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TELEPHONE SYSTEM

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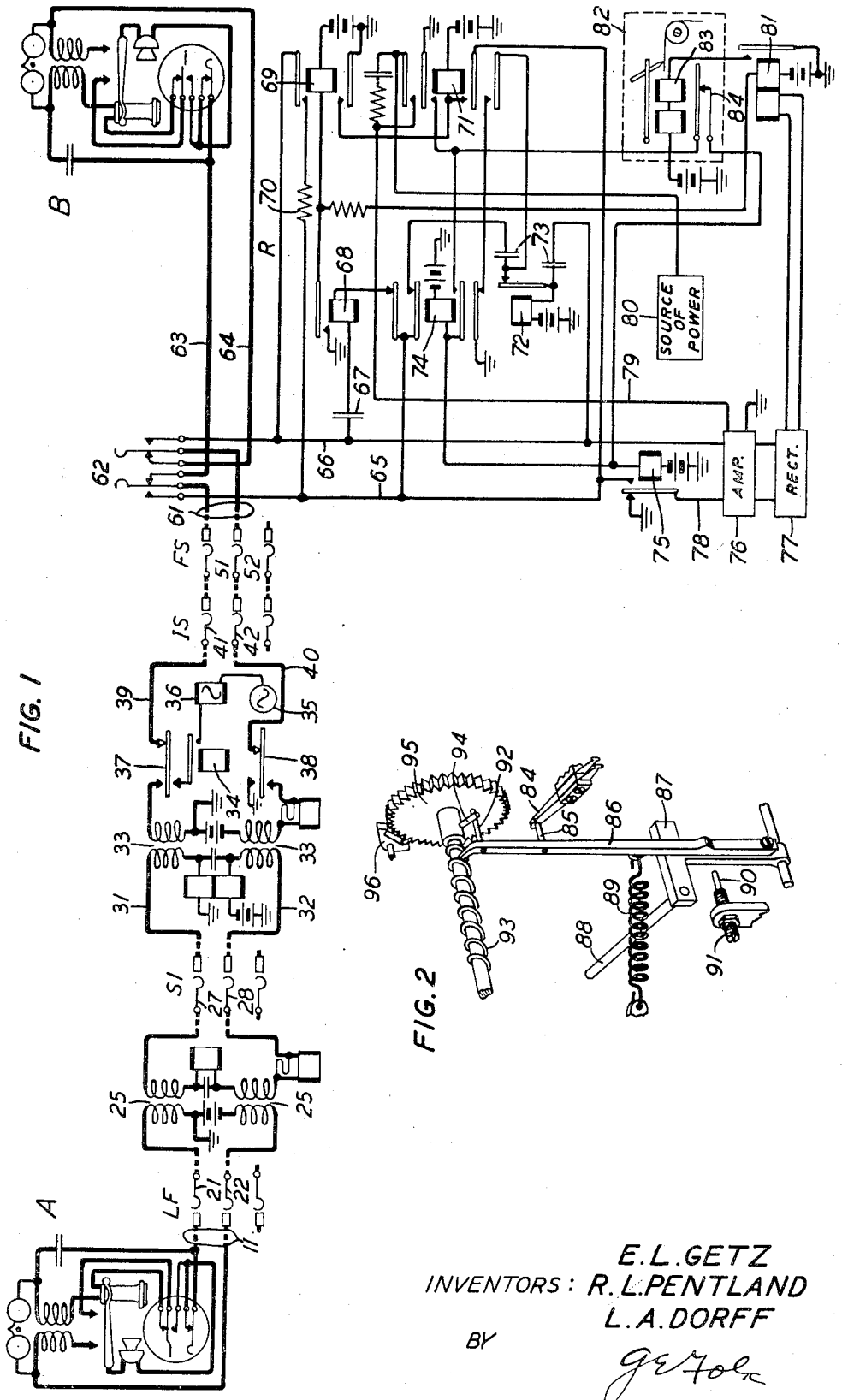


FIG. 1

FIG. 2

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TELEPHONE SYSTEM

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This invention relates to telephone systems and more particularly to call recorders for use at subscribers' stations.

The object of this invention is to provide efficient and reliable mechanism and simplified controlling circuits for use in recording unanswered incoming telephone calls at a subscriber's station.

In automatic and semi-automatic telephone systems it is usual to separately supply the calling and called stations with talking battery, the voice frequency talking currents being inductively transmitted through condensers in series with the talking conductors of the lines or through the windings of repeating coils bridged across the lines. Recording apparatus, which is provided at subscribers' stations for recording the telephone numbers of calling lines on unanswered calls, may be designed to respond to direct current impulses, in which case it is necessary to modify one or more of the selector switch circuits to repeat such impulses to the call recorder when received from the calling subscriber's impulse sending device; such impulses may also pass through one or more impulse repeaters. By providing call recording equipment capable of responding to impulses inductively transmitted over the talking circuit, there is no necessity for modifying the selector switch circuits and the only change in the telephone system required to give unanswered-call number-recording service is to equip the station with call recording equipment and a switch for connecting the recorder to the line.

This invention is a recording mechanism capable of responding to inductive impulses received over the talking circuit from a calling subscriber's telephone station to record the number of the calling station. According to one feature of the invention an amplifier is provided to receive the impulses and a rectifier is provided to convert the impulses for operating an impulse relay.

A further feature of the invention is an arrangement whereby the call recording mechanism at a subscriber's station is effective to immediately operate the ring cut-off relay when ringing current is received over the line.

A further feature is an arrangement whereby the call recording mechanism at a subscriber's station is effective to transmit an audible signal to the calling station as soon as the ringing current ceases, the duration of the signal being limited to a definite interval of time at the end of which the line is connected to the recording equipment.

The invention is applicable to any automatic or semi-automatic telephone system, in which means are provided at a calling station for creating current impulses, and will be better understood by considering the operation of a system in which its features have been incorporated. One such system is represented schematically in the drawing which forms a part of the following description. Although the system shown in the drawing is arranged so that the calling station will be charged for all calls to stations equipped with number-recording apparatus, it is of course understood that the arrangement might be such as would prevent charging of the calling station or the arrangement might be such as would effect charging of the called station.

Referring to the drawing, Figure 1 shows a calling subscriber's station A and line 11 connected by a line-finder switch LF to a district selector switch S1, an incoming selector switch IS, a final selector switch FS, a called subscriber's station B, and call recording equipment at station B including a pen-register. Fig. 2 shows in detail a portion of the mechanism of the pen-register at station B.

The equipment at the subscribers' stations A and B is of the usual type employed in automatic telephone systems including a dial for use in establishing any desired connection. The called station B is also provided with recording equipment R to which the line 61 may be transferred by the operation of the key 62. The recording equipment comprises a relay 68 for responding to ringing current, a resistance 70 for connection across the line conductors to trip the ringing, a buzzer 72 for transmitting an audible signal over the line conductors to a calling subscriber, control relays 71 and 74 for controlling the tripping bridge and buzzer, an amplifier 76 for amplifying incoming impulses, a control relay 75 for extending the line conductors to the amplifier, a rectifier 77 for transforming the amplified impulses into direct current impulses, an impulse relay 81 for responding to the rectified impulses, and a pen-register 82 for recording the impulses received by relay 81. The amplifier 76 may be one of any of the well known types; it may be similar to that disclosed in the patent to J. N. Walters, No. 1.559,659, November 3, 1925. The rectifier 77 may be one of any of the well known types. If desired, the amplifier and rectifier may be combined.

The pen-register mechanism consists of a mag-

net 83, the armature of which carries a pen arranged to engage a moving tape to record each operation of impulse relay 81. Recorders of this type are well known in the art, and reference may be had to the patent to N. H. Suren, No. 550,462, issued November 26, 1895, the patent to G. L. Foote, No. 671,046, issued April 2, 1901 and the patent to B. Hurd, No. 1,000,601, issued August 15, 1911 for a complete description of the construction and operation of such recorders. The contact springs 84 have been added for the purpose of controlling the length of the period during which the audible signal is being transmitted to the calling station. These contact springs and their arrangement with respect to the magnet and driving mechanism of the recorder are shown in Fig. 2. In this figure the push rod 88 is actuated by the armature of the recorder magnet 83, to disengage the control arm 86 from the worm 93 and disengage the pin 92 from the stop-pin 94. The spring 89 pulls the control arm 86 back against the stop 90 thus opening the contacts 84. When the stop-pin 94 is freed, the ratchet wheel 95 begins to rotate under control of the pallet 96 as is usual in clock-work mechanisms. When the magnet 83 becomes deenergized, the spring 89 pulls the control arm into engagement with the worm 93, so that the arm 86 creeps forward until the pin 92 re-engages the stop-pin 94. The contacts 84 are thus held open after the magnet 83 releases until the clock-work mechanism is stopped by pin 92. The interval during which the contacts 84 are held open may be varied by adjusting the position of pin 90 by means of screw 91. The addition of springs 84 thus provides a convenient arrangement for controlling the length of the period during which the aforementioned distinctive tone is transmitted to the calling station. It is, of course, understood that any other timing arrangement, for instance, a dash pot relay controlled by the contacts of relay 81, might be used to control the disconnection of the tone.

The line-finder switch LF and selector switches S1, IS and FS and their associated equipment are represented schematically, only those portions being shown which are necessary to a full and complete explanation of this invention. These switches may be of the panel type and similar in construction to the switch disclosed in the patent to Craft et al. 1,123,696, January 5, 1915. The operation of the selector switches is controlled by a register-sender in accordance with dial impulses from the calling station, but the register-sender is not shown in the drawing since it is not directly related to this invention; reference may be had to the patent to Stearn et al. 1,395,977, November 1, 1921 for a complete description of the operation of such a register-sender and the switches controlled thereby.

Assume first that the key 62 is normal when a connection from the calling line 11 is established with the called line 61. When the ringing control relay 34 of the incoming selector circuit operates as described in the aforementioned patent to Stearn et al., it connects the source of ringing current 35, through the winding of tripping relay 36, the upper front contact of relay 34, the springs of sequence switch cam 37, conductor 39 and brush 41 of selector IS, brush 51 of the final selector FS, the upper conductor of line 61, the left-hand back contact of key 62, over conductor 63, through the ringer of station B, back over conductor 64, through the right-hand back contact of key 62, the lower conductor of line 61, brush 52 of selector FS, brush 42 and conductor 40 of selector IS, through the springs of sequence switch cam 38, to ground. When the receiver is removed at station B, the trip relay 36 operates to advance the sequence switch of the incoming selector to a position in which battery and ground are connected through the right-hand windings of repeating coil 33, the springs of cams 37 and 38, conductors 39 and 40, brushes 41 and 42 of selector IS, brushes 51 and 52 of selector FS, over line 61 to the called station B; the ringing circuit is opened when the sequence switch advances. The calling station A is now connected over line 11 through brushes 21 and 22 of line-finder LF and the left-hand windings of repeating coil 25 to battery and ground in the district selector circuit. The talking current is inductively transmitted between the calling and called stations through the repeating coils 25 and 33, the connection between the right-hand windings of coil 25 and the left-hand windings of coil 33 being traced through brushes 27 and 28 of selector S1 and conductors 31 and 32 of the incoming selector circuit. When the receivers are returned to the receiver hooks at stations A and B, the connection is released in the manner described in the aforementioned patent to Stearn et al.

Assume next that the key 62 is operated when the connection is extended from station A to station B so that the line 61 is connected to the recording equipment R instead of to the telephone instrument. In this case, the ringing circuit extends from the upper conductor of line 61 through the front contacts of key 62, over conductor 65, through the uppermost back contact of relay 74, the winding of relay 68, through condenser 67, and back over conductor 66 to the lower conductor of line 61. Relay 68 is operated by the ringing current thereby closing obvious circuits for causing the operation of relays 69 and 81. Relay 69 closes an obvious circuit for operating relay 71 and also bridges the resistance 70 across conductors 65 and 66 thereby causing operation of the tripping relay 36 of the incoming selector. Relay 81 closes the circuit for operating magnet 83 of the pen-register 82. The operation of tripping relay 36 causes the advance of the sequence switch of the incoming selector, the normal talking connection between lines 11 and 61 being completed through cams 37 and 38 as hereinbefore described. The ringing circuit is opened by the advance of the sequence switch so that relay 68 releases.

With relay 71 operated, a circuit is closed from battery through the winding and back contact of the buzzer magnet 72, through the lowermost contact of relay 71 to ground at the lower back contact of relay 74. The alternate operation and release of buzzer 72 causes a distinctive tone to be transmitted through condensers 73 and the inner upper back contact of relay 74, over conductors 65 and 66 and line 61, and through repeating coils 33 and 25 to the calling station A. This tone indicates to the subscriber at station A that the called station B is equipped with number recording apparatus. Upon the release of relay 68 in consequence of the opening of the ringing circuit at the incoming selector, relays 69 and 81 release, but relay 71 is held operated through its inner lower front contact and over conductor 65 to ground at the repeating coil 33 of the incoming selector. The release of relay 69 opens the bridge through resistance 70 and the release of relay 81 causes the release of magnet 83. With magnet 83 normal and as soon thereafter as the contacts 84 are again closed by the control arm 85 (shown in

Fig. 2), a circuit is closed from battery through the windings of relays 74 and 75 in parallel, through the back contact of magnet 83, to ground at the inner upper front contact of relay 71. The operation of relays 74 and 75 prepares for the receipt of dial impulses from the calling station by opening the circuit for operating the buzzer 72, by disconnecting conductor 65 from the winding of relay 68 and from condenser 73, and by transferring conductor 78 from ground at the back contact of relay 75 to the conductor 65. The amplifier is now ready to receive impulses, the source of power 80 being connected through the uppermost front contact of relay 71 to conductor 79 which supplies the amplifier 76.

When the calling subscriber no longer hears the buzzer tone, he may dial his own telephone number for registration at the called station, the impulses thus created being inductively transmitted over the talking circuit to line 61 and thence to the amplifier 76. The impulses are amplified and transformed into direct current impulses which cause the alternate operation and release of the impulse relay 81, the left-hand winding of relay 81 being connected to receive the rectified impulses from the rectifier 77. Each operation of relay 81 causes a corresponding operation of the pen-register mechanism whereby the impulses are recorded by this mechanism in the usual manner.

When the receiver is replaced at the calling station, the connection is released and the automatic switches are restored to normal as described in the aforementioned patent to Stearn et al. Relay 71 releases when its holding circuit is opened by the advance of the sequence switch in the incoming selector circuit. The release of relay 71 causes the release of relay 74 and 75 and disconnects the source of power 80 from the amplifier 76. The recording mechanism R is now ready for further operation on the next incoming call.

What is claimed is:

1. In a telephone system, a subscriber's line, a recording mechanism connected to said line, said mechanism comprising a register for recording a telephone number, impulse receiving means for actuating said register in accordance with impulses incoming over said line, a tone source, means actuated by ringing current incoming over said line for connecting said tone source to said line, and means effective a predetermined interval after the connection of said tone source to said line for disconnecting said tone source and for operatively connecting said impulse receiving means to said line.

2. In a telephone system, a subscriber's line, a recording mechanism connected to said line, said mechanism comprising a register for recording a telephone number, means for actuating said register in accordance with impulses incoming over said line, a tone source, and means for disconnecting said tone source prior to the receipt of impulses.

3. In a telephone system, a subscriber's line, a recording mechanism for said line comprising an amplifier for receiving impulses over said line and a register for operation in accordance with said impulses, a tone source, means actuated by ringing current incoming over said line for connecting said tone source to said line, and means for disconnecting said tone source prior to the receipt of impulses.

4. In a telephone system, a subscriber's line, a recording mechanism for said line comprising an amplifier for receiving impulses over said line and a register for operation in accordance with said impulses, a tone source, means actuated by ringing current incoming over said line for operatively connecting said tone source to transmit a tone over said line, and means for operatively disconnecting said tone source and for operatively connecting said recording mechanism to said line.

5. In a telephone system, subscribers' lines, a calling station, a called station, means including automatic switches for establishing a connection between said stations, means associated with one of said switches for connecting a source of ringing current to the called station, a tone source at said called station, means responsive to ringing current incoming to said called station for rendering said tone source effective to transmit a tone to said calling station, a recording mechanism comprising an amplifier and a register for receiving and recording impulses incoming to said called station, and means for operatively disconnecting said tone source and for operatively connecting said recording mechanism.

6. In a telephone system, subscribers' lines, a calling station including an impulse sender, a called station, means including automatic switches for establishing a talking connection between said stations, means associated with one of said switches for connecting a source of ringing current to the called station, a tone source at said called station, means responsive to ringing current incoming to said called station for rendering said tone source effective to transmit a tone to said calling station, a recording mechanism comprising an amplifier for receiving impulses created by the operation of said sender and inductively transmitted over said talking connection and a register for operation in accordance with the received impulses, and means for operatively disconnecting said tone source and for operatively connecting said recording mechanism in readiness for the receipt of said impulses.

7. In a telephone system, a subscriber's line, a recording mechanism for said line comprising an amplifier for receiving impulses over said line and a register for operation in accordance with said impulses, a tone source, means actuated by ringing current incoming over said line for rendering said tone source effective to transmit a tone over said line, and means for operatively disconnecting said tone source and for completing the connection between said line and said amplifier.

8. In a telephone system, a calling subscriber's line, a called subscriber's line, means for establishing a connection between said lines, recording mechanism for said called line comprising an impulse receiving relay and a register for operation in accordance with series of impulses received by said relay, a tone source at said called station, means for transmitting ringing current over said called line, means responsive to ringing current received over said line for rendering said tone source effective to transmit a tone over said line to said calling station, and means for operatively disconnecting said tone source and for operatively connecting said line to said recording mechanism, the disconnection of said tone source constituting a signal to indicate to said calling subscriber that the recording mechanism at said called station is ready to register a number dialed by said calling subscriber.

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