

1,051,228.

2 SHEETS—SHEET 1.

Fig. 1.



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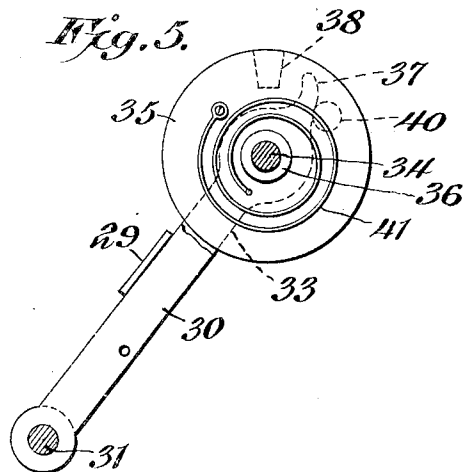
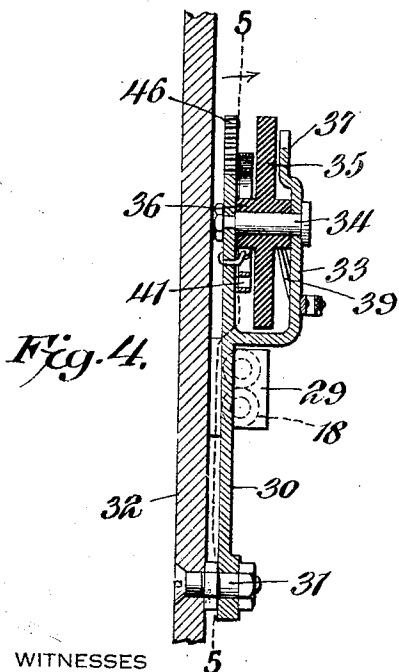
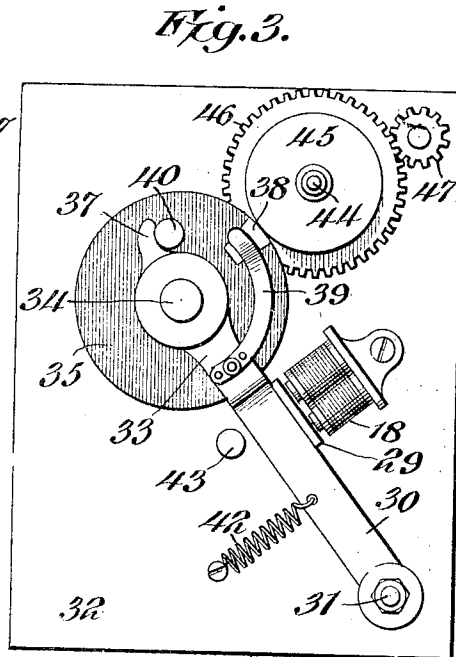
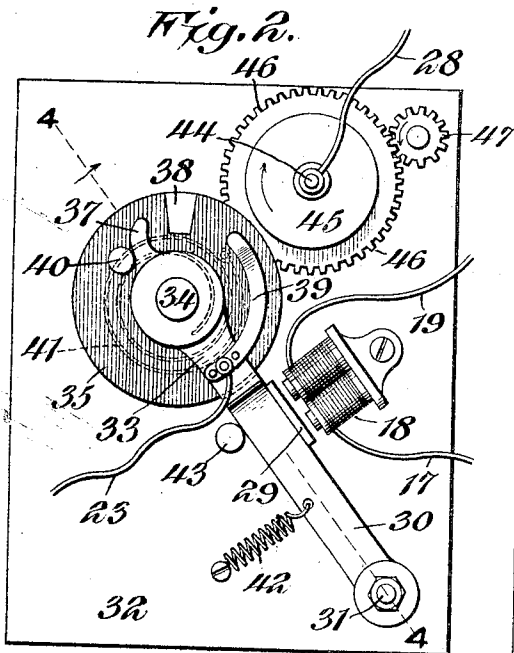
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ELAPSED TIME ELECTRIC SIGNAL.
APPLICATION FILED OCT. 18, 1910.

1,051,228.

Patented Jan. 21, 1913.

2 SHEETS-SHEET 2.



WITNESSES

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ELAPSED-TIME ELECTRIC SIGNAL.

1,051,228.

Specification of Letters Patent.

Patented Jan. 21, 1913.

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To all whom it may concern:

Be it known that I, FAIRBANKS C. HIRDLER, a citizen of the United States, residing at Oklahoma, in the county of Oklahoma and State of Oklahoma, have invented a new and useful Elapsed-Time Electric Signal, of which the following is a specification.

This invention has reference to improvements in elapsed time electric signals, and its object is to provide a signal means which on the failure of a transmitted signal to elicit a response, will cause another signal to be produced at another point automatically after the lapse of a predetermined time.

The present invention is of general application, but is especially adapted for use in connection with telephone call signals, particularly those coming from a subscriber and produced at the central station, and for convenience of description it will be considered that the present invention is for a telephone call signal with the understanding, however, that the general features of the invention are adapted for the production of signals of any kind and for any purpose to which the invention is applicable. It is, therefore, apparent that the invention is not limited to any specific details of construction or arrangements of parts, but that various modifications and changes may be made to suit the different conditions of installation and the circumstances of use, while still retaining the salient features of the invention. Furthermore, even in the art of telephony there are various systems in commercial use, including the automatic, the semi-automatic, and the manual, and as the latter has by far the greatest extent of use, the following description will for convenience be directed particularly to the manual system of telephony. Again, practically all the manual systems comprise subscribers' sets, subscribers' lines, telephone exchange switch boards, and operators, such operators being the manual or human element of the system. Since practically the only differences between various manual systems is in the exchange switch-board which in itself does not affect the present invention, the following description will be further based upon an exchange switch-board of the Western Electric type as being the one in most common use, and, furthermore, the particular showing of the drawings is confined for simplification to a local telephone system, but it will be understood that the in-

vention is equally well adapted to long distance telephone systems.

When a subscriber calls up central, there is a waiting period before an answer comes from the central operator, and this waiting period may be very short, or may be comparatively prolonged, depending upon the conditions then present at the central switch-board. The waiting period which corresponds to the speed of answer of the operator must be kept as low as possible where the telephone company desires to increase business and make money, and such speed of answer must be uniform. As an example, if one company gives to its subscribers an average speed of answer on all calls of five seconds with, say, ten per cent. of the answers at a maximum of six seconds, and another company gives its subscribers an average speed of answer of four seconds with four per cent. of its calls at twelve seconds, and two per cent. of the calls at twenty seconds, then, although the second company gives a faster average service, yet it is evident that the first company gives the better general service.

By the present invention it is commercially and theoretically possible not only to better the average time of answer to line signals, but, also, to positively reduce delayed answers to line signals to any desired and predetermined minimum, a delayed call being usually considered as one which is answered in a time greater than two and one-half times that of the standard average of answering a call.

The present invention will be best understood from a consideration of the following detailed description, taken in connection with the accompanying drawings forming a part of this specification, in which drawings:—

Figure 1 is a diagram showing so much of a local telephone system as is necessary for the understanding of the present invention, and also illustrating the present invention applied thereto. Fig. 2 is a plan view of a switch mechanism comprised in the present invention. Fig. 3 is a view similar to that of Fig. 2, but showing another phase in the operation of the structure. Fig. 4 is a section on the line 4—4 of Fig. 2. Fig. 5 is a section on the line 5—5 of Fig. 4 omitting some of the more distant parts seen in Fig. 4.

Referring to Fig. 1 there is shown a subscriber's set 1, a subscriber's line 2,

multiple jacks 3 at the central station of which one is the answering jack associated with the regular line signal lamp 4. There is, also, shown a line signal pilot lamp relay 5, a line signal lamp relay 6, a cut-off relay 7 and a battery 8, which may be a twenty-four volt battery. There is, also, indicated an answering plug 9 of the cord circuit, and in this circuit is a common battery 10 and two leads 11 are shown as going to the balance of the cord circuit. The armature 12 of the relay 6 is connected to a conductor 13 which is usually grounded at the switch-board common ground, but in the present invention this conductor leads first through an auxiliary relay 14 and then to ground, indicated at 15.

The parts so far described, with the exception of the relay 14, belong to the standard Western Electric switch-board circuits and are only referred to for the understanding of the present invention.

The relay 14 has an armature 16 connected on one side by a conductor 17 to one terminal of an electro-magnet 18, the other terminal of which is connected by a conductor 19 to one side of a battery 20 which may be a twenty-four volt battery, the same as the battery 8. The other side of the battery 20 is connected by a conductor 21 to a contact terminal 22 in the path of the armature 16, so that when the relay 14 is energized there is established a circuit from the armature 16 by way of the conductor 17 to the magnet 18, then by way of the conductor 19 to the battery 20, and from the latter by way of the conductor 21 to the contact 22 and back to the armature 16, the magnet 18 being thereby energized.

Branched off from the conductor 21 is another conductor 23, and branched off from the conductor 19 is another conductor 24, the latter being connected to one side of a relay 25, the other side of which is connected by a conductor 26 to one side of a signal light 27 constituting the elapsed time line signal light, and the other side of this lamp 27 is connected to a conductor 28 which will be hereinafter referred to.

The magnet 18 is provided with an armature 29 fast on an arm 30, which latter is carried by a pivot 31 shown in Fig. 4 as a bolt carried by a base board 32, but it will be understood that this showing of the base-board is simply indicative, and any suitable support may be used.

At the end remote from the pivot pin 31 the arm 30 is formed with an overhang 33 between which and the body of the arm there extends a pintle 34 forming the journal for a disk 35 provided with a hub 36, by means of which the disk is centralized between the main body of the arm 30 which may be straight and the overhang 33. The free end of the overhang 33 is in the form

of a tooth 37 shown as slightly curved, but such curvature is not mandatory. This tooth is also bent toward the corresponding face of the disk 35, so as to approach quite closely thereto for a purpose which will presently appear.

The disk 35 is made of some suitable insulating material, such as hard rubber or vulcanized fiber, and carries at its periphery a block 38 of metal, in the path of which is the free end of a brush 39 carried by the arm 30 and normally bearing at the free end on the disk. Projecting from the face of the disk engaged by the arm 39 is a pin 40 in position to engage either side of the tooth 37, and this pin is held against one side of the tooth 37 by a spring 41 made fast at one end to the under face of the disk, and at the other end to the arm 30, the said spring being of the ordinary coiled type and normally under sufficient tension to maintain the pin 40 against the tooth 37, but which spring will permit the turning of the disk 35 practically one complete rotation until stopped by the engagement of the pin 40 with the other side of the tooth 37, the curvature of the latter being such as to then partially embrace the pin. The tooth 37 is bent toward the disk 35 so that it is engaged by the pin 40, which latter, while projecting enough from the face of the disk to engage the tooth 37, will pass under the overhang 33 without engaging the latter.

The arm 30 is under the normal control of a spring 42 tending to move it away from the magnet 18, but such movement under the action of the spring 42 is limited by a stop pin 43 in the path of the arm 30.

Mounted on the base board 32 or other suitable support is a stud 44 upon which is mounted a disk 45 of conducting material, and this disk may be fast to a gear wheel 46 driven by a pinion 47, the said gear wheel and pinion being indicative of any suitable driving means for the disk 45, whereby a continual rotative movement at a predetermined speed may be imparted to the disk 45. The motor may be a spring motor or an electric motor, or power may be applied to the disk 45 in any other manner, it being the purpose of the present invention to have the disk 45 rotating at all times at a substantially constant speed for a purpose which will presently appear, the only mandatory feature of the structure being that the rotation of the disk 45 shall be such as will answer the purposes of the present invention.

When the magnet 18 is energized, the armature 29 is attracted and the arm 30 participates in this movement against the action of the spring 42 until the edge of the disk 35 is brought against the edge of the disk 45, and as the latter is constantly rotating, rotative movement is then imparted

to the disk 35, the direction of this rotative movement being such as to carry the pin 40 away from its normal position of engagement with the tooth 37 and the block 38 is carried by the disk until finally as the pin 40 engages the hollow side of the tooth 37 and so arrests further movement of the disk 35, the block 38 is in engagement with the brush 39 and also in engagement with the disk 45, the block 38 reaching to and being exposed at the periphery of the disk 35. The block 38 therefore acts as a bridging member between the brush 39 and disk 45. The disk 35 ceases further rotative movement even though the rotative movement of the disk 45 continues, and there is simply produced rubbing contact between the edge of the disk 45 and that edge of the block 38 then engaged by the disk 45. The rotative movement imparted to the disk 45 has caused a winding of the spring 41, so that when the circuit through the magnet 18 is broken and the magnet becomes deenergized and the spring 42 becomes active to move the arm 30 back into engagement with the stop 43, the spring 41 will then on unwinding return the disk 35 to its normal position with the stop pin 40 in engagement with the tooth 37 on the outwardly curved side thereof, and the block 38 removed from the disk 45 and brush 39 sufficiently to prevent any accidental closure of the circuit through these parts. The normal position of the parts is shown in Fig. 2, while the position of the parts after the disk 35 has been fully acted upon by the disk 45 is shown in Fig. 3.

Branched off from the line conductors 2 are other conductors 48 terminating in an elapsed time answering jack 49 which may be engaged by the elapsed time answering cord circuit 50, a part only of which latter is shown, but it may be of the usual construction.

In the operation of the system and structures described, let it be assumed that the subscriber at the subscriber's station 1 takes the receiver off the hook in the usual procedure calling up central. This causes the energization of the relay 6, so that the lamp 4 is made to glow, and at the same time a circuit is established from the battery 8 through the armature 12 of the relay 6 by way of the conductor 13 through the relay 14, the return circuit being by way of the ground 15 back to the battery 8, so that the relay 14 is also energized; and its armature 16 is attracted into engagement with the contact 22. This establishes a circuit from the battery 20 through the magnet 18 thereby causing a movement of the arm 30 until the disk 35 is in engagement with the disk 45 and the disk 35 begins to rotate. The speed of the disk 45 and its proportionate size with relation to the disk

35 is such that the block 38 is not brought under the brush 39 and in engagement with the disk 45 until a certain time has elapsed. If now the call is answered by the regular operator before the block 38 reaches the brush 39, by inserting the plug 9 into the proper jack 3, the cut off relay 7 will operate thereby deenergizing the relays 6 and 14 and cutting out the lamp 4, this causing the deenergization of the magnet 18 and the return of the arm 30 to the normal position under the action of the spring 42, so that the disk 35 is returned to its normal position by the spring 41. Under these conditions the operation of the system is the same as though the improvement were not present. Suppose, however, that the regular operator does not answer before the contact or bridging block 38 reaches the brush 39 and disk 45, then there is established a circuit from the battery 20 by way of the conductor 24 through the relay 25 which controls the pilot lamp and the latter will be caused to glow, thence the current traverses the conductor 26 to the lamp 27, causing the latter to glow, this lamp being the elapsed time line signal lamp; and from thence the circuit is by way of the conductor 28 to the stud 44, disk 45, block 38, brush 39, and conductor 23 back to the battery 20. As soon as the delayed call operator, in front of whom the lamp comes in, sees the same, she inserts the plug 50 in the jack 49 and completes the call in the regular manner. The elapsed time line signal lamp 27 will stay lighted even if the delayed call operator and the regular operator do not answer, since the disk 45 will remain in contact with the block 38 simply moving on the same in rubbing contact therewith.

The rocker arms 30 in an installation may be mounted on switch racks, say twenty or more in a row, and then an equal number of disks 45 may be mounted on a suitable shaft or a single solid shaft may replace the disks and be driven by a single motor. Of course, the stop pin 43 and the pivot 31 may be made sufficiently long to be common to all the rocker arms. These and other like changes are such as would suggest themselves to any engineer installing the system and consequently the invention is susceptible of such changes without any departure from the scope of the invention.

By properly proportioning the speed of the driving member 45, a certain prescribed time is given the regular operator to answer the call, and if the regular operator fails to answer the call within such time, the call is automatically switched to the elapsed time operator who will then answer the call. The large majority of calls are, of course, answered within the minimum waiting period by the regular operator and

only a comparatively small number are delayed sufficiently to cause the operation of the elapsed time signal means, whence the elapsed time signal operator may cover a section of the switch-board controlled by several regular operators, so that even in large exchanges but few elapsed time operators are needed. At the same time the average answer to line signals is materially reduced and more prompt and better service is rendered the subscribers than can occur with the usual central station arrangements, the present invention reducing the delayed answers to line signals to such predetermined minimum as may be desired.

The elapsed time signal may, of course, be applied to the pilot lamps only, or to any signal lamps, or to drops in annunciators, or to bells and buzzers and the like. In fact, the invention is applicable to all conditions where it is desirable to divert an electric current from one translating device to another after the lapse of a predetermined time.

What is claimed is:—

1. In a telephone system including a call circuit having a call signal means at the central station, another call circuit at the central station normally disconnected from the first named call circuit and including a signal means, and means at the central station responsive to a call impulse sent through the first named signal circuit to establish in the second named signal circuit electric conditions automatically productive of a signal at a predetermined time after the energization of the first named signal circuit.

2. In a telephone system provided with a call circuit extending from a local station to the central station and there having a call signal means, a call circuit local to the central station and forming an adjunct to the first named call circuit and normally disconnected therefrom, said second named call circuit including a source of electrical energy, and signal means individual thereto, and means controlled by a signal impulse sent from the local station for causing the closing of the second-named call circuit to automatically produce a signal a predetermined time after the energization of the first-named call circuit.

3. An attachment or adjunct for the central station end of a telephone signal system comprising a circuit including a source of current, a signal means, a sluggishly operating means for completing said circuit and automatically energizing the signal means after a predetermined period of time, and means controlled by the first named signal means for setting the sluggishly operating means into operation on the receipt of a signal impulse at the central station over the first named signal circuit.

4. In a telephone signal system, provided with a signal circuit including a signal means at the central station, a normally open circuit including a source of current, a signal means other than the first named signal means, a sluggishly operating circuit closer for the second named circuit for closing said circuit and automatically energizing the signal means a predetermined time after the circuit closing means is set into operation, and means independent of the first named signal for setting the circuit closing means into operation, said last named means being under the control of signal impulses received at the central station.

5. In a signal system for telephones, an adjunct to the normal signal circuits comprising a normally open circuit, a source of current and an elapsed-time circuit closer in said circuit, a signal means also in said circuit, and another circuit controlling the elapsed-time circuit closer and in turn controlled by the normal signal circuit of the system, said normally open circuit causing the display of a signal on its closure by the elapsed time circuit closer.

6. In a telephone system having a signal circuit extending from local stations to a central station, a circuit local to the central station, a source of current included in said circuit, a circuit closer for said circuit controlled by signal impulses received at the central station, said circuit closer being independent of the normal signal means at said central station, another circuit local to the central station and including a signaling means, and a sluggishly acting circuit closer controlled by the first named circuit local to the central station for establishing the second named circuit at the central station and the display of a signal a predetermined time after the display of the signal by the first named signal means at the central station.

7. In a telephone system having local stations and a central station and a signal system extending from the local stations to the central station and at the central station including signal means, a drive means at the central station capable of constant operation, a circuit closer at the central station for each local station, said circuit closer including means capable of being actuated by the drive means for a predetermined time before reaching the circuit closing position, a circuit at the local station for each circuit closer and including a source of current and a signal means individual to said circuit, an operating means for each circuit closer for causing the engagement of the drive and driven means, said operating means being provided with electric actuating means and a circuit including said actuating means, and a circuit closer for said second named circuit controlled by signal impulses acting on the signal means included in the first named

signal circuit and independent of said signal means.

8. In a telephone system including local and central stations, a signal system including at the central station a signal for each local station, a circuit closer at the central station for each local station, a circuit at the central station controlled by said circuit closer and including a source of current, a rock arm having a normal tendency in one direction, electro-magnetic means included in said circuit and acting on the arm to move it against its normal tendency, a rotatable member carried by the rock arm and provided with a circuit closing member, a driving means for the rotatable member capable of constant actuation and into engagement with which the rotatable member is moved by the movement of the rock arm against its normal tendency, another circuit local to the central station and including a signal means, and means for the closure of the last named signal circuit by the rotatable circuit closer at a predetermined point in its rotative movement.

9. In a telephone system including local and central stations, a signal system including at the central station a signal for each local station, a circuit closer at the central station for each local station, a circuit controlled by said circuit closer and including a current source, a rock arm having a normal tendency in one direction, electro-magnetic means included in said circuit and acting on the arm to move it against its normal tendency, a rotatable member carried by the rock arm and provided with a circuit closing member, a driving means for the rotatable member capable of constant actuation and into engagement with which the rotatable member is moved by the movement of the rock arm against its normal tendency, another circuit local to the central station and including a signal means, and means for the closure of the last named signal circuit by the rotatable circuit closer at a predetermined point of its rotative movement, the rotatable circuit closer being provided with means for returning it to normal position when released from engagement with the drive member.

10. In an electric system, a circuit including a source of current, a circuit closing member included in said circuit, a continuously moving actuating member, a signal device in the circuit rendered active by the closure of said circuit by the continuously moving device, another circuit including a signal device and provided with means for rendering said device active, and means controlled by the energy rendering the second named signal device active for causing the engagement of the circuit closing device in the first-named circuit with the continuously moving device for closing the first-

named circuit a predetermined time interval after the energization of the circuit containing the second-named signal device.

11. In a telephone system having a central station with call receiving circuits and signals therein, another circuit for each call receiving circuit local to the central station and including a call receiving signal in position to be responded to by another operator than the one to respond to the first-named signal, said second-named circuit including means for its energization and an elapsed time circuit closer, means for causing the actuation of the elapsed time circuit closer to close the second-named circuit at the circuit closer, and another circuit closer in the second-named circuit controlled by a call signal received over the first-named circuit to close the second-named circuit at said last named circuit closer and constructed to move to open circuit position when not being acted upon by said call signal.

12. In a telephone system provided with a central station having call receiving signals responsive to impulses sent to the central station from local stations, a circuit for each call signal and including a call signal individual to said circuit, an elapsed time circuit closer for said circuit, constantly active means for actuating the circuit closer and normally out of actuating relation thereto, and means controlled by a signal impulse received at the central station from a local station for establishing the active relation of the actuating means with the elapsed time circuit closer to cause a second signal on the failure of response at the central station to the first signal within a predetermined time.

13. In an electric system, means for the establishment of an electric circuit after a predetermined elapse of time comprising a rock arm, a disk carried thereon, stop means for limiting the movement of the disk to a predetermined extent, a brush carried by the rock arm, a contact member carried by the disk and movable thereby into engagement with the brush at one limit of the travel of the disk, and a drive member adapted to engage and actuate the disk and make electric contact with the contact member carried by the disk when the said contact member is in engagement with the brush.

14. In an electric system, means for the establishment of an electric circuit and means for establishing another electric circuit a predetermined time after the establishment of the first named circuit comprising a rock arm having a normal constraint in one direction, electro-magnetic means controlled by the first named circuit for moving the arm against its normal constraint, a disk carried by the rock arm and having a normal constraint to rotate in one direction, a contact block carried by the disk, a brush

carried by the arm in the path of the contact block, means for limiting the movement of the disk, and a drive member for the disk in the path of the disk when moved
5 by the electro-magnetic means, said drive member causing a rotation of the disk against its normal constraint and making electric contact with the contact block on the disk when the latter is brought into en-
10 gagement with said driving means.

15 15. In an electric system, a rock arm, means for constraining the arm in one direction, an electro-magnet for moving the arm in the other direction, a rotatable disk carried by the arm, a contact block on the disk,
15 a brush on the arm in the path of the contact block, co-acting stop members on the disk and arm for limiting the rotative movement of the disk, constraining means tend-

ing to maintain the disk at one limit of its
rotative movement, and a rotatable contact
member constituting a drive member for the
disk and engaging the contact block on the
disk when the latter has been moved by the
drive member to the limit of its travel in
opposition to the constraining means for
the disk, the drive member and the driven
disk being related to establish an electric
circuit at a predetermined time after the
drive member has begun to actuate the
driven member.

In testimony, that I claim the foregoing
as my own, I have hereto affixed my signature
in the presence of two witnesses.

FAIRBANKS C. HIRDLER.

Witnesses:

LAWRENCE T. BERGER,
HARRY LEWIS.