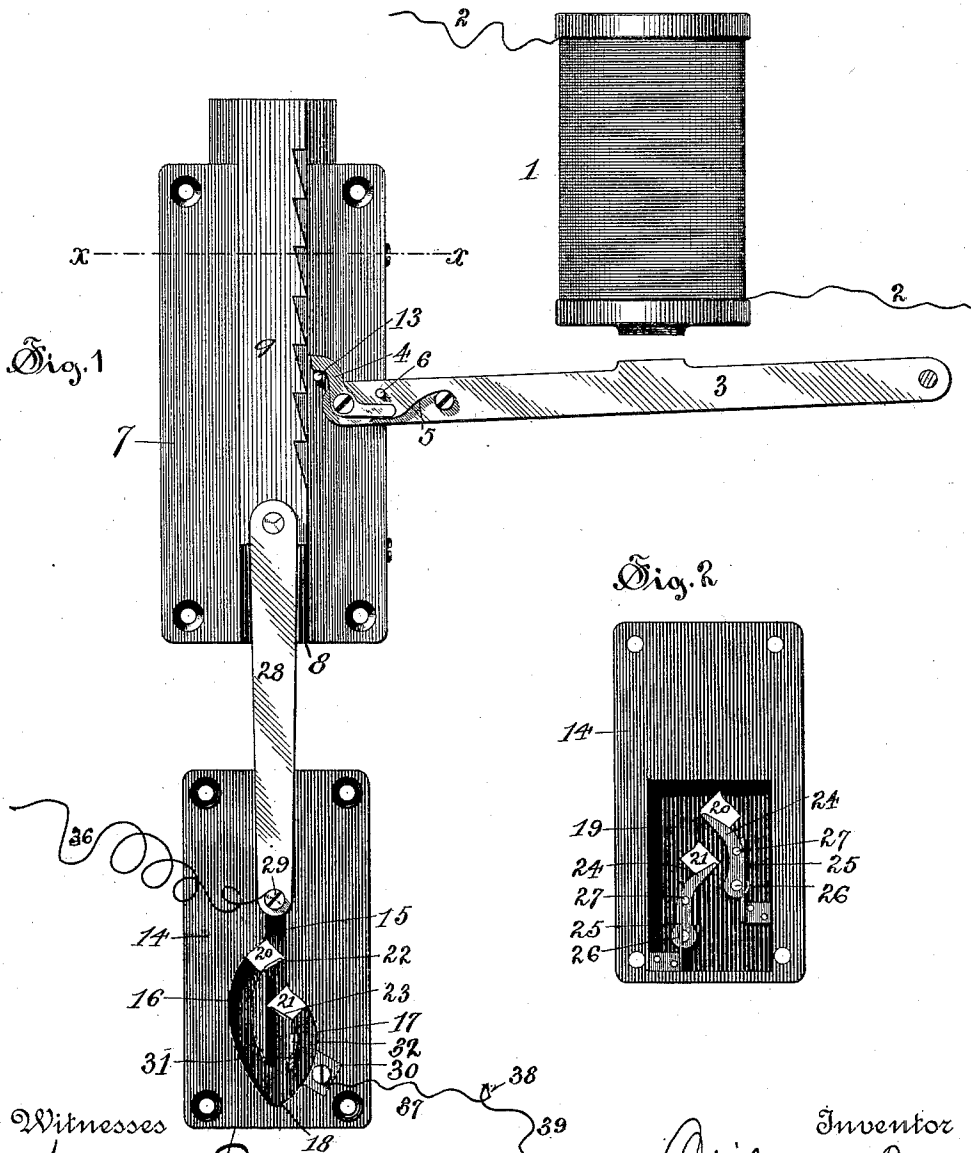
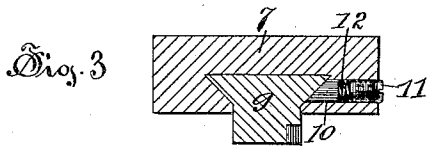
(No Model.)

4 Sheets—Sheet 1.

W. EDDY.
ELECTRIC SIGNALING APPARATUS.

No. 408,224.

Patented Aug. 6, 1889.



Witnesses

Frank H. Turpont
Harry R. Williams

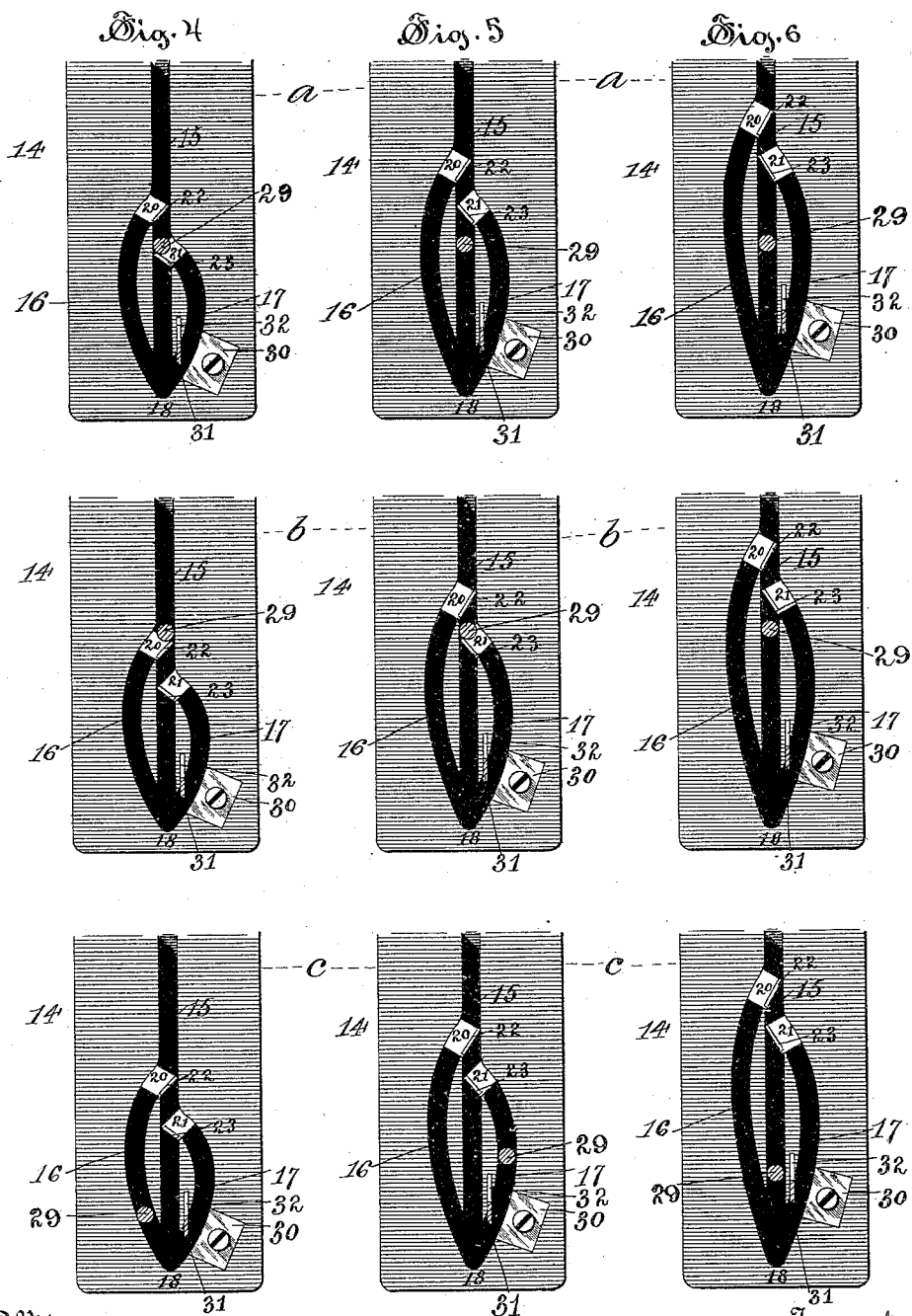
Inventor

Willard Eddy.

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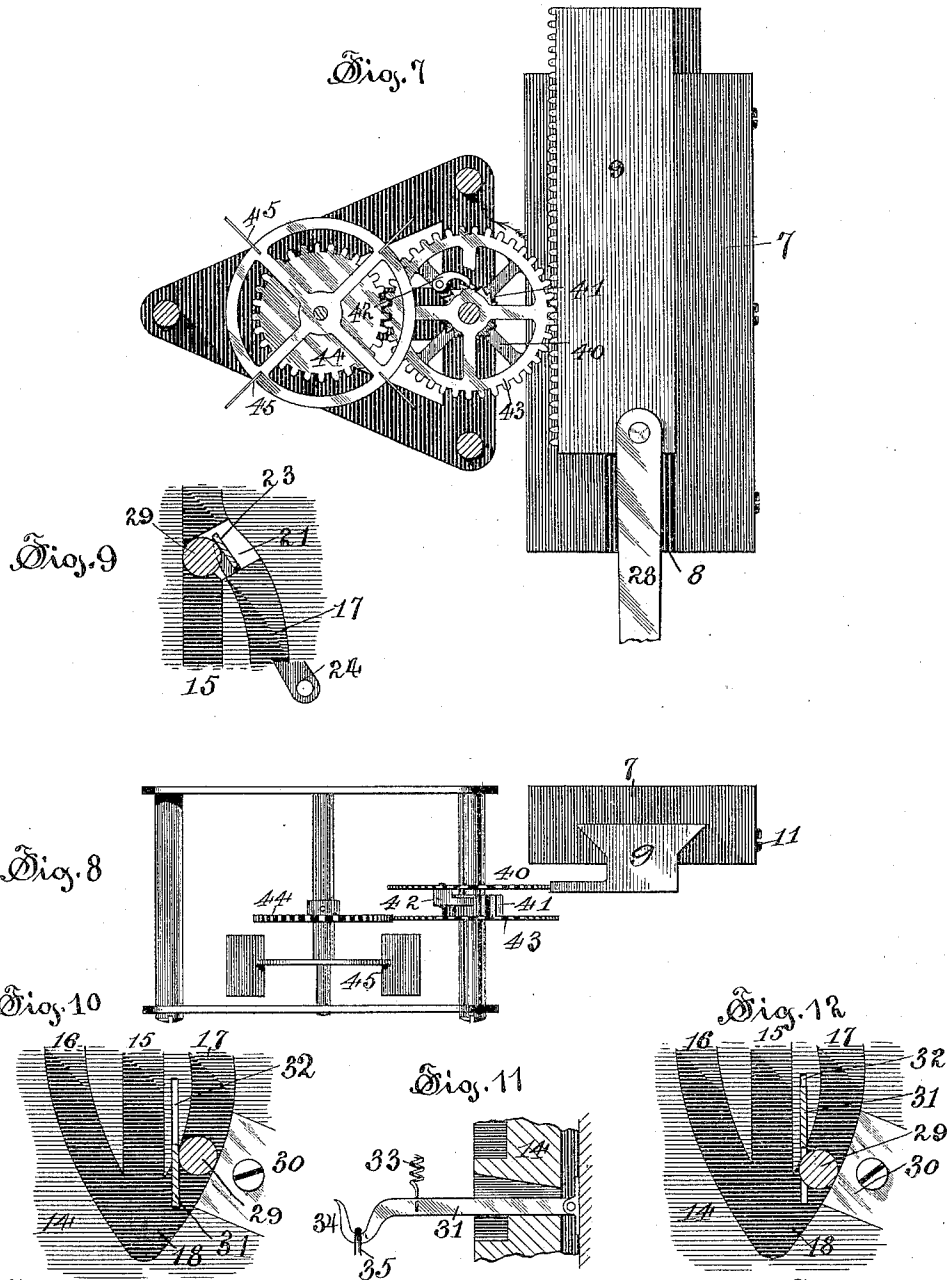
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4 Sheets—Sheet 4.

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Fig. 13

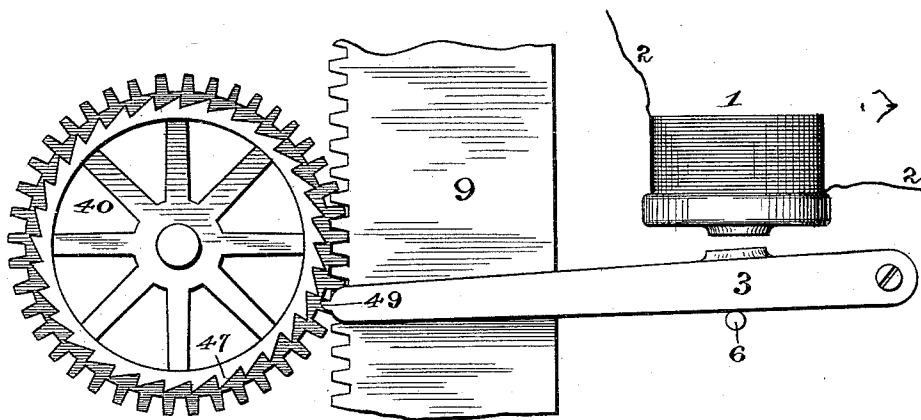
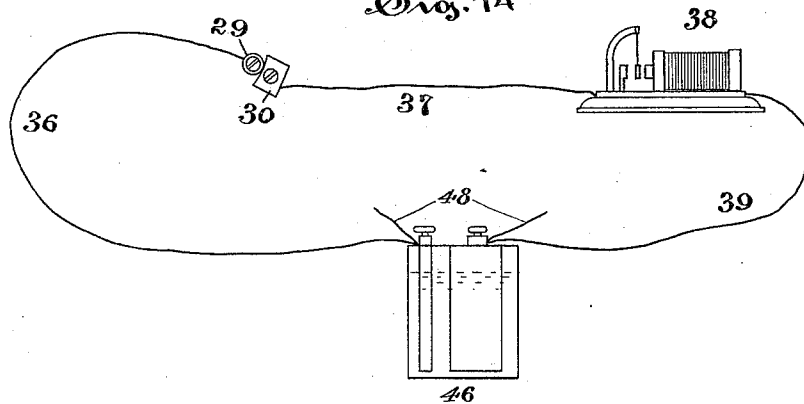


Fig. 14



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UNITED STATES PATENT OFFICE.

WILLARD EDDY, OF HADDAM, CONNECTICUT.

ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 408,224, dated August 6, 1889.

Application filed November 12, 1888. Serial No. 290,559. (No model.)

To all whom it may concern:

Be it known that I, WILLARD EDDY, of Haddam, Middlesex county, Connecticut, have invented certain new and useful Improvements in Electric Signaling Apparatus, which are described in the following specification, and are illustrated by the accompanying drawings.

This apparatus is primarily designed to be used as a telephone-call and belongs to the class of individual signals. Assuming a central office or telephone-exchange which is connected with a number of telephones or local stations upon a single line, it is well understood that an individual call must enable the central office to signal any one of those stations which may be desired without signaling any other station at the same time. To accomplish this result I provide each local station with peculiar differentiating mechanism, which is actuated from the central office and controls a local alarm. Said differentiating mechanism may for convenience be termed a "differentiating switch" and is fully illustrated in said drawings.

Figure 1 is a front view of a differentiating switch and actuating mechanism, which are constructed in accordance with my invention. Fig. 2 is a rear view of said switch. Fig. 3 is a cross-sectional view of a portion of said actuating mechanism on the sectional line *xx* of Fig. 1. Figs. 4, 5, and 6 exhibit a series of three differentiating switches, each of which is shown in three phases of operation. Fig. 7 is a front view of a portion of said actuating mechanism with modifications, including a special retarding device. Fig. 8 is a top view of Fig. 7. Figs. 9, 10, 11, and 12 are details. Fig. 13 is a modified detail supplementing Fig. 7. Fig. 14 is a representation of a complete local call-circuit.

In Fig. 1 the numeral 1 denotes an electromagnet, which is located at one of the stations on a telephone-line 2, leading from a central office or exchange. (Not shown in the drawings.) Magnet 1 has a pivoted armature 3, carrying a pawl 4, which is provided with a spring 5 and stop 6. Numeral 7, in the same figure, denotes a metallic plate having a vertical longitudinal dovetailed slot 8, which is occupied by a sliding rack-bar 9.

Plate 7 contains an adjustable-frictional device, which is seen in Fig. 3, and consists of a cushion 10, bearing on rack-bar 9, a screw 11, and an intermediate spring 12. The teeth of rack 9, being without slot 8, as seen in Figs. 1 and 3, are within reach of pawl 4 when the latter is extended, but are beyond its reach when the pawl is retracted, as seen in Fig. 1. A pin 13 protrudes from the face of plate 7 as a stop for pawl 4. Plate 7 is mounted upon a convenient support in the position shown in Fig. 1, while a switch-plate 14, formed of non-conductive material, is similarly mounted a little below, as indicated in the same figure. Both these plates may conveniently be attached by screws to one of the inside vertical walls of the telephone-box. The front and back sides of plate 14 are seen in Figs. 1 and 2, respectively. In the front side of this plate is a longitudinal groove or channel 15, a curved lateral channel 16, and a shorter curved lateral channel 17. These three channels or grooves intercommunicate in a common pocket 18, near the bottom of plate 14. Channels 16 and 17 also separately intercommunicate with channel 15 at different distances above pocket 18, as will hereinafter more fully appear. In the back side of plate 14 is a shallow excavation or cavity 19, as seen in Fig. 2. The division-wall which separates cavity 19 from the above-described channels is perforated by two holes 20 and 21, which are respectively located at the upper junctions of channels 16 and 17 with channel 15. Said junctions are respectively provided with oblique gates 22 and 23, which are respectively mounted upon arms 24. These arms are pivoted at 26 in cavity 19, and are normally held in the positions indicated in Figs. 1 and 2 by means of springs 25 and stop-pins 27. From bar 9 depends a link armed with a horizontal switch-pin 29, which is made of brass or other conductive material, is insulated from link 28, and is adapted to travel in channels 15, 16, and 17. This pin may be regarded as the movable element of the switch. At the lower outer edge of channel 17 a brass or copper contact-plate 30 is sunk in plate 14, while across the inner and opposite edge of the same channel extends a contact-lever 31. This lever is seen in Figs. 1, 10, and 12 in cross-sectional views

in the plane of the front surface of plate 14. A side view of the same is Fig. 11. Lever 31 is pivoted at the back of plate 14, passes through a narrow slot 32 in that plate, and is provided with a lifting-spring 33 and with a terminal hook 34 for the support of a telephone, as indicated in Fig. 11. A suspended telephone is indicated in Fig. 11 by the terminal telephone-ring 35. Switch-pin 29, as indicated in Figs. 1 and 14, is connected by wire 36 with one terminal 48 of a voltaic cell 46. That cell is preferably the transmitter-battery which is in common use. Plate 30 is connected by wire 37 with an alarm 38. This alarm, which is merely indicated in Fig. 1, is preferably a "rattler" or a "buzzer," so called, or other audible electric signal, as shown in Fig. 14. By means of wire 39 alarm 38 is connected with the other terminal 48 of said voltaic cell or transmitter-battery 46. The three switches, which are shown in Figs. 4, 5, and 6, respectively, differ in length, so that gates 22 and 23 are at a greater distance from pocket 18 in Fig. 5 than in Fig. 4, and are at a still greater distance in Fig. 6. These switches may illustrate the construction, arrangement, and operation of a series consisting of any desired number of such switches, according to the number of telephones or local stations which may be located upon a single line 2. This line is here assumed to be part of a normally-open circuit.

Those modifications of my invention which would adapt the same for use in a normally-closed circuit are not here described. The central office is provided with a battery or other generator and a circuit-closer of any convenient form and mode of operation. Each station is provided with a described switch of predetermined length, a voltaic cell, an electric signal, and mechanism for actuating said switch, as described. Such are the construction and arrangement of my invention in its primary form.

The modification which is introduced in Figs. 7 and 8 requires but little description. Bar 9 is here provided with teeth which are in constant engagement with a gear-wheel 40. By means of ratchet and pawl 41 and 42 wheel 40 when turned in one direction engages a second gear-wheel 43, but when turned in the opposite direction is disengaged therefrom. A third gear-wheel 44, carrying fans 45, constantly engages wheel 43. In this modification motor mechanism similar to that shown in Fig. 1 and similarly connected may be applied to bar 9 in substantially the same manner which has been already described; or similar motor mechanism, as in Fig. 13, may be applied to wheel 40 by means of ratchet-teeth or a curved rack 47 upon the side of said wheel.

Such being the construction and arrangement of my invention in its primary and in its modified forms, the mode of its operation is now to be explained.

The operation of the invention in its

primary form, as shown in Figs. 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, and 14, may be first described. When no electrical impulse or no such impulse sufficient to affect magnets 1 is transmitted through line 2, armatures 3 occupy positions of separation from magnets 1, and pawls 4 are disengaged from bars 9, as illustrated in Fig. 1. At the same time bars 9 and links 8 occupy their lowest attainable positions relatively to plates 7 and 14, and pins 29 rest in pockets 18. In this position of affairs if an electrical impulse of sufficient energy is sent from the central station through line 2 magnet 1 is energized at each station on that line, armature 3 is attracted, pawl 4, being relieved of the weight of that armature, is advanced by the force of spring 5 into engagement with a tooth of bar 9, that bar is lifted, and pin 29 is drawn up out of pocket 18 through a portion of channel 15. The distance so traversed by pin 29 is uniform at all the stations. Let the stations whose switches are represented in Figs. 4, 5, and 6 be designated as stations No. 1, No. 2, and No. 3, respectively. At station No. 1 pin 29 in its described upward movement presses against the lower side of gate 23, pushes that gate aside against the resistance of spring 25, and rises to a point in channel 15 between gates 22 and 23. Fig. 9 shows pin 29 in the act of passing gate 23. Immediately after the passage of pin 29 gate 23 is automatically closed by the action of spring 25. At stations Nos. 2 and 3 pin 29 is by the described impulse raised too little to pass gates 23, for the reason that those gates are located at greater distances from pocket 18. All this is illustrated at *a* in Figs. 4, 5, and 6, where pin 29, though raised to an equal height in each figure, stands above gate 23 in Fig. 4 only. If, now, the electrical impulse which was sent through line 2 is interrupted, armatures 3 fall and pawls 4 are retracted, as illustrated in Fig. 1. After a momentary hesitation, caused by the retarding influence of cushion 10, bar 9, being set free from pawl 4, slides slowly downward in slot 8 at each of said stations, unless prevented by an immediate repetition of such electrical impulse. As bar 9 thus descends at station No. 1, pin 29, sliding obliquely downward along the upper surface of gate 23, closed as described, is thereby switched into channel 17 and descends through that channel until stopped in contact with plate 30 by encountering lever 31, as seen in Fig. 10. The local circuit through the transmitter-cell 46 and local alarm 38 is thus closed by way of wires 36, 37, and 39, as shown in Fig. 14. Station No. 1 is thus called by the sounding of alarm 38. This alarm if constructed in the form of an electric bell or buzzer, as described, continues to ring until the telephone, suspended by hook 35, is removed from lever 31. The latter is then drawn up by spring 33 out of the way of pin 29, as seen in Fig. 12. This pin then descends into pocket 18, the alarm-circuit is interrupted, and the bell stops ring-

ing. Meanwhile pins 29 at stations Nos. 2 and 3, descending by channels 15, have returned to their respective pockets 18. So all the signals stand in unison, as at first; but if said electrical impulse, which was interrupted as described, be immediately repeated pawl 4, engaging the next tooth of bar 9, lifts pin 29 again the same distance and in the same course as before at each station. Accordingly at station No. 1 pin 29 now passes above gate 22 in the same manner in which that pin previously passed above gate 23, as described. At station No. 2 pin 29 at the same time passes gate 23 in the same manner; but at station No. 3 pin 29 still occupies a position below both gates 22 and 23. This is illustrated at *b* in Figs. 4, 5, and 6, where pin 29, though raised to an equal height in each figure, is seen to be above both gates at station No. 1, between both gates at station No. 2, and below both gates at station No. 3. If, now, the second electrical impulse, which was sent through line 2, be also interrupted, bar 9 is again released from pawl 4 at each station, and after a momentary hesitation, due to the influence of cushion 10, slides deliberately downward in slot 8, unless again prevented by a second repetition of the electrical impulse which was sent through wire 2. At station No. 1, as bar 9 thus descends, pin 29, being turned into channel 16 by the action of gate 22, descends by the way of that channel unobstructedly to pocket 18, as illustrated at *c* in Fig. 4. At station No. 2 pin 29, being directed by gate 23 into channel 17, descends therein, as at *c* in Fig. 5, until stopped in contact with plate 30 by lever 31, as illustrated in Fig. 10. Station No. 2 is thus signaled in the same manner and with the same effect which were above described in connection with the signaling of station No. 1. At station No. 3 pin 29, descending by channel 15, as seen at *c* in Fig. 6, falls ineffectually into pocket 18, from which it started. As soon as the telephone is unhooked from lever 31 at station No. 2 pin 29 descends to pocket 18, so that in this case also the signals all stand at unison after the call; but if the electrical impulse, which was twice interrupted, as described, be immediately repeated again pins 29, starting from the positions indicated at *b* in Figs. 4, 5, and 6, are carried still farther upward in channel 15, so that pin 29 is now above both gates 22 and 23, both at station No. 1 and at station No. 2, and is between gates 22 and 23 at station No. 3. If, now, the third electrical impulse sent to line be interrupted, pins 29, unless prevented by a further repetition of that impulse, presently descend in the respective courses about to be described. At stations Nos. 1 and 2 pins 29 descend to pockets 18 by channels 16, while at station No. 3 pin 29, descending by channel 17, is stopped by lever 31 in contact with plate 30, and thus closes the electric circuit containing the local alarm. Station No. 3 is thus signaled. When the telephone is

unhooked at this station, pin 29 descends into pocket 18, and all the signaling devices again stand at unison in pockets 18. If the electrical impulse, thrice interrupted, as described, should be at once repeated again, pins 29, starting from the highest point before reached, would be carried so high as to be above both gates at each of the three stations mentioned. If released at that point of elevation, pins 29 will descend by channels 16 to pockets 18 at all of said stations; but in a more extended system another station provided with a differentiating switch whose gates are farther removed from pocket 18 may thereby be called; and so on indefinitely. From this mode of operation it is obvious that any desired station on line 2 may be separately signaled by sending from the central office to all the stations on that line the particular number of electrical impulses which are adapted to raise pin 29 to a position between gates 22 and 23 at such desired station. It is also to be noticed that after each signal the apparatus returns to unison at all the stations. If, however, the alarm which is sounded at any station is not immediately followed by the unhooking of the telephone at that station, the alarm there continues to ring until a greater number of impulses is sent to line than were used in exciting that alarm. Then the apparatus at said station returns to pocket 18 by the way of channel 16 and stands in unison with the apparatus at the other stations. In cases in which my invention is used upon lines where no telephones are used lever 31 must be moved by hand, in lieu of being moved by said spring 33.

The mode of operation of my invention in the modified forms which are illustrated in Figs. 7, 8, and 13 need but little special description, since these modifications affect only the means of actuating the switch, and do not extend to the switch itself.

An electro-magnetic motor (not shown in Figs. 7 and 8, but similar to the motor which is shown in Fig. 1) must be understood to be applied to bar 9, as already described, or a similar motor must be understood to be applied to wheel 40, as explained in connection with Fig. 13. When wheel 40 is by the action of such motor rotated in the direction indicated by the arrow in Fig. 7, the remaining wheels 42 and 43, and also the fans 45, are unaffected; but when the action of the motor is interrupted, and bar 9 descends under the influence of gravity, all said wheels and the said fans are brought into action and produce a delaying or retarding effect upon the descent of the said bar.

Such are the construction and mode of operation of my invention in its primary form, which is illustrated in Figs. 1, 2, 3, 4, 5, 6, 9, 10, 11, and 12, and in its modified form, which is illustrated in Figs. 7 and 8.

In the modification shown in Fig. 13 the step-by-step movement, which is imparted in the described manner to bar 9, is by construc-

tion so slight relatively to the requisite described movement of pin 29 that two, three, or some other predetermined number of impulses must be sent over line 2 in order to produce the same movements which are in the foregoing description attributed to a single impulse.

The invention admits of numerous other modifications, which are sufficiently obvious without pictorial illustration.

The substance of the invention is not found in the form of the motor which actuates bar 9; nor in the intermediate mechanism whereby the motor is connected with pin 29; nor in the form of that pin, regarded as a contact-piece, reciprocating in several courses; nor in the form of the channels and mechanical guides or gates, whereby that pin is directed in said courses; nor in the mechanism or the source of the power whereby an alarm is caused to act when said pin is directed in a predetermined course; nor in the character of that alarm, as being audible, visible, electrical, or otherwise, but resides in the elements and combinations hereinafter claimed.

I claim as my invention—

1. In a differentiating switch, a switch-pin and mechanism for imparting to said switch-pin variable reciprocating movements, in combination with a system of three channels or mechanically-defined courses determining the lateral movements of said pin, and having a common terminal pocket and gates of intercommunication between one of said channels and each of the other of said channels at unequal distances from said common pocket, substantially as and for the purpose specified.

2. In a differentiating switch, a switch-pin and mechanism for imparting a variable reciprocating motion to said switch-pin, in combination with a switch-plate having for the guidance of said switch-pin a main channel, and two lateral channels branching from said main channel and returning to different portions of the same, substantially as and for the purpose specified.

3. A switch-pin, mechanism for imparting reciprocating motion to said switch-pin, a switch-plate having three channels of unequal length, which are provided with a common terminal pocket and with two movable gates between one of said channels and each of the other of said channels, in combination with alarm mechanism which is connected with the shortest of said channels, substantially as and for the purpose specified.

4. A switch-pin and mechanism which imparts to said switch-pin reciprocating movements of greater or less amplitude, as desired, in combination with a switch-plate having three intercommunicating channels of unequal lengths, said channels being provided with a common terminal pocket and with gates located at unequal distances from said common pocket and determining the course of said pin in and among said channels, according to the amplitude of said reciprocating

movements, substantially as and for the purpose specified.

5. A switch-plate which has a system of intercommunicating channels, consisting of a main channel and two lateral channels, all said channels having a common terminal pocket, and said lateral channels having gates or apertures of intercommunication with said main channel at points unequally distant from said common pocket, in combination with an electric motor, and intermediate mechanism, whereby motion may be communicated from said motor to said switch-pin, substantially as and for the purpose specified.

6. A reciprocating switch-pin, an electric motor, and a connection between said motor and said pin, in combination with a system of guides and gates limiting the reciprocating movements of said pin to three intercommunicating courses of unequal lengths, and an alarm which is connected with the shortest of said courses, substantially as and for the purpose specified.

7. A system of guides, a switch-pin which is movable therein through three separate courses of unequal lengths, and an electric motor actuating said pin, in combination with an alarm which is excited when said pin reaches a certain position in the shortest of said courses, substantially as and for the purpose specified.

8. An electric motor, a sliding bar which is actuated thereby, and a switch-plate which has three intercommunicating channels of unequal lengths, in combination with a switch-pin which is movable in said channels, and a connecting-link between said sliding bar and said switch-pin, substantially as and for the purpose specified.

9. A switch-plate which has three intercommunicating channels of unequal lengths, a switch-pin which is adapted to circulate in said channels, an electric motor, and intermediate mechanism whereby motion may be communicated from said motor to said switch-pin, in combination with an alarm which is connected with the shortest of said channels, substantially as and for the purpose specified.

10. A switch-plate which has three intercommunicating channels of unequal lengths, a switch-pin fitted to slide in and among said channels, an electric motor, an intermediate mechanism which actuates said switch-pin, in combination with an alarm, and mechanism whereby said alarm is brought into action whenever said switch-pin reaches a predetermined point in the shortest of said channels, substantially as and for the purpose specified.

11. A switch-pin which has a system of intercommunicating channels of unequal lengths provided with gates, a switch-pin which is fitted to slide in and among said channels, an electric motor, intermediate mechanism whereby said motor may impart to said switch-pin reciprocating movements of variable amplitude, as desired, and an alarm, in combination with mechanism for working said

alarm, and mechanism whereby said switch-pin is brought into connection with said alarm-working mechanism whenever said switch-pin reaches a predetermined position in said system of intercommunicating channels, substantially as and for the purpose specified.

12. A switch-plate which has a system of three intercommunicating channels—namely, a central or main channel and two lateral channels of unequal lengths—a switch-pin which is movable in said channels, an electric motor, intermediate mechanism whereby said motor can move said switch-pin, an alarm, and mechanism whereby said alarm is brought into action whenever said switch-pin reaches a predetermined point in the shortest of said lateral channels, all located at one of several stations on a single line, in combination with a similar equipment of like elements similarly connected to said line and located at each other of said stations, substantially as and for the purpose specified.

13. A system of channels which have local

apertures of intercommunication, a switch-pin which is movable in said system, an alarm which is brought into action when said switch-pin reaches a predetermined point in said system, and an electric motor which may actuate said switch-pin, all located at one of several stations on a single-line wire, in combination with a system of channels which have differently-located apertures of intercommunication, a switch-pin, an alarm, and an electric motor, all located at another of said stations, said motors being connected in series with each other and with a central office which is provided with a generator and circuit-closer, substantially as and for the purpose specified.

In testimony whereof I hereunto set my name in the presence of two witnesses.

WILLARD EDDY.

Witnesses:

ALBERT H. WALKER,
JOHN H. WHITE.