

May 8, 1923.

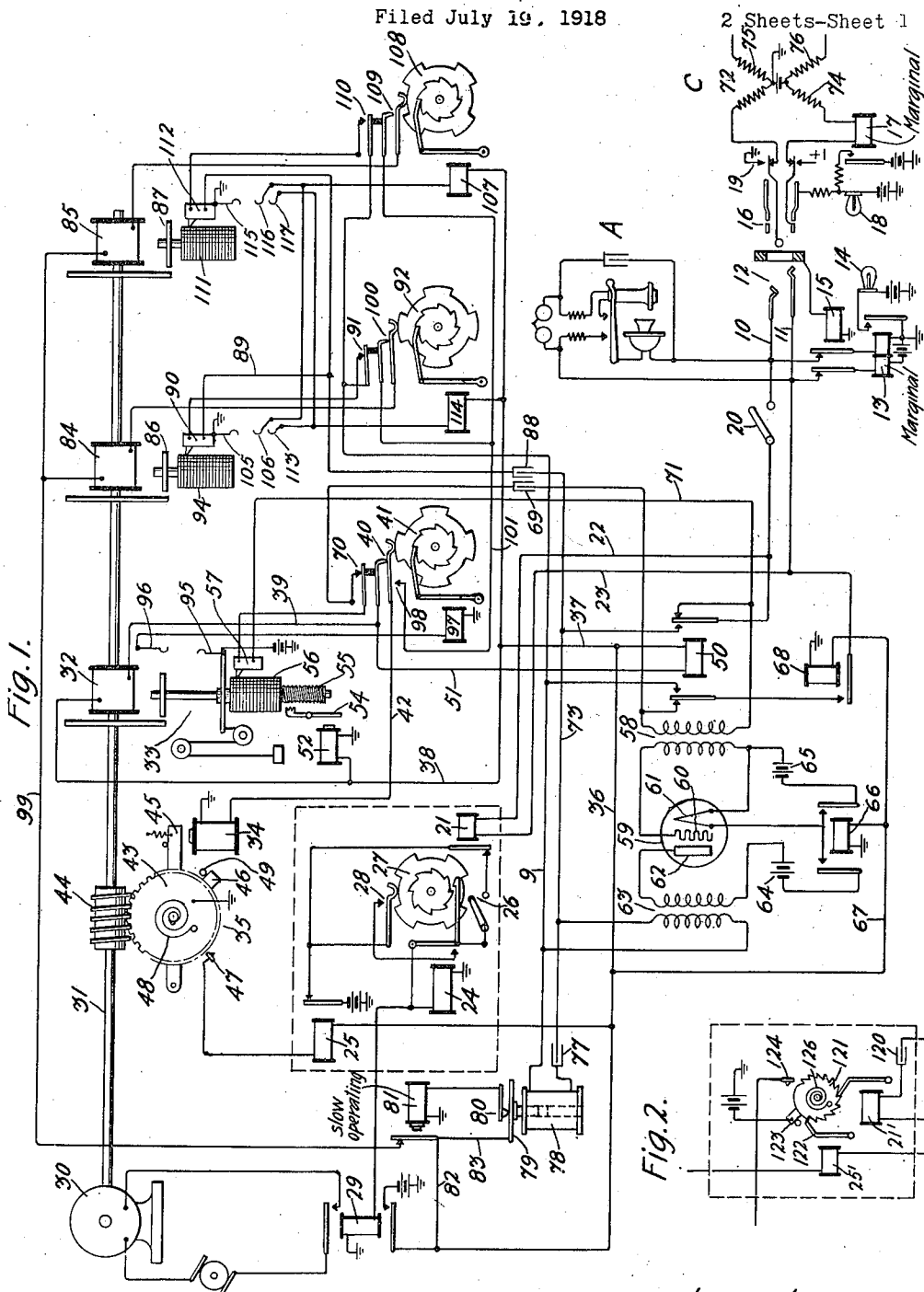
1,454,157

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PHONOGRAPHIC RECORDING AND REPRODUCING SYSTEM

Filed July 19, 1918

2 Sheets-Sheet 1



Inventor:
Henry C. Egerton.
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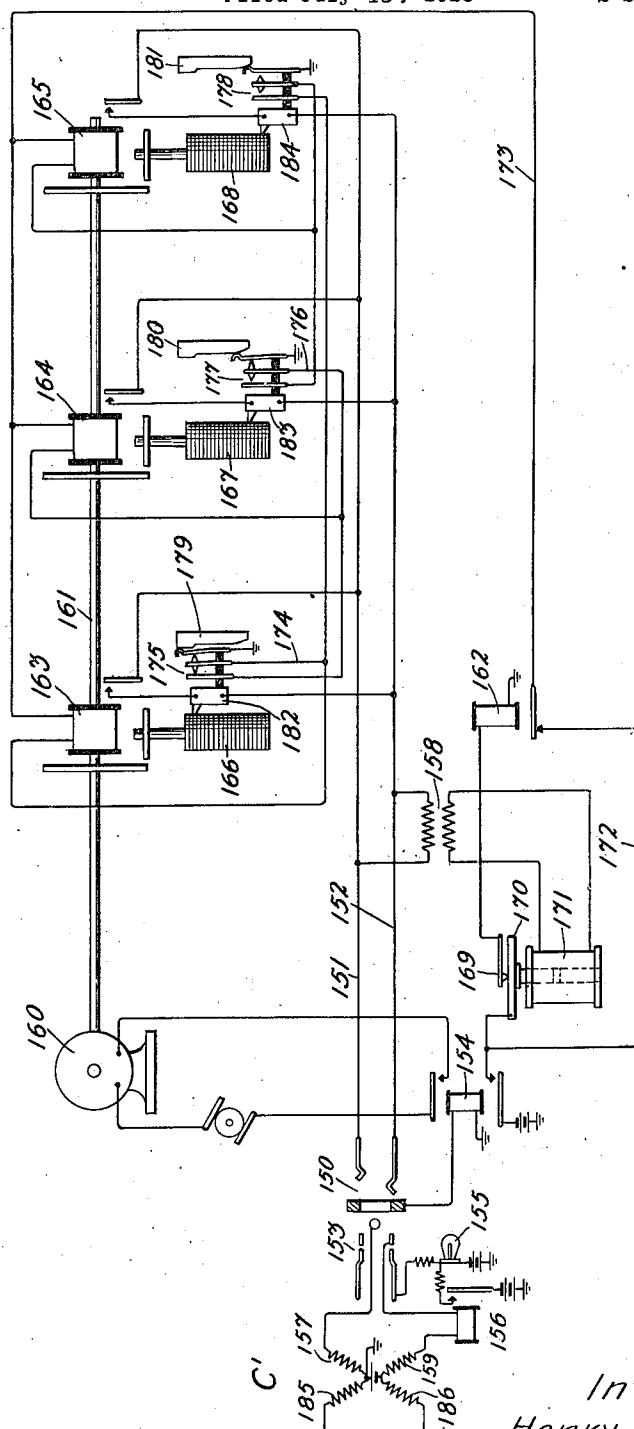
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2 Sheets-Sheet 2

Fig. 3.



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UNITED STATES PATENT OFFICE.

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PHONOGRAPHIC RECORDING AND REPRODUCING SYSTEM.

Application filed July 19, 1918. Serial No. 245,757.

To all whom it may concern:

Be it known that I, HENRY C. EGERTON, a citizen of the United States, residing at Ridgewood, in the county of Bergen, State of New Jersey, have invented certain new and useful Improvements in Phonographic Recording and Reproducing Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to recording and reproducing systems and more particularly to systems in which recording and reproducing is accomplished telephonically.

The principal object of the present invention is the provision of a system in which the recording means is automatically controlled so as to be operated only during the actual delivery of the matter to be recorded and in which the recording means is not operated during appreciable pauses occurring in the delivery of the matter being recorded. In accordance with this feature of the invention, means controlled by current variations developed by the transmission of the matter to be recorded is provided and utilized to control the recording in such a way that the record is consumed only during the actual delivery of a message; the record not being consumed during appreciable pauses occurring in the delivery of the message itself.

A further object of the invention is to amplify the answering message in its delivery and to also amplify the message to be recorded in its transmission to the recording record. In accordance with this feature of the invention there are provided electromagnetic reproducing and recording means together with an electrical amplifier, means to transmit matter to be recorded to the amplifier, and means to associate the amplifier with the reproducer to amplify the currents developed thereby and to associate the recorder and amplifier to amplify the matter to be recorded in its transmission to the recorder.

Another object of the invention is to restore automatically the apparatus of a system to normal condition upon termination of the message or upon the occurrence of such a delay in the delivery thereof, that it is to be presumed that no message is to be given or that the message has been completed. In accordance with this feature of the inven-

tion, means are provided which effect the restoration of the apparatus to normal or idle condition in event that no operating currents are received within an allotted continuous interval; which interval is preferably long enough so that pauses of reasonable length in the delivery of a message will not effect the restoration of the system to normal condition.

Further objects and features of the invention will appear from a consideration of the following description and claims forming a part hereof.

In the drawings which illustrate embodiments of the present invention, Fig. 1 diagrammatically illustrates a combined answering and recording system as applied to a subscriber's telephone station; Fig. 2 illustrates a slightly different control arrangement from that shown within the dotted lines in Fig. 1 and which can be readily substituted therefor; and Fig. 3 illustrates one form of the invention as applied to a receiving station of a telephone dictating system.

Referring to Fig. 1 the usual apparatus of a subscriber's set A is indicated as connected to line conductors 10 and 11, terminating at a jack 12 at a central office, at which the line relay 13, line lamp 14 and cut-off relay 15 of the line are also located. The calling end of a cord circuit C having the usual plug 16, supervisory relay 17, supervisory lamp 18 and ringing key 19, is also indicated and provides for telephonic communication with station A in the usual manner, so long as the subscriber is present to attend to his calls. In event the subscriber should leave the telephone unattended, it is desirable that parties calling that station be informed of the subscriber's absence and that they may leave a message. In the present instance apparatus is provided for this purpose and the subscriber on leaving first operates a switch 20 to connect the apparatus with the line conductors 10 and 11, and immediately thereafter closes a switch 26 which conditions the system for subsequent operation.

Assume that this has been done. On closure of the switch 20, an operating circuit is established for relay 21, extending from ground, right-hand winding of line relay 13, normal right-hand contact of cut-off relay 15, conductors 10 and 22, winding of relay 21, conductors 23; and 11, normal

left-hand contact of relay 15, and left-hand winding of relay 13, through battery to ground. The resistance of relay 21 is sufficiently high and relay 13 is so adjusted that the latter relay will not receive sufficient current to operate under these conditions, and the giving of a false indication by the illumination line lamp 14 is accordingly prevented.

The circuit for the stepping magnet 24 and relay 29 is normally open at switch 26 and due to the fact that switch 20 is the first to be closed, and that closure of relay 21 immediately opens such circuit before the switch 26 is closed, the closure of switch 26 does not complete the circuit at this time. Under these conditions closure of this circuit depends upon the deenergization of relay 21 as hereinafter explained.

On a subscriber calling party A the operator would insert the calling plug 16 of the cord circuit C with which the calling subscriber's line had been connected into jack 12 of line A. The plug and jack are so arranged that upon insertion of the plug the sleeve contacts engage in advance of the tip and ring contacts, whereby the cut-off relay 15 is energized during insertion. The operation of relay 15 opens the circuit previously traced for relay 21, which immediately releases, completing a circuit for stepping relay 24, extending from grounded battery, normal contact of release relay 25, normal contact of relay 21, switch 26, armature and winding of relay 24 to ground. The stepping relay on each energization rotates a cam switch 27 one step and in the present instance closes a contact 28, completing a locking circuit for itself extending from grounded battery, normal contact of relay 25, contact 28, and alternate contact and winding of relay 24 to ground. The tip and ring contacts of the plug 16 and jack 12 are engaged immediately subsequent to the operation of stepping relay 24, and thereby complete a second circuit to again operate relay 21, this circuit extending from battery of the cord circuit C, tip contacts of the plug and jack, conductor 10, switch 20, conductor 22, winding of relay 21, conductors 23 and 11, ring contacts of jack and plug, and winding of supervisory relay 17 back to battery. The energization of relay 21 opens its normal contact but as the locking circuit for relay 24 has already been established this does not interfere with the operation of the system. The supervisory lamp 18 is illuminated during the insertion of the plug, and while the supervisory relay is included in the circuit just traced, the relay 21 is of such high resistance and the supervisory relay is so adjusted that it will not operate at this time to effect the extinguishment of the lamp 18.

Continuing with the operation of the system, a relay 29 is connected in parallel with the stepping relay 24 and initially energized at the same time. Relay 29 is also included in parallel connection with the locking circuit of relay 24 and remains operated during maintenance of this locking circuit. The actuation of relay 29 closes a power circuit through its upper alternate contact for a motor 30, which drives the phonographic apparatus of the system through the medium of a shaft 31. The relay 29 on operation also closes an actuating circuit for the clutch magnet 32 of an answering phonograph 33, and for the governing magnet 34 of a switch 35 controlling the operation of the release relay 25; this circuit extending from grounded battery, lower alternate contact of relay 29, conductors 36, 37 and 38, winding of clutch magnet 32, conductor 39, contact 40 of a cam switch 41, conductor 42, and winding of magnet 34 to ground.

The switch 35 comprises a gear 43, movable into and out of engagement with a worm 44, fixed to the shaft 31, by the pivoted lever arm 45, the position of which depends upon the condition of the governing magnet 34. The gear 43 is normally engaged with the worm 44 and carries a contact 46 which engages a contact 47 to complete a circuit for the release relay 25 upon a predetermined revolution of gear 43. The amount of revolution necessary is so selected that a desired interval of time, for example, ten seconds will elapse before these contacts will be engaged, and inasmuch as the gear 43 is returned by a spring 48 to the position in which the contact 46 engages a stop 49, upon each disengagement of the gears upon operation of relay 34, the entire predetermined revolution must take place subsequent to a reengagement of the gears before the contacts 46 and 47 will be engaged. Inasmuch as the relay 34 is energized at this time the gears are disengaged and the gear 43 will not rotate.

A relay 50 is arranged in a parallel branch of the circuit traced for the magnets 32 and 34 and operates coincident therewith; this branch circuit starting from conductor 35 and extending through the winding of relay 50 and conductor 51 to conductor 39. A magnet 52 controlling the feed of the answering record 56 is also connected in parallel with this circuit; the branch circuit therefor extending from conductor 38 through the winding of this magnet to ground. On operation the magnet engages its armature 54 with the threads of a screw 55 which feeds the record 56 upward as shown in the drawing upon the coincident operation of the clutch magnet 32. Upon release of the armature 54 of magnet 52 the record is automatically returned to its

normal position, a weight cord running over a pair of pulleys being shown in the present case to accomplish this purpose.

The answering record 56 may be inscribed to give any desired answer, as, for example, "Mr. A is not here at present, if you desire will you kindly give your name, telephone number and message to the dictaphone." An electro-magnetic reproducer 57 such as shown in a copending application of Henry C. Egerton, bearing Serial No. 214,906, filed Feb. 1, 1918, issued as Patent No. 1,284,623, Nov. 12, 1918, or any other suitable electro-magnetic reproducer, is associated with the answering record, and inasmuch as it is desirable in some cases to amplify the current changes produced by the reproducer, an amplifier arrangement has been provided in the present system. While any one of a number of different types of amplifiers may be used for this purpose, a vacuum tube amplifier has been illustrated on the drawings. This amplifier arrangement comprises an input coil 58, a vacuum tube 59 having an input electrode or grid 60, a thermionic cathode or filament 61, an output electrode or plate 62 and an output coil 63. The plate 62 is maintained positive with respect to the filament 61 by a source of direct current 64, and another source of direct current 65 is provided to effect the heating of the filament 61; the circuits from these current sources being controlled by a relay 66, the circuit of which is completed upon the actuation of relay 29 as previously explained. This circuit extends from grounded battery, lower alternate contact of relay 29, conductors 36 and 67 and winding of relay 66 to ground. A parallel branch of this circuit extends from conductor 67 through the winding of a relay 68 to ground so this relay is operated at the same time as relay 66 to connect the line conductor 11 with the answering and recording circuits of the apparatus, as hereinafter explained.

At this stage of operation relays 50, 66 and 68 are energized and the reproducer 57 is actuated by the record 56 to vary the magnetic field of the reproducer, which in turn induces corresponding voice currents of a fluctuating character in the coils of the recorder. These currents being of a fluctuating character can pass through the condenser 69, completing a circuit through the primary winding of input coil 58 to induce corresponding alternating currents thereto in the secondary of this coil. This circuit extends from reproducer 57, engaged contact 70 of cam switch 41, condenser 69, primary winding of coil 58 and conductor 71 to the reproducer 57. To those familiar with the operation of the vacuum tube amplifier it will be evident that the potential of the grid 60 is varied accordingly, and that the potential difference between the grid 60

and the plate 62 is correspondingly varied. These changes of potential produce current fluctuations corresponding therewith but of increased amplitude in the circuit passing through the primary winding of the output coil 63. These fluctuations in turn induce similar fluctuating currents in the secondary winding of the output coil 63, which are impressed upon the line conductors 10 and 11, over a circuit extending from battery of the cord circuit C, winding 72 of the repeating coil thereof, tip contacts of plug and jack, conductor 10, switch 20, right-hand alternate contact of relay 50, conductor 73, secondary winding of coil 63, conductor 9, left-hand alternate contact of relay 50, alternate contact of relay 68, conductor 11, ring contacts of jack and plug, winding of relay 17, and winding 74 of the repeating coil to battery. The passage of the fluctuating currents through the windings 72 and 74 of the repeating coil induces corresponding fluctuations in the windings 75 and 76 thereof which are transmitted to the calling party and reproduce the message delivered by the record 56 in the receiver thereat.

A parallel circuit for the telephonic currents generated in the secondary winding of the output coil 63, extends from conductor 73 through a condenser 77, and winding of a telephonic current relay 78 to conductor 9. The fluctuating telephonic currents flowing through the winding of relay 78 move the armature 79 thereof in accordance with these fluctuations. A contact member 80 is also provided and mounted so as to lightly and yieldingly engage the armature 79 when the latter is stationary. The natural period of the armature 79 is preferably relatively high and the natural period of the contact member 80 is preferably much lower, so that, during the receipt of fluctuating telephonic currents the vibrations of the armature 79 and contact member 80 keep them separated so far as practical purposes are concerned.

The relay 78 controls the circuit of another relay 81, which circuit extends in series through armature 79 and contact member 80. Battery is supplied to this circuit upon the operation of relay 29 and the consequent condition thereof depends on whether or not relay 78 is being actuated by fluctuating telephonic currents passing through its winding. So long as no current is passing through the winding of relay 78 the contact between armature 79 and member 80 is closed, and in event of the relay 29 being energized completes the operating circuit of relay 81 (which is preferably slow to operate and quick to release) over a circuit extending from grounded battery, lower alternate contact of relay 29, conductors 82 and 83, armature 79, contact 80 and winding of relay 81 to ground. As soon, however, as

fluctuating currents pass through the winding of relay 78, the armature system is set in vibration to open this circuit at contact 80 and to maintain it open for all practical purposes so long as the fluctuating currents are received. As soon as they cease the circuit is again closed to operate relay 81.

Relay 81 is designed to control the clutch magnets 84 and 85 of the recording apparatus 86 and 87 respectively, as hereinafter explained, but is without effect thereon at the present stage of operation, inasmuch as the operating circuits for these magnets are open at other points at this time.

Still another parallel circuit for the telephonic currents generated in the secondary of the output coil 63 extends from conductor 73 through condenser 88, conductor 89, electromagnetic recorder 90, upper engaged contact 91 controlled by cam 92 to conductor 9. Recorder 90 would be operated thereby, but inasmuch as the recording cylinder 94 is not in motion at this time, this is not objectionable, especially since the mechanical construction of the recording apparatus is preferably such that the recorded 90 is engaged with the cylinder 94 only during recording movement of the cylinder.

The message carried by the record 56 will be transmitted to the calling subscriber in the manner previously described and the answering apparatus carries a contact 95 arranged to engage a contact 96 just prior to the completion of the answering message and to be disengaged therefrom immediately upon completion of this message. On engagement of these contacts a stepping relay 97 is energized, and upon its subsequent deenergization, upon the disengagement of these contacts, this relay operates to turn the cam switch 41 one step, thereby opening contacts 40 and 70. The opening of contact 70 opens the circuit of the reproducer 57; while the opening of contact 40 opens the circuits of clutch magnet 32, governing magnet 34, and relay 50. The magnet 52 controlling the record feed is, however, still energized and prevents the restoration of record 56 to its initial position at this time. The energizing circuit for magnet 52 extends from grounded battery, lower alternate contact of relay 29, conductors 36, 37 and 38 and winding of magnet 52 to ground.

The preceding operations consume but a few seconds and upon the deenergization of relay 50 another direct current circuit is completed and sufficient current flows through this circuit to operate the supervisory relay 17 at this time. This circuit extends from battery, winding 72 of repeating coil, tip contacts of plug 16 and jack 12, conductor 10, switch 20, right-hand normal contact of relay 50, primary winding of input coil 58, left-hand normal contact of relay 50, alternate contact of relay 68, con-

ductor 11, ring contacts of jack 12 and plug 16, winding of relay 17 and winding 74 of the repeating coil back to battery. The operation of relay 17 substitutes a path of low resistance about the lamp 18 and thus effects its extinguishment.

In ordinary telephone systems this lamp is extinguished on the called subscriber removing his receiver from the hookswitch on answering, and indicates to the operator that the desired connection has been obtained. The extinguishment of the lamp 18 in the present case will indicate that connection has been obtained with the desired station and that it is unnecessary to operate the ringing key 19 to signal party A. The application of signaling current in the usual manner is not objectionable, however, and in cases where subscriber A has returned but failed to open the switches 20 and 26, the ringing of the bell of his set would enable him to open the switches and to answer the call in person.

Operation of the cam 41 in addition to opening contacts 40 and 70 also closes a contact 98 so that release of relay 81, due to the actuation of relay 78 on the calling party speaking, completes an operating circuit for the clutch magnet 84 of the recording apparatus 86. This circuit extends from grounded battery, lower alternate contact of relay 29, conductor 82, normal contact of relay 81, conductor 99, clutch magnet 84, lower closed contact 100 of cam 92, conductor 101, closed contact 98 of cam 41, conductor 42, and winding of governing magnet 34 to ground. The actuation of the clutch magnet 84 sets the recording apparatus 86 in operation.

Upon the release of relay 50 as a result of the opening of contact 40, the primary winding of the input coil 58 was disconnected from the circuit from the reproducer 57, and connected through the normal contacts of this relay and the alternate contact of relay 68 with the line conductors 10 and 11 through which telephonic connection is obtained with the calling subscriber. The calling party in delivering his message will set up current fluctuations through the windings 75 and 76 of the repeating coil, inducing corresponding currents in the winding of the input coil 58, current fluctuation in this primary resulting in the production of corresponding amplified current fluctuations in the secondary of the output coil 63. The amplified currents passing through the relay 78 operate it to keep the contact 80 open to prevent relay 81 from pulling up and opening the circuit of the clutch magnet 84 so long as these currents continue. Should the calling party stop talking, even for a short while, it would result in a cessation of the fluctuating currents generated in the output coil 63, and

contact 80 of relay 78 would close energizing relay 81, which in turn opens the circuit of the clutch magnet 84 and governing magnet 34, thus stopping the recording apparatus 86 until the talking party again resumes his message. Relay 34 is deenergized at the same time as clutch magnet 84, should the calling party stop talking, and allows the gear 43 to be operated by the worm 44 to move the contact 46 toward the contact 47 until the magnet 34 is again energized on the resumption of the message. So long as this interval does not exceed that after which the contacts 46 and 47 will be engaged, the recording mechanism 86 will be set in motion immediately upon the resumption of the message. From this it will be apparent the recording mechanism is operated only during the actual delivery of the message and thus prevents the waste of recording space on the cylinders which would take place were the recording apparatus operated during silent intervals such as often occur in the delivery of a lengthy message.

Should no message be delivered within the allotted interval, it is to be presumed that the party does not care to leave a message or has completed it, and under these conditions the restoration of the system to normal condition is desirable. The contacts 46 and 47 are engaged after this interval and energize release relay 25, which on operation opens the circuits previously traced for stepping relay 24 and relay 29. Relay 24 on release also opens at another point the holding circuit for itself and relay 29, and moves its pawl into position to step cam 27 to a position to open contact 28 on its next energization. Relay 29 on deenergization will open the circuits of relay 25, magnet 52, relays 66, 68 and 81, and also opens the control circuit of the motor 30. The relay 25 would thereupon release, but inasmuch as relay 21 would still remain energized under these conditions, no circuit for the stepping relay 24 is completed at this time. The release of magnet 52 permits the record 56 to be returned to its initial position, and in returning to this position the contacts 95 and 96 are first engaged, energizing stepping relay 97 and then disengaged, deenergizing this relay and thereby moving the cam wheel 41 around one step to engage the contacts 40 and 70 ready to answer a subsequent call. The release of relay 66 cuts off the current from the amplifier, thereby preventing unnecessary drain on the batteries 64 and 65, while the release of relay 68 disconnects the line conductor 11 from the amplifying apparatus.

The deenergization of relay 68 opens the circuit over which the supervisory relay 17 is maintained attracted, whereupon its armature returns to normal position, since,

while a direct current circuit is still completed through the supervisory relay 17 in series with relay 21, and relay 21 maintained operated thereby, yet the resistance of relay 21 is of such a value and relay 17 is so adjusted that its armature will be retracted under these conditions. This removes the short-circuiting path about the signal 18, whereupon this signal is illuminated to give the usual disconnect indication. On receiving a like signal from the supervisory signal (not shown) associated with the end of the cord circuit extending to the calling subscriber, indicating that the calling subscriber had restored his receiver to its hook switch, the operator removes the plugs of the cord circuit C from the engaged jacks in the usual manner. In removing the plug 16 the tip and ring connections are opened before the sleeve connections, which results in opening the circuit through relay 21. The armature thereof is accordingly retracted, completing an operating circuit for the stepping relay 24 extending from grounded battery, normal contacts of relays 25 and 21, closed contacts of key 26, and armature and winding of relay 24 to ground. Relay 29, which is in parallel with relay 24, is also operated at this time. The consequent operation of relay 24 steps the cam 27 one step, thereby opening contact 28, and the operation of relay 29 momentarily closes the circuit through electromagnet 34 which attracts arm 45 of switch 35 thus disengaging the gears 43 and 44 and permitting the return of gear 43 to its normal position. The sleeve connections of the plug 16 and jack 12 on being opened immediately subsequent to the tip and ring connections open the circuit of the cut-off relay 15, and this relay on deenergization completes the normal operating circuit for relay 21 extending through the windings of the line relay 13, without, however, operating it for reasons previously set forth.

The apparatus is now in normal condition to answer and record subsequent calls. On receipt of another call it will be answered as previously described and the calling party's message will be recorded on cylinder 94 immediately after the preceding message, inasmuch as the recorder 90 stops at the end of the preceding message and is ready to begin the next succeeding message at that place on the record.

In cases where a number of messages are likely to be received or where they are apt to be of unusual length it is desirable to provide two or more recording cylinders so arranged that when one is filled another cylinder will take up the recording. The present system accomplishes the purpose and is so arranged that recording is done on both records during the time the change is being made from one to the other, so that none of

the message will be lost. Assume that cylinder 94 is almost filled when a new message is begun. Recording will take place as previously described until the recorder 90 reaches a predetermined distance from the end of the record, whereupon contacts 105 and 106 will be closed momentarily completing an energizing circuit for the stepping magnet 107 individual to recording apparatus 87. On opening of this circuit, due to subsequent movement of the recorder 90, magnet 107 is deenergized and in returning to its normal position steps the cam switch 108 around one step, closing the contacts 109 and 110 thereof. Closure of contact 109 completes an operating circuit for the clutch magnet 85, similar to that described for clutch magnet 84 and sets the recording cylinder 111 in motion; while closure of contact 110 completes an operating circuit for the recorder 112 through a connection arranged in parallel with the circuit of the recorder 90. Recording now takes place on both cylinders 94 and 111 until cylinder 94 has been filled to a predetermined point when the contacts 105 and 113 are first momentarily engaged to energize the stepping magnet 114 of the cam switch 92. On subsequent movement of the recorder 90, magnet 114 is deenergized and in returning to its normal position steps the cam switch 92 around one step, opening the contact 91 to disconnect the recorder 90 from the recording circuit without, however, disconnecting recorder 112 which continues to record the continuing message on cylinder 111. The opening of contact 100 opens the circuit of the clutch magnet 84, thereby preventing further movement of the cylinder 94; but without affecting the circuit shortly before completed for the clutch magnet 85. Recording would now take place on cylinder 111 as previously described for cylinder 94, until the completion of the message, whereupon the system is restored to normal condition as previously explained.

Upon the return of the subscriber to his telephone he will reproduce the messages recorded in his absence in any desired manner. Any record which was not completely filled could be put back on the recording apparatus so that the next recording would start immediately after the other; while any records completely filled could be resurfaced and replaced on its recording apparatus for subsequent use, or an unused record substituted therefor.

The intercontrol between recording apparatus 86 and 87 is such that immaterial of the cylinder on which recording first takes place, as soon as that cylinder is filled, the other is operatively connected to continue the recording, the recording apparatus 87 having appropriate circuit connections and contacts 115, 116 and 117 which operate in

the same way as the contacts 105, 106 and 113 of apparatus 86 to provide for this operation.

In disconnecting the answering recording apparatus from his telephone line the subscriber first opens switch 26 through which the initial operating circuit for stepping magnet 24 and relay 29 extends, and then the switch 20. The opening of switch 20 opens the circuit of relay 21, which thereupon releases without, however, completing the circuit for magnet 24 and relay 29, this being open at switch 26. In reconnecting with the line the switch 20 is first closed and then switch 26 as previously explained.

Fig. 2 illustrates a modified form of control apparatus designed to be substituted for the apparatus enclosed in dotted lines in Fig. 1. The modified system is otherwise the same as the system of Fig. 1 but is designed to be set in operation on the application of the pulsating signaling current normally used in signaling a station. In the actuation of this system the switch 20 would be closed on the subscriber leaving his telephone but no direct current circuit is closed at this time since a condenser 120 is interposed in the operating circuit of the stepping relay 21', which is operated by pulsating or alternating signaling current to step a toothed wheel 121 one step on each energization. A release magnet 25' controls the release of a pawl 122 normally engaging the wheel 121 to hold it in the position to which it is stepped by the magnet 21'. The wheel 121 carries a contact 123 which engages another contact 124 after a few steps have taken place, and thereby completes an operating circuit for relay 29, which is maintained until release relay 25' is energized to withdraw the pawl 122 in restoring the system to normal condition.

On receipt of a call for station A the operator would insert the calling end of cord circuit C into the jack 12 of A's line and operate key 19 to supply pulsating or alternating current to operate the stepping magnet 21'. On engagement of contacts 123 and 124 by this operation the circuit of relay 29 is closed, whereupon relay 29 operates, closing a number of circuits as previously set forth in the description of the system of Fig. 1.

Relay 68 is operated in this connection and upon the deenergization of relay 50 after the message on the record 56 has been delivered to the calling subscriber, a direct current circuit is completed, which effects the operation of the supervisory relay 17 to indicate that connection has been made with station A. This circuit is identical with the operating circuit for the supervisory relay as described for the arrangement shown in Fig. 1, and the remaining operations are the same as therein described until the apparatus is ready for restoration. At this stage

the engagement of contacts 46 and 47 completes an operating circuit for release magnet 25', which on actuation disengages the pawl 122 from the tooth wheel 121 which thereupon returns to normal under the influence of a spring 126. Contacts 123 and 124 are separated in this operation and relay 29 is thereupon released. The circuits controlled by relay 29 are accordingly opened, including that of relay 68 which on release opens the circuit of the supervisory relay 17. The consequent release of this relay effects the illumination of the lamp 18 and indicates to the operator that disconnection is desired. The other steps in operation correspond with those set forth at length in regard to the system shown in Fig. 1, and upon withdrawal of the plug 16 from the jack 12 the modified system will be completely restored to normal condition ready for subsequent use.

Fig. 3 illustrates one form of the present invention as applied to a recording station of a telephone dictating system, wherein dictation is delivered over a telephone line and recorded upon suitable records, which when filled are removed and transcribed. In the arrangement described a jack 150 is provided at the switchboard and given a definite number which will be given by the subscriber when he desires to dictate over his telephone line. Line wires 151 and 152 extend from the jack 150 to the recording apparatus. In the present system the apparatus is shown as having three records, but any desired number of records may be arranged for and arranged so that when one is filled, recording shifts to a second, and then to the third, and thence back to the first again, a fresh record having been placed thereon in the meantime.

On receipt of a call for the recording station, the operator after connecting with the calling party will insert the jack 153 on the other end of the cord circuit C' used into the jack 150, thereby operating a control relay 154 over a circuit extending from grounded winding of relay 154, sleeve connections of jack 150 and plug 153 and supervisory lamp 155 to grounded battery. The lamp is immediately extinguished, however, since a circuit for the supervisory relay 156 is completed, extending from battery winding 157 of the repeating coil of the cord circuit, tip contacts of the plug and jack conductor 151, primary winding of an induction coil 158, conductor 152, ring contacts of the jack and plug, winding of 156 and winding 159 of the repeating coil to the other side of the battery. The relay 156 operating, shunts out of the lamp 155 to effect its extinguishment in the well-known manner, and indicates that connection has been obtained with the recording station. The operation of relay 154 closes at its upper contact a control circuit for a motor 160 driving a shaft 161 through which the recording apparatus is driven, and closes at its lower contact a circuit for a control relay 162, governing the operation of the clutch magnets 163, 164 and 165 of the recording cylinders 166, 167 and 168 respectively. This circuit extends from ground, winding of relay 162, engaged contacts 169 and 170 of a telephonic current relay 171, and alternate contact of relay 154 to grounded battery. The relay 171 shown corresponds with the relay 78 shown on Fig. 1 and has its contacts closed except during the passage of currents therethrough. The winding of this relay is in series with the secondary winding of the induction coil 158, so that it is actuated only during the passage of the fluctuating voice currents through the primary of the coil 158. Under these conditions the relay 162 is operated except during the receipt of voice currents at the recording station, and thereby prevents closure of the clutch circuits except when dictation is actually taking place. Waste of recording space is thereby prevented and as soon as dictation is started the voice currents in passing through the primary of the induction coil 158, induce corresponding currents in the secondary which actuate relay 171 to disengage the contacts 169 and 170, whereupon relay 162 is released and the clutch circuit completed to start recording upon the proper record or records.

The apparatus is preferably arranged so that when one record is practically filled, another will start recording and both record the same matter until the first record is filled, whereupon the first is disconnected and the second continues the recording alone. As shown on the drawing, records 166 and 167 are both in condition to receive dictation, record 166 being just short of completely filled, and record 167 being just started. Under these conditions on the release of relay 162, clutches 163 and 164 were both energized, the circuit for clutch 163 extending from grounded battery, lower alternate contact of relay 154, conductor 172, normal contact of relay 162, conductor 173, winding of clutch 163, conductor 174 and second and middle and right-hand engaged contacts of switch 175 to ground. Clutch 164 is energized over a parallel branch of this circuit extending from conductor 173, winding of clutch 164, conductor 176 and middle and right-hand engaged contacts of switch 177 to ground. The engagement of the contacts of the switches 175, 177 and 178 is controlled by cams 179, 180 and 181 respectively, so arranged that all three switch contacts are engaged just prior to the filling of a record to complete a parallel operating circuit for the clutch of the next record, extending from conductor 173, through the clutch of the next record, conductor leading to the left-

hand contact of the switch of the record nearly filled, and thence through the three engaged contacts thereof to ground. None of the switch contacts are engaged until
 5 after recording has commenced on its individual record but as soon as this has once commenced the middle and right contacts are engaged to complete a circuit through its clutch independent of the switch of the
 10 preceding record. The original energizing circuit is, however, maintained until after the completion of this independent circuit. In the system as shown dictation will be taken on both records 166 and 167 for a
 15 very few moments, whereupon switch 175 rides off the cam 179 and opens all its contacts, thereby opening the circuit of clutch 163 and the initial circuit of clutch 164. The independent circuit for clutch 164 having
 20 been closed by this time, however, recording continues on record 167.

The clutch magnets 163, 164 and 165 on operating, in addition to setting their respective records into motion also complete
 25 the connection of their respective electromagnetic recorders 182, 183, 184, with line conductors 151 and 152. The clutches 163 and 164 are accordingly energized as soon as dictation is started and the fluctuating
 30 voice currents developed by the dictator in passing through the windings 185 and 186 of the repeating coil of the cord circuit C' induce corresponding currents in the windings 157 and 159 thereof which actuate the
 35 recorders 182 and 183. The circuit therefor extends from battery, winding 157 of repeating coil, tip connections of the plug and jack, conductor 151, thence in parallel through recorders 182 and 183 and the alterna-
 40 te contacts controlled by their respective clutch magnets 163 and 164 to the conductor 152, thence through the ring connections of the jack and plug, winding of relay 156 and winding 159 of the repeating coil back to
 45 battery. On record 166 being filled, its clutch 163 is deenergized and its recorder 182 disconnected from circuit, the recording being continued on record 167, as previously explained.

50 On completion of dictation the party dictating will restore his set to normal, thereby illuminating the disconnect signal (not shown) associated with his end of the cord circuit, and the operator on observing this
 55 signal will take down the connection. The disengagement of the plug 153 and jack 150 in this operation opens the circuit of relay 154, which on release opens the circuits of the motor 160 and of the relay 162, which
 60 thereupon release, restoring the system to normal ready for subsequent calls.

Succeeding dictation will start on the same record as that on which preceding dictation ended, and immediately thereafter so no
 65 space is wasted. An attendant will remove

the records as filled and replace them by new records, resetting the records thereof back to the beginning of the new record.

The arrangements herein set forth are intended as merely illustrative of the present invention, which is not limited to the precise details set forth except as specified in the claims forming a part hereof.

What is claimed is:

1. A recording system comprising a
 75 mechanical type record, a recorder operable to cut a record trace thereon, means to effect recording movement of both the record and the recorder, and automatic means controlling the means to effect recording movement in such a way that movement of neither the record nor the recorder takes place during appreciable pauses occurring in the delivery of the matter to be recorded.

2. A recording system comprising a
 85 mechanical type record, a recorder operable to cut a record trace thereon, means to effect recording movement of both the record and the recorder, and automatic means controlling the means to effect recording movement in such a way that movement of both the record and the recorder takes place during actual delivery of the matter to be recorded but in such a way that movement of neither the record nor the recorder takes place during appreciable pauses occurring in the delivery of such matter.

3. A recording system comprising in combination, a mechanical type record, a recorder operable to cut a record trace thereon, means to effect recording movement of both the record and the recorder, means to produce electrical current fluctuations incidental to transmission of the matter to be recorded, and electrical means automatically governed
 105 by the fluctuating current so developed controlling the means to effect recording movement in such a way that movement of neither the record nor the recorder takes place during appreciable pauses occurring in the delivery of such matter.

4. An answering and recording system comprising an answering record, an electromagnetic reproducer associated therewith, a recording record, an electromagnetic recorder associated therewith, an electrical amplifier, means to transmit matter to be recorded to the amplifier, means to operatively associate the amplifier with the reproducer during answering to amplify the currents developed by the reproducer, and means to operatively associate the amplifier with the recorder during recording to amplify the matter to be recorded in its transmission to the recorder.

5. An answering and recording system comprising an answering record, an electromagnetic reproducer associated therewith, a recording record, an electromagnetic recorder associated therewith, an electrical
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amplifier, means to transmit matter to be recorded to the amplifier, and common means to operatively associate the amplifier with the reproducer during answering to

means to vary the association with the telephone line of the amplifier in such a way that the amplified currents developed by the reproducer are delivered to the telephone line during answering and that the current developed by the means associable with the telephone line are amplified in transmission to the recorder during recording.

6. An answering and recording system comprising an answering record, an electromagnetic reproducer associated therewith, a recording record, an electromagnetic recorder associated therewith, an electrical amplifier, means to transmit matter to be recorded to the amplifier, means to operatively associate the amplifier with the reproducer during answering to amplify the currents developed by the reproducer, means to dissociate the amplifier from the reproducer upon completion of delivery of the answering message, and means thereupon actuated to operatively associate the amplifier with the recorder to amplify the matter to be recorded in its transmission to the recorder.

9. A recording system comprising a record, a recorder, means to effect relative recording movement between the record and the recorder, means to condition the system for the reception of a message to be recorded, and means to automatically restore the system to normal condition provided no message to be recorded is received within a predetermined interval after the conditioning of the system.

7. An answering and recording system comprising an answering record, an electromagnetic reproducer associated therewith, a recording record, an electromagnetic recorder associated therewith, an electrical amplifier, a telephone line, means associable with telephone line to develop fluctuating currents therein incidental to the transmission of matter to be recorded, means to operatively associate the reproducer with the amplifier during answering to amplify the currents developed by the reproducer, means to connect telephonically the telephone line with the reproducer through the amplifier during answering, means to operatively associate the amplifier with the recorder during recording, and means to telephonically connect the telephone line with the recorder through the amplifier during recording in such a way that currents developed by the means associable with the telephone line are amplified in transmission to the recorder.

10. A recording system comprising a record, a recorder, means to effect relative recording movement between the record and the recorder, means to condition the system for the reception of a message to be recorded, means to actuate the means to effect relative movement upon the commencement of a message to be recorded, and means to automatically restore the system to normal condition upon the expiration of a predetermined interval after completion of the message.

11. A recording system comprising a record, an electromagnetic recorder, means to effect relative recording movement between the record and the recorder, a telephone line telephonically associated with the recorder, means to develop telephonic currents incidental to the transmission of a message to be recorded, means governing the operative association of the means to develop telephonic currents with a telephone line, means to condition the system for the reception of the message, means to actuate the means to effect relative recording movement upon the commencement of the message, and means to automatically restore the system to normal condition upon the completion of the message independent of the means governing the operative association of the means to develop telephonic currents with the line.

8. An answering and recording system comprising an answering record, an electromagnetic reproducer associated therewith, a recording record, an electromagnetic recorder associated therewith, an electrical amplifier, a telephone line associable with said amplifier, means to associate the telephone line therewith, means associable with the telephone line to develop fluctuating currents therein incidental to the transmission of matter to be recorded, means to operatively associate the reproducer with the amplifier during answering to amplify the currents developed by the reproducer, means to operatively associate an amplifier with the recorder during recording, and

12. A recording system comprising a record, an electromagnetic recorder, means to effect relative recording movement between the record and the recorder, a telephone line telephonically associated with the recorder, means to develop telephonic currents incidental to the transmission of a message to be recorded, means governing the operative association of the means to develop telephonic currents with a telephone line, means to condition the system for the reception of the message, means to actuate the means to effect relative recording movement upon the commencement of the message, and means to automatically re-

store the system to normal condition upon the expiration of a predetermined interval after the completion of the message independent of the means governing the operative association of the means to develop telephonic currents with the line.

13. A recording system comprising a record, a recorder, means to effect relative recording movement between the record and the recorder, means to condition the system for the reception of a message to be recorded, and automatic means operated upon an appreciable pause occurring in the delivery of the message to be recorded to restore the system to normal condition if the delivery of the message is not resumed within a predetermined interval after the beginning of such pause.

14. A recording system comprising a record, a recorder, means to effect relative recording movement between the record and the recorder, means to condition the system to be recorded, and automatic means operated upon an appreciable pause occurring in the delivery of the message to be recorded to restore the system to normal condition if the delivery of the message is not resumed within a predetermined interval after the beginning of such pause; the restoring means upon the occurrence of such a pause being moved from the position it normally occupies immediately prior thereto and means to return the restoring means to such normal position upon resumption of the delivery of the message within the predetermined interval.

15. A recording system comprising a record, a recorder, means to effect relative recording movement between the record and the recorder, means to condition the system for the reception of the message to be recorded, automatic means operated upon appreciable pauses occurring in the delivery of the message to restore the system to normal condition if the delivery of the message is not resumed within a consecutive predetermined interval after the beginning of such pause, and means to insure the elapse of the predetermined consecutive interval before restoration of the system to normal condition independent of the occurrence of prior pauses of less than the predetermined consecutive interval.

16. An answering and recording system comprising an answering record having an answering message thereon, a reproducer associated therewith, a recording record, a recorder associated therewith, means to effect relative reproducing movement between the answering record and the reproducer, means operative upon the completion of the answering message to condition the system for the reception of a message to be recorded, means to automatically restore the system

to normal condition upon the completion of the message to be recorded, and means to prevent the operation of the automatic restoring means until after completion of the delivery of the message on the answering record.

17. A recording system comprising a record, a recorder, a motor, a clutch serving on operation to condition the record and the recorder for relative recording movement upon receipt of a message to be recorded, power transmission means connecting the motor and the clutch, means engageable with the transmission means and operable to restore the system to normal condition upon the completion of a predetermined interval after the beginning of a pause occurring in the delivery of the message, and means maintaining the restoring means out of operative engagement with the power transmission means during actual recording of the message.

18. A recording system comprising a record, a recorder, an electric motor, a controlling circuit therefor, a clutch serving on operation to condition the record and the recorder for relative recording movement upon receipt of the message to be recorded, power transmission means connecting the motor and the clutch, means operated by the transmission means serving to effect the opening of the motor circuit upon the completion of a predetermined interval after the beginning of a pause occurring in delivery of a message.

19. A recording system comprising a record, a recorder, an electric motor, a controlling circuit therefor, a clutch serving on operation to condition the record and the recorder for relative recording movement upon receipt of the message to be recorded, a shaft connecting the motor and the clutch, a gear carried by the shaft, a second gear engageable with the first gear, a second circuit closed upon a predetermined movement of the second gear, and means operated upon the closure of the second circuit to effect the opening of the motor circuit.

20. A recording system comprising a record, a recorder, an electric motor, a controlling circuit therefor, a clutch serving on operation to condition the record and the recorder for relative recording movement upon receipt of the message to be recorded, a shaft connecting the motor and the clutch, a gear carried by the shaft, a second gear engageable with the first gear, a second circuit closed upon a predetermined movement of the second gear, and means operated upon the closure of the second circuit to effect the opening of the motor circuit, and means to maintain the gears out of operative engagement during the actual recording of the message.

21. A controlling mechanism comprising a pair of normally engaged gears, means to drive one of said gears and thereby operate the second, a circuit for said driving means, 10
5 contact means associated with the second gear operated upon a predetermined movement thereof to effect a change in said circuit, means to effect a disengagement of said gears, and means for returning said second gear to its normal position upon their disengagement.

In witness whereof, I hereunto subscribe my name this 15th day of July, A. D., 1918.

HENRY C. EGERTON.