The invention relates to tone control arrangements for dictating apparatus using mechanical reed generators and transistor-reed relay circuits. The apparatus has a central dictation unit with an associated control unit. The generators are operated by the dictator to generate tone signals of predetermined frequency which are then transmitted and recognized by the control unit in order to control the action of the dictating apparatus.

13 Claims, 13 Drawing Figures
TONE CONTROLLED DICTATION APPARATUS

The tone control arrangements disclosed herein are of special interest in connection with dictating apparatus involving telephone communication networks, but may also be adapted for other telecommunication systems or locally controlled machine environments. In the preferred embodiment of the invention, tones are generated by actuation of mechanical reed generators and recognized in the central dictation equipment by reed relays that are selectively responsive to the generated signals.

Considerable effort has been made in the past to develop tone controlled apparatus but, until now, such apparatus has generally been characterized by relatively slow speeds of operation due to the inherent dependence upon the mechanical vibratory aspects of the reed generators and reed relays. Delays in response of such equipment, in some cases, may run as much as 200 milliseconds (0.2 seconds). Fast equipment response is not only generally desirable to establish more satisfactory operation, but, under some circumstances, extended delays, such as that just mentioned, may be intolerable as an example, such delays are undesirable in equipment that provides "error-free" dictation. In such equipment, provision is made for the dictator to review material that he has previously dictated and to re-dictate portions of the material, as desired. To illustrate this, a dictator may have dictated the numerical sequence: "1, 2, 3, 5, 5, 6, 7, etc."

Subsequently, the dictator backspaces to the beginning of the sequence for review purposes and discovers that he inadvertently dictated the number "5" twice. If a magnetic record media is used, it is possible for the dictator to erase the first "5" and to record the number "4" in its place. In order to do this he will ordinarily backspace or reverse the equipment to the beginning of the sequence, listen to the numbers "1, 2, 3", stop the equipment and change its mode from Listen to Record, re-dictate the number "4", and again change the mode of the equipment from Record to Listen. The revised sequence then becomes "1, 2, 3, 4, 5, 6, 7, etc.", as it should be, and is error-free. In order to accomplish error-free dictation of the nature described, it is necessary that the dictating apparatus respond rapidly to the control changes, such as mode changes from Record to Listen, or vice versa, or else the newly dictated material, such as the number "4", may overlap previously dictated material that should have been retained, thereby resulting in the recording of improper sequences or the loss of material entirely.

Accordingly, an object of the invention is to provide tone controlled apparatus with rapid equipment response to generated signals.

Another object of the invention is to provide dictating apparatus with tone generating and response facilities that requires a minimum of operator attention.

An additional object of the invention is to provide tone controlled dictating apparatus that is characterized by extremely accurate initiation and termination of functions.

Still another object of the invention is to provide tone control arrangements that are useful in either a system or machine environment.

A further object of the invention is to provide dictating apparatus with tone generation and response capabilities established in a simplified manner in connection with readily available machine or system components.

Also, an object of the invention is to provide tone-oriented arrangements for performing all functions normally required in a dictating application.

Still another object of the invention is to establish a rapid response of apparatus to controlling signals while maintaining uniformity and accuracy of response throughout the operations of the apparatus.

In order to accomplish these and other objects of the invention and according to one embodiment, dictating apparatus is arranged in a telecommunication environment with an auxiliary tone generating member adapted for installation on existing telephone handsets for generation of signals through the lines and novel circuits are provided at centrally located dictation equipment for selective response to generated signals in a reliable and rapid manner for effecting functions of the equipment according to the requirements of the user. In other variations, tones are generated from integral provided signal generating members over private lines to effect functions through comparable selectively operated circuits or from a locally disposed operator handset either by direct wire or under control of signals radiated from the handset.

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of the various embodiments of the invention as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 represents several equipment configurations in which the invention may be incorporated.
FIG. 2 is a block diagram of various components at the receiving end of one of the configurations shown in FIG. 1, such as a dictation system using telephone communication network facilities.
FIG. 3 illustrates a signal generating unit that is useful in a system such as that in FIG. 2.
FIGS. 4a and 4b represent cross-sectional views of the signal generating unit of FIG. 3.
FIGS. 5a and 5b represent alternative signal generating apparatus.
FIGS. 6a and 6b represent waveforms of typical control signals that result from actuation of the apparatus of FIGS. 3, 4a, 4b, 5a and 5b.
FIG. 7 illustrates certain components and circuit connections provided in a central dictation apparatus such as that shown in FIGS. 1 and 2.
FIG. 8 illustrates certain principles of operation of response circuits provided in a control unit in the system of FIG. 2.
FIGS. 9a and 9b together represent a detailed circuit diagram of certain telephone equipment and control circuits in the block diagram of FIG. 2.

The dictating apparatus discussed herein, in all forms, makes use of a central dictation unit 1, FIG. 1, that is not shown in every detail but that is generally comparable to the dictation recording equipment disclosed in U. S. Pat. application Ser. No. 216,261, entitled "Multiple Station Selection System" with N. J. Almanes and M. P. Langendorf as inventors, filed Aug. 10, 1962 now U.S. Pat. No. 3,222,460 and assigned to the same assignee as the present invention. The central dictation apparatus 1 has an associated control unit 2 that includes the major portion of the circuit shown in FIGS. 9a and 9b. Control unit 2 passes audio signals to and from the dictation equipment 1 and in addition
recognizes tone signals for establishing various modes of operation and effecting various functional operations in unit 1.

In order to illustrate the wide applicability of the principles of the present invention, a number of possible machine and system configurations are illustrated in FIG. 1. As an example, signals may be generated over direct wire 3 from microphone handset 4 with machine 1 and control unit 2 being physically located in close proximity to the user of the equipment. As an alternative, tones can be audibly generated from a handset 4 for recognition by control unit 2 as indicated by symbols 5. While not involving tone generation or recognition, direct operator control of dictating equipment of the general type described is presented in the IBM Customer Engineering Manual "Dictation Equipment," Form No. 241-5071, Revised Oct. 5, 1962. This equipment is similar in all basic respects to that taught in the Albanes, et al., application, previously noted. Recording apparatus of this type includes a volume control 6, a tuning control 7 for establishing accurate tracking of recorded signals on a record media, such as a magnetic belt, a belt release lever 8 for loading and unloading magnetic belts, and an index assembly 9 for perforating an index slip 10 with secretary (SEC) instruction perforations or end of letter (LTR) perforations as dictation progresses.

Another configuration that is possible and that is more like the system taught in the Albanes et al., application is a remote microphone system such as that described in the IBM Customer Engineering Instruction Manual, Form No. 241-5170-dated Nov. 3, 1962. In a system of this nature, a number of remote stations, such as stations 11 and 12 are interconnected with recording apparatus 1 by means of a direct wire communication facility 13. The remote stations 11 and 12 have associated microphone handsets 14 and 15 that serve to control apparatus 1 by appropriate manipulation of buttons such as SEC-LTR button 16, Record-Listen-Review (REC-LIS-REV) button 17, and dictate bar 18 on microphone handset 14. Remote stations such as stations 11 and 12, can be modified to generate tones of predetermined frequencies under control of buttons such as buttons 16, 17, and 18 or by the addition of separate tone generating buttons 19 and 20. The generated tones can be recognized for selecting a particular central recorder, as well as controlling function of the recorder selected, as taught by the present invention.

Another system configuration involves telephone transmission facilities including transmission lines 21 and telephone units 22, 23, and 24. These units have associated transmitter-receiver handsets 25, 26, and 27.

Many types of dictating systems involving telephone transmission facilities have been developed in the past. One such system is described in the IBM Customer Engineering Instruction Manual, Form No. 241-5059, dated June 5, 1962. The system described in this manual makes use of PBX switching equipment. In the PBX dictating system, a number of remote stations are selectively connected by dial networks to a number of central recording units. In order to establish a connection an individual telephone unit is dialed in the conventional manner. When a remote telephone unit has been connected to a dictating unit, all of the functions of the dictating equipment are initiated by dialing particular predetermined digits on the telephone unit. In a typical case, the digits dialed are: digit 1 for dictate, digit 2 for secretary instruction perforation, digit 3 for playback, and digit 4 for end of letter perforations.

One of the purposes of the present invention is to eliminate the necessity for dialing a particular digit in order to effect a related function of the dictating equipment 1, FIG. 1. In FIG. 1, telephone units 22 and 23 communicate with dictating equipment 1 and control unit 2 through telephone unit 24. Handset 27 is placed on an induction unit 28 for inductive pick-up of incoming and outgoing signals. Induction unit 28 has an arm 29 that extends over the cradle to operate a switch actuating member, such as member 30 on telephone unit 24. Connection of one of the units 22 or 23 to the dictating equipment 1 is performed in a manner similar to that in the PBX system with the operator at the remote station dialing a predetermined number. The ringing of unit 24 in response to the dialling of the preselected number is recognized by induction unit 28 and control unit 2, whereupon arm 29 is raised to connect unit 24 to the calling station.

Handsets 25 and 26 are provided withreed signal generating units 31 and 32 that are shown in more detail in FIGS. 3, 4a, and 4b. Following the successful connection of a particular station to the central recording equipment 1, the generators 31 or 32, as the case may be, are operated by the dictator to generate tone signals of predetermined frequency which are then transmitted and recognized by control unit 2 in order to control the action of dictating apparatus 2.

In an alternative arrangement, telephone units 22 or 23 may be connected to the control unit 2 by a direct telephone unit 33.

The inventive arrangements disclosed herein will be described in connection with the inductive telephone system of FIG. 1. The principles of the invention however are applicable to any of the configurations in FIG. 1.

FIG. 2 is a block diagram and FIGS. 9a and 9b are detailed diagrams of the central station apparatus including induction unit 28, control unit 2, and dictating unit 1. FIG. 9a should be arranged to the left alongside FIG. 9b to form a composite diagram. Direct telephone unit 33 is also shown as an alternative input to control unit 2. Induction unit 28 includes a reproducer 34, cradle switch solenoid 35 for operating arm 29 in FIG. 1; an induction coil 36 and a telephone cradle 28a for accommodating telephone handset 27. Certain of these elements are shown in detail in FIG. 9a.

Control unit 2 includes a power supply 37, a preamplifier 38, and amplifier 39, a tone generator 40 and a number of relays involved in operation of the control unit. The relays are as follows:

<table>
<thead>
<tr>
<th>Relay Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Power On Relay</td>
</tr>
<tr>
<td>R2</td>
<td>Voice Operated Relay (VOR)</td>
</tr>
<tr>
<td>R3</td>
<td>Series Relay</td>
</tr>
<tr>
<td>R4</td>
<td>Delay (Transfer) Relay</td>
</tr>
<tr>
<td>R5</td>
<td>Record-Listen Relay</td>
</tr>
<tr>
<td>R6</td>
<td>Sequence Relay</td>
</tr>
</tbody>
</table>
Control unit 2 also has a number of reed relay sections as follows:

<table>
<thead>
<tr>
<th>Reed Relay Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>VR1</td>
<td>Stop Reed Relay</td>
</tr>
<tr>
<td>VR2</td>
<td>Record Reed Relay</td>
</tr>
<tr>
<td>VR3</td>
<td>Listen Reed Relay</td>
</tr>
<tr>
<td>VR4</td>
<td>Secretary (SEC) Reed Relay</td>
</tr>
<tr>
<td>VR5</td>
<td>Letter (LTR) Reed Relay</td>
</tr>
</tbody>
</table>

The conventional relays and reed relays in control unit 2 are shown in more detail in FIGS. 9a and 9b. Various control lines are shown from control unit 2 to dictating unit 1. Dictating unit 1 includes its own power supply 41 and amplifier 42 and a number of relays and solenoids indicated in detail in FIG. 7. Dictating unit 1 is connected to control unit 2 by means of an “M” terminal block 43, FIG. 9b, having connectors designated “M1-M13”. The M terminal connections and related dictating functions are as follows:

<table>
<thead>
<tr>
<th>M Terminals</th>
<th>Dictating Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Power Supply</td>
</tr>
<tr>
<td>M2</td>
<td>Instruction Solenoid</td>
</tr>
<tr>
<td>M3</td>
<td>Record Relay</td>
</tr>
<tr>
<td>M4</td>
<td>Clutch Magnet</td>
</tr>
<tr>
<td>M5</td>
<td>Ground</td>
</tr>
<tr>
<td>M6</td>
<td>Reverse Magnet</td>
</tr>
<tr>
<td>M7</td>
<td>No Connection</td>
</tr>
<tr>
<td>M8</td>
<td>Backspace Solenoid</td>
</tr>
<tr>
<td>M9</td>
<td>Amplifier Input</td>
</tr>
<tr>
<td>M10</td>
<td>Letter Solenoid</td>
</tr>
<tr>
<td>M11</td>
<td>Amplifier Ground</td>
</tr>
<tr>
<td>M12</td>
<td>No Connection</td>
</tr>
<tr>
<td>M13</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

Control unit 2 serves to transfer speech signals during dictation from a remote handset, such as handset 25 to dictating unit 1 and during a listen mode from dictating unit 1 to handset 25, and also responds to tones generated by the generator unit at the remote station, such as unit 31, to effect various functions in dictating unit 1. The various speech and control signals are transmitted between control unit 2 and dictating unit 1 through the M terminals M1-M11.

As shown in FIG. 3, generating unit 31 has a number of control buttons that are effective to generate predetermined tones for controlling dictating unit 1. These include: Record button 44, Review/Listen button 45, Secretary (SEC) button 46, and Letter (LTR) button 47. A separate stop button 48 may be provided on unit 31 for stopping any action previously initiated under control of buttons 44-47. Unit 31 is retained on handset 25 by an elastic strap 49 having a clip 50 adapted for attachment to a stud 51 on unit 31. In operation, unit 31 is strapped to handset 25 at the transmitter end of the handset.

Referring to FIGS. 4a and 4b, unit 31 has a number of resonant reeds, such as reeds 52 and 53 for generating tone signals required during operation. Generating unit 31 has a resonator plate 54 for transmitting generated signals to handset 25 for transmission. Only one keybutton, such as keybutton 44, is shown in FIGS. 4a and 4b, but the structural arrangements shown apply to the other keybuttons on generating unit 31, also. Keybutton 44 has extensions 44a and 44b. Extension 44a is positioned over a strap 55 that has a permanent magnet 56 attached thereto. Extension 44b is arranged adjacent the end of reed 53. The unoperated position of button 44 is shown in FIG. 4a. In order to generate the tone required to establish a Record mode in dictating unit 1, button 44 is depressed as shown in FIG. 4b. As button 44 moves downward, extension 44b trips past the end of reed 53, initiating vibration in the reed and thereby generating the Record tone. During the downward movement of button 44, extension 44b moves against strap 55 and thereby moves magnet 56 into contact with reed 52. A flat spring 57 exerts pressure to restore button 44 upwardly to its normal position. When button 44 is released by the operator of the equipment, the extensions 44a and 44b also move upwardly. This permits strap 55 and magnet 56 to restore. Magnet 56 exerts movement on reed 52 during the upward movement for an interval of time until the magnetic force exerted by magnet 56 can no longer hold reed 52 due to the tension exerted by strap 55. When magnet 56 releases reed 52, reed 52 vibrates and generates another distinctive tone signal that is recognized by control unit 2 to stop the record function and to place control unit 2 in condition for recognizing subsequently generated signals. Only a single reed is shown for generating the stop signal in FIG. 4a and 4b, but in the preferred embodiment disclosed herein, two reeds are provided for the stop function for increased reliability.

The circuits disclosed in the present case are predicated upon the generation and recognition of the following tones:

<table>
<thead>
<tr>
<th>Tone Frequency</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>365 cycles per second (cps)</td>
<td>Record</td>
</tr>
<tr>
<td>490 cycles per second (cps)</td>
<td>Listen</td>
</tr>
<tr>
<td>405 cycles per second (cps)</td>
<td>Letter Punch</td>
</tr>
<tr>
<td>435 cycles per second (cps)</td>
<td>Secretary Punch</td>
</tr>
<tr>
<td>405 cycles per second and above (cps)</td>
<td>Stop</td>
</tr>
</tbody>
</table>

An alternative generating unit for initiating reed signals electromagnetically is shown in FIGS. 5a and 5b. The generating unit includes a number of tuned reeds 60-65 with associated contacts 66-71, as shown in the top elevation of the unit in FIG. 5a. Considering the side elevation of FIG. 5b, if electrical potential is connected to a contact and associated reed, such as contact 71 and reed 65, the reed will oscillate at the resonant frequency of the reed. An electromagnet 72 develops signals that are transmitted to a sounding board 73 for pickup by a transducer 74. Relating the generator of FIGS. 5a and 5b to that shown in FIGS. 4a and 4b, the sounding board 73 corresponds to the resonator plate 54.

FIG. 6a represents the waveform of a typical signal resulting from vibration of a reed in one of the tone generators 31 or 32. The resonant coupler 54, FIG. 4a, transfers reed vibrations to the telephone handset 25 thereby causing the telephone transmitter diaphragm to vibrate at the same frequency as the reed. Electrical signals of 1 milliwatt (mw) or greater at 600 ohms with a frequency equal to the reed vibrations are induced on the telephone line. The electrical signal induced has the characteristics of a ring, that is a large amplitude during the interval A to B, FIG. 6a, with a subsequent gradual
decrease to zero level after approximately 300 milliseconds (ms). Interval A to B represents about 50 milliseconds, interval B to C represents about 100 milliseconds and interval C to D represents about 100 milliseconds. The circuits in control unit 2, FIGS. 9a and 9b are arranged to respond to the generated signal of FIG. 6a during the entire interval A to D but are effective to initiate or terminate a function only in response to a developed signal having a fairly constant amplitude as indicated in the interval B to C, FIG. 6b. In accordance with one of the principles of the present invention, each of the vibrating reed relays VR1–VR5 has an associated circuit including a transistor for insuring a rapid response to any signal of sufficient duration having the required frequency characteristics.

The principles of operation of the tone responsive circuits are illustrated in FIG. 8. The circuit of FIG. 8 includes a resonant reed contact bank 80 with individual reeds 81–85 that vibrate at particular predetermined resonant frequencies. The circuit includes two transistors designated Q1 and Q2.

Transistor Q1 is biased into class B operation by voltage divider resistors 86 and 87 so that only a small direct current flows through coil L1. Transistor Q2 is forward biased in a similar manner by resistors 88 and 89. When a tone signal having a frequency equal to the resonance of one of the reeds 81–85 relative to coil L1, appears at input 90, it is amplified by transistor Q1. An alternating signal current flows through coil L1 inducing a flux in the magnetic circuit of L1 and the reed corresponding to that frequency oscillates. When one of the reeds 81–85 oscillates and closes its contacts, additional base current flows through transistor Q1, switching Q1 into saturation. A large direct current then flows through coil L1 and the reed involved is held securely in contact. Circuit branches are provided from the individual reeds 81–85 for controlling functions that may be desired when the associated reeds are selected. These circuit branches are designated 91–95.

The circuit, including transistor Q1, is a latching type circuit since it continues to close at input 90 and since it switches a particular circuit 91–95 and holds the same active even after the signal at input 90 terminates. When the circuit with transistor Q1 latches, no signals subsequently received at terminal 90 will affect the circuit. However, a tone signal having a frequency that corresponds to the resonant frequency of reed 96 appearing at input 90 is amplified by transistor Q2. The alternating signal current flowing through coil L2 induces flux in the magnetic circuit involving coil L2, thereby causing reed 96 to oscillate. Transistor Q1. collector receives its potential from terminal 97 and as soon as resonant reed 96 opens, the collector circuit to coil L1 and transistor Q1 is interrupted. The reed 81–85 that was previously selected releases and the circuit with transistor Q1 returns to its neutral state. The circuit of FIG. 8 provides five control functions by lines 91–95 in response to five distinct tone frequencies. A greater or lesser number of functions can be provided for by having a corresponding number of reeds and related control frequencies. A sixth tone frequency controls reed 96 and is used as a stop frequency to restore the circuit to a neutral condition.

The principles of operation of the circuit in FIG. 8 are extended in the detailed circuits of FIGS. 9a and 9b.

In order to illustrate the utility of the inventive arrangements, a typical sequence of operations of the inductive type telephone system using induction unit 28, FIG. 9a, will be described. Induction telephone unit 28 is connected to control unit 2 comprising the majority of the circuits of FIGS. 9a and 9b by mating connectors 101 and 102. Instead of induction unit 28, a direct unit 33 can be connected to control unit 2 by insertion of connector 103 with connector 102 instead of connector 101.

As indicated in connection with FIG. 2, the circuits of FIGS. 9a and 9b include various relays designated R1–R6 and a number of other circuits including transistors T1–T11.

When not in use, the equipment is in a standby condition and power supply 37 provides operating voltages from a source (not shown) through plug 104 and switch 105, which is closed at this time.

When the proper number is dialed from one of the remote stations, such as telephone unit 22, the resulting ringing current develops a signal in portion 36a of induction coil 36 which is applied to the base of transistor T4. The ringing current is amplified by transistor T4 and is supplied to transistor T5. The output of transistor T5 passes through transformer 106. The positive portions of the ringing signal are applied through diode 107 and applied by a feedback loop to the base of transistor T4 for the development of automatic gain control (AGC). Also a portion of the incoming ringing signal is divided by resistors 108 and 109 and provided by line 110 to the base of transistor T3. The output of transistor T3 passes through transformer 111 to the base of transistor T2 resulting in the energization of the voice operated relay (VOR) R2. When the VOR relay R2 is energized, its associated contacts R2–1 and R2–2 transfer.

The R2–2 contacts provide a path for energizing Sequence relay R6. This results in the closure of contacts R6–1 and R6–2. Contacts R6–1 are in a path designated ×–× in series with the R2–1 contacts and a capacitor designated 112. Closure of contacts R6–1 in connection with the previously closed contacts R2–1 supplies a momentary DC potential of approximately 50 milliseconds duration to the base of transistor T1 and capacitor 112. Transistor T1 then switches on, energizing the Power On relay R1. Contacts R1–1 and R1–2 associated with relay R1 then close. The R1–1 contacts complete a power path to dictating unit 1 by way of receptacle 114 into which plug 115, FIG. 7, is connected. Relay contacts R1–2 supply energizing potential to telephone solenoid 35 by line 116 and terminal connectors 7 in connector blocks 101 and 102. Solenoid 35 operates arm 29 thereby closing the cradle switch in unit 24, FIG. 1, and completing the audio signal transmission path from telephone unit 22 to the central recording apparatus.

The closure of contacts R1–2 also provides energizing potential to a side tone circuit including transistor T6 by line 117, relay contacts R4–2, and line 118. The side tone is supplied through transformer 119, and terminals 8 of connector blocks 101 and 102 to transducer 34 for transmission to the calling party. This indicates to the calling party that the dictation machine is now in a seized condition. The side tone also indicates that the dictation machine is in a Stop mode. The VOR
relay R2 under control of transistor T2 continues to vibrate in response to any received voice signals or audio control signals, maintaining contacts R2-1 and R2-2 closed. The circuit associated with transistor T1, including capacitor 112 and resistor 120, has a time constant of approximately 25 to 30 seconds. Therefore, if transistor T2 and VOR relay R2 drop due to the cessation of voice or audio control signals, transistor T1 and Power On relay R1 are maintained on an additional 25 to 30 seconds. When capacitor 112 discharges sufficiently, transistor T1 ceases conduction, relay R1 drops, and the equipment is restored to a standby condition.

Assuming that control unit 2 and dictating equipment 1 are in a seized condition, the dictator using telephone unit 22 will depress one of the buttons 44–47, FIG. 3, to initiate a desired function in the dictating equipment. Ordinarily, the first button depressed by the dictator is Record button 44. Depression of button 44 generates a 365 cps signal that is received by coil 36 and applied to the base of transistor T4. The signal is amplified by transistor T4 and further amplified by transistor T5. The signal is applied through transistor T3 by line 110 to keep the VOR circuit active.

Associated with contacts R2-2 is a capacitor 121 that is normally charged through the R2-2 point. The appearance of the 365 cps signal transvers the R2-2 points and provides a discharge path by line 122 for capacitor 121 to energize Sequence relay R6. Sequence relay R6 is energized momentarily for a period of 90 to 100 milliseconds, closing contacts R6-1 and R6-2.

The 365 cps signal is transferred through a volume control 123, contacts R6-2, now closed, contacts R4–3, closed, and by line 124 to four capacitors designated 125, 126, 127, and 128. Capacitors 125–128 serve as inputs to transistors T8–T11 and associated reed relays VR2–VR5 that control the Record, Listen, Secretary punch, and Letter punch, respectively.

Relay VR2 has a mechanical reed that responds to the 365 cps signal thereby vibrating contacts 129. This applies a charging potential from terminal 1 of block 43 to capacitor 133 thereby switching transistor T8 on. Transistor T8 saturates, pulling relay VR2 contact 129 fully closed and the circuit latches. The circuit remains latched until released by the receipt of Stop tone signals of 405 cps and 455 cps generated by release of record button 44 as discussed in connection with FIG. 4a, or by depression of a separate stop button 48 that may be supplied on generating unit 31, FIG. 3. The other control circuits including transistors T9, T10, and T11 and associated reed relays VR3, VR4, and VR5 respond to signals of 490 cps, 455 cps, and 405 cps, respectively. These circuits have reed contacts 130, 131, and 132 and associated capacitors 134, 135, and 136 for initiating operation of the circuits. The VR2 and VR3 circuits, once activated, remain latched until potential is removed by energization of transistor T7 and reed relay VR1 in response to the recognition of stop tones of 405 cps and 455 cps simultaneously. The operation of the VR4 and VR5 circuits is only momentary.

In order to insure proper response of the control reeds associated with relays VR1–VR5, it is necessary that the amplitude of all signals applied to the input of the resonant reed bank be maintained at a constant level. The automatic gain control (AGC) serves this purpose, but since the AGC depends upon the received signal for its source of DC potential, the AGC action is not instantaneous. Considering the waveform of FIG. 6a, the first portion of a received signal during the interval A to B has a larger amplitude than that portion of the signal from B to C. The time duration of the developed signal of FIG. 6b during interval A to B depends upon the reaction of the AGC network. In order to insure that the signal applied to the reed bank is of uniform amplitude the circuit reaction to any applied tone control signal is delayed until the interval of B to C, FIG. 6b, during which the developed signal has a substantially uniform amplitude. This is accomplished by delaying the application of the signal for an interval of time until the AGC becomes effective. The average time for the AGC circuit to become effective is approximately 25 milliseconds. The signal delay is accomplished by selecting an RC time constant for resistor 137 and capacitor 138, such as 40 milliseconds, that delays the response of transistor T2 to the incoming signal for a sufficiently long time period. This means that by the time the R2–2 contacts transfer thereby discharging capacitor 121 through Sequence relay R6 to complete the input circuit to transistors T7–T11, the interval A to B in FIG. 6b will have passed. This insure that only a signal of fairly constant amplitude, such as the signal during interval B to C in FIG. 6b, will be applied to the control circuits, FIG. 9b.

The latching of the Record circuit including transistor T8 and reed relay VR2 supplies energizing potential through diode D7 to energize Delay relay R4. The associated contacts R4–1, R4–2, and R4–3, transfer. The closure of contacts R4–1 establishes a path for subsequent energization of Series relay R3 when a Stop signal is received. Contacts R4–2 open, removing potential from transistor T6 thereby terminating the generation of the side tone during the Record mode. Contacts R4–3 transfer, thereby opening the input circuit, including line 124, to capacitors 125–128 and transferring the input circuit to the base of transistor T7, instead.

A path is also established through terminal M3 of terminal block 43 to energize the Record relay, FIG. 7 and through terminal M4 to energize the clutch magnet, FIG. 7. This establishes a Record mode in dictating equipment 1 and initiates driving of the magnetic belt in order to record speech signals applied by terminals M9 and M11 to amplifier 42, FIG. 7.

When the dictator decides to terminate recording and to stop the dictating equipment, he generates a Stop signal comprising the tones 405 cps and 455 cps. The combined tones are supplied through contacts R6–2, R4–3, now transferred, to the input of transistor T7 and relay VR1 which responds by vibrating the reed contacts 140 and 141. Contacts 140 and 141 are wired in series thereby insuring that both of the tones 405 cps and 455 cps must be present before the stop circuit responds.

Closure of contacts 141 through contacts R4–1 energizes Series relay R3 thereby opening the associated
contacts 142. This removes the potential to relay VR2 and transistor T8 by line 143. Transistor T7 is maintained in saturation momentarily by the potential through contacts 140, 141, and contact R4–1 to its base. The period of time involved is just a few milliseconds which is long enough for relay R3 to be energized and for contacts 142 to open.

Since transistor T8 and relay VR2 are now inactive, contact 129 is open and the potential to hold Delay relay R4 through diode D7 is removed. Therefore, relay R4 is de-energized, transferring the contacts R4–1, R4–2, and R4–3 to their normal inactive positions. As a result, the opening of contacts R4–1 drops Series relay R3, the closure of contacts R4–2 reinstates the side tone generating circuit, including transistor T6, and contacts R4–3 transfer the input signal path to the input capacitors 125, 126, 127, and 128 rather than to the base of transistor T7. Since potential is removed from transistor T7 it returns to an inactive state and relay VR1 also becomes de-energized.

During a Record mode, when transistor T8 is saturated and relay VR2 energized, audio signals are supplied to the dictating equipment from the Y and Z terminals, FIG. 9a to correspondingly designated terminals in FIG. 9b which are connected to the M terminals M9 and M11 and thence to the amplifier input circuits, FIG. 7.

If the Listen tone signal of 490 cps is received after the equipment is placed in a Stop mode, as a result of depressing Review-Listen button 45, such signal results in the saturation of transistor T9 and the energization of relay VR3. Potential is applied by terminal M8 of block 43 to energize the Backspace magnet, FIG. 7 which backspaces the head and record media in dictating equipment 1 for review of previously dictated material. Successive backspace operations can be performed by depressing button 45 as many times as desired. No circuit exists for energizing the Record relay, FIG. 7, so dictating equipment 1 is automatically in a Listen mode. The clutch magnet, FIG. 7, is energized by potential through terminal M4 of terminal block 43.

Delay relay R4 is energized through diodes D9 and D10 and a path also exists for energizing the Record/Listen relay R5. Relay R5 actuates contacts 145 and establishes the proper circuit connections for transmitting signals reproduced from the record media in the dictating equipment to the transducer 34 for subsequent transmission over the telephone communication facilities to the person using the equipment.

The operation of reed relays VR2 and VR3 is attended by a concurrent operation of Delay relay R4 in order to set the circuits up for recognition of a subsequently received stop tone. The tone signals of 405 cps and 455 cps are recognized respectively by transistor T10 and relay VR4 in combination, and transistor T11 and relay VR5 in combination. Since only a momentary energization of the Letter solenoid of Secretary solenoid from terminals M10 and M2, FIG. 7, is required, it is not necessary that relay R4 be energized and the Secretary and Letter circuits, FIG. 9b, respond only momentarily to accomplish these functions.

In any event, the operation of the tuned reed circuits disclosed herein is performed in a rapid, efficient manner. Considering the energization of the Record reed circuit including transistor T8 and relay VR2, for example, the circuit latching action previously described including the charging of capacitor 133 requires only 12 to 15 milliseconds, which in the case of the 365 cps signal involves only the first, second and part of the third alternating cycle of the generated signal for a fully latched condition. In prior art circuits involving vibrating reeds, the switching time involved has usually been in the order of 100 to 150 milliseconds which is approximately ten times slower than the reaction time of the circuits disclosed herein.

Considering again the example of "error-free" dictation set forth early in the present case it is clear that any corrections required during the course of dictation can be effected with the novel arrangements of the present invention in an extremely accurate fashion since the equipment responds rapidly to starting and stopping commands and to changes in modes of operation. Also, the compact generating unit 31 shown in FIGS. 3, 4a, and 4b provides a simplicity of operation of the equipment which requires a minimum of attention on the part of the operator.

While it has not been stressed herein, the direct telephone unit 33, FIG. 9a can be substituted for the induction type telephone unit 28 for cooperation with telephone transmission facilities if a direct hook-up is desired. The novel circuit arrangements operate in either case in a comparable fashion and with comparable speed and accuracy.

As pointed out earlier, it is possible to utilize the principles of the invention in any one of a number of system or machine environments depending upon the requirements of the dictating application involved. If desired, more than one central recorder, such as recorder 1, can be provided in any of the system configurations with automatic or manual selection of any recorder by any remote station.

While the invention has been particularly shown and described with reference to several embodiments, it will be understood by those skilled in the art that various changes in form and detail may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In a device of the type for controlling a dictating machine, having the modes of stop and dictate, by means of command signals transmitted over a transmission link and means for coupling the transmission link to and decoupling the transmission link from the dictation equipment upon callup and hangup of the telephone line, wherein the improvement comprises:

(a) a first circuit including a first signal responsive means responsive to a first distinct command signal and being coupled to initiate a stop mode; and

(b) a second circuit including a second signal responsive means responsive to a second distinct command signal and being coupled to initiate and latch a dictate mode into operation,

(c) means coupled from said first signal responsive means to said second signal responsive means for disabling said second signal responsive means only when said first signal responsive means is initiated, and

(d) inhibit means coupled from said second signal responsive means to said first circuit and said
second circuit for enabling the first circuit to and inhibiting the second circuit from conducting signals to the signal responsive portion thereof when said second signal responsive means is operating and for inhibiting the first circuit from and enabling the second circuit to conduct signals to the signal responsive portions thereof when said second signal responsive means is not operating.

2. In a device of the type for controlling a dictating machine, having a first mode and a second mode, by means of command signals transmitted over a transmission link and means for coupling the transmission link to and decoupling the transmission link from the dictation equipment upon callup and hangup of the telephone line, wherein the improvement comprises:

a first circuit including a first signal responsive means responsive to a first distinct command signal and being coupled to initiate said first mode;
a second circuit including a second signal responsive means responsive to a second distinct command signal and being coupled to initiate said second mode into operation;
means coupled from said first signal responsive means to said second signal responsive means for disabling said second signal responsive means only when said first signal responsive means is initiated, and inhibit means coupled from said second signal responsive means to said first circuit and said second circuit for enabling the first circuit to and inhibiting the second circuit from conducting signals to the signal responsive portion thereof when said second signal responsive means is operating and for inhibiting the first circuit from and enabling the second circuit to conduct signals to the signal responsive portions thereof when said second signal responsive means is not operating.

3. In a device of the type for controlling a dictating machine, having the modes of stop and at least another mode, by means of command signals transmitted over a transmission link and means for coupling the transmission link to and decoupling the transmission link from the dictation equipment upon callup and hangup of the telephone line, wherein the improvement comprises:

a first circuit including a first signal responsive means responsive to a first distinct command signal and being coupled to initiate a stop mode and
a second circuit including a second signal responsive means responsive to a second distinct command signal and being coupled to initiate and latch said another mode into operation,
means coupled from said first signal responsive means to said second signal responsive means for disabling said second signal responsive means only when said first signal responsive means is initiated, and inhibit means coupled from said second signal responsive means to said first circuit and said second circuit for enabling the first circuit to and inhibiting the second circuit from conducting signals to the signal responsive portion thereof when said second signal responsive means is operating and for inhibiting the first circuit from and enabling the second circuit to conduct signals to the signal responsive portions thereof when said second signal responsive means is not operating.

4. In a device of the type for controlling a dictating machine, having a first mode and a second mode, by means of command signals transmitted over a transmission link and means for coupling the transmission link to and decoupling the transmission link from the dictation equipment upon callup and hangup of the telephone line, wherein the improvement comprises:

a first circuit including a first signal responsive means responsive to a first distinct command signal and being coupled to initiate said first mode;
a second circuit including a second signal responsive means responsive to a second distinct command signal and being coupled to initiate said second mode into operation;
means coupled from said first signal responsive means to said second signal responsive means for disabling said second signal responsive means only when said first signal responsive means is initiated, and inhibit means for inhibiting the second circuit from conducting signals to the signal responsive portion thereof when said second signal responsive means is operating.

5. In a device of the type for controlling a dictating machine, having the modes of stop and at least another mode, by means of command signals transmitted over a transmission link and means for coupling the transmission link to and decoupling the transmission link from the dictation equipment upon callup and hangup of the telephone line, wherein the improvement comprises:

a first circuit including a first signal responsive means responsive to a first distinct command signal and being coupled to initiate a stop mode and
a second circuit including a second signal responsive means responsive to a second distinct command signal and being coupled to initiate and latch said another mode into operation,
means coupled from said first signal responsive means to said second signal responsive means for disabling said second signal responsive means only when said first signal responsive means is initiated, and inhibit means for inhibiting the second circuit from conducting signals to the signal responsive portion thereof when said second signal responsive means is operating.

6. In a device of the type for controlling a dictating machine, having the modes of stop and dictate, by means of command signals transmitted over a transmission link and means for coupling the transmission link to and decoupling the transmission link from the dictation equipment upon callup and hangup of the telephone line, wherein the improvement comprises:

a first circuit including a first signal responsive means responsive to a first distinct command signal and being coupled to initiate a stop mode and
a second circuit including a second signal responsive means responsive to a second distinct command signal and being coupled to initiate and latch a dictate mode into operation,
means coupled from said first signal responsive means to said second signal responsive means for disabling said second signal responsive means only when said first signal responsive means is initiated, and inhibit means for inhibiting the second circuit from conducting signals to the signal responsive portion thereof when said second signal responsive means is operating.
7. A tone control arrangement, comprising: controlled apparatus, said apparatus having circuits for establishing a number of different operations in said apparatus;
a tone generating unit for generating signals of predetermined frequencies;
a control unit interconnected with said controlled apparatus, said control unit having circuitry for amplifying any received signal including an automatic gain control circuit;
means for transmitting generated tone signals from said generating unit to said control unit;
individual tone recognition circuits in said control unit, said recognition circuits including a transistor and an associated tuned reed relay selectively responsive to said generated signals to provide control signals;
delay means in said control unit effective to delay transmittal of any received signal to said recognition circuits until the automatic gain control circuits have become effective to develop a signal of substantially constant amplitude from a said received signal;
and circuit connections from said recognition circuits for supplying said control signals to said apparatus.

8. A tone control arrangement, for dictating apparatus, comprising:
a centrally located dictation unit, said dictation unit having facilities for recording and reproducing signals on a record media and individual circuits for establishing a number of different operations in said dictation unit;
a remote operator station including a telephone transmitter-receiver;
a detachable tone generating unit for said transmitter-receiver, said generating unit generating signals of predetermined frequencies in response to depression of related buttons by an operator;
a control unit interconnected to said dictation unit; telephone facilities including an induction unit for transmitting audio signals including speech signals and generated tone signals from said remote station to said control unit;
individual tone recognition circuits at said dictation unit, each of said tone recognition circuits having a transistor connected for energization in series with a tuned reed relay selectively responsive to said generated signals;
circuit connections from said tone recognition circuits for supplying control signals to said control circuits;
holding circuit connections for latching certain of said transistor-relay recognition circuits whenever energized by a tone;
a stop tone circuit responsive to receipt of a predetermined stop tone signal for removing holding potential from any previously latched tone recognition circuit;
and a transfer delay circuit responsive to energization of one of said recognition circuits to transfer connection of said signal path to the input of said stop tone circuit.

9. A tone control arrangement for dictating apparatus, comprising:
a dictation unit, said dictation unit having facilities for recording and reproducing signals on a record media and control circuits for establishing a number of modes of operation and initiating a number of functions in said dictation unit, including Record and Listen modes and Letter and Secretary indexing operations;
a tone generating unit, said generating unit generating signals of predetermined frequencies in response to depression of related buttons;
means for transmitting generated tone signals from said generating unit to said dictation unit along a signal path;
individual mode recognition circuits at said dictation unit, each of said mode recognition circuits having a transistor connected for energization in series with a tuned reed relay selectively responsive to one of said generated signals and holding circuit connections to latch any energized transistor into saturation;
individual function recognition circuits at said dictation unit, each of said function recognition circuits having a transistor connected for energization in series with a tuned reed relay selectively responsive to said generated signals but connected only for momentary energization to initiate the function involved;
a stop tone recognition circuit responsive to receipt of a predetermined stop tone signal for removing holding potential from any previously latched mode recognition circuit;
a transfer delay circuit responsive to energization of one of said mode recognition circuits to transfer connection of said signal path to the input of said stop tone recognition circuit;
and circuit connections from said mode and function recognition circuits for supplying control signals to establish the mode of operation or to initiate the function involved.

10. A control arrangement for dictating apparatus, comprising:
a centrally located dictation unit, said dictation unit having facilities for recording and reproducing signals on a record media and individual circuits for establishing a number of modes of operation and initiating a number of functions in said dictation unit including Record and Listen modes and Letter and Secretary indexing operations;
a remote station;
a tone generating unit at said remote station, said generating unit generating signals of predetermined frequencies in response to depression of related buttons;
control unit interconnected with said dictation unit;
means for transmitting audio signals including speech signals and generated tone signals from said remote station to said control unit along a signal path;
individual mode recognition circuits in said control unit, each of said mode recognition circuits having a transistor connected for energization in series with a tuned reed relay selectively responsive to one of said generated signals and holding circuit connections to latch any energized transistor into saturation;
individual function recognition circuits in said control unit, each of said function recognition circuits having a transistor connected for energization in series with a tuned reed relay selectively responsive to said generated signals but connected only for momentary energization to initiate the function involved;

a stop tone recognition circuit in said control unit responsive to receipt of a predetermined stop tone signal for removing holding potential from any previously latched mode recognition circuit;

a transfer delay circuit in said control unit responsive to energization of one of said mode recognition circuits to transfer transmitted signals to the input of said stop tone recognition circuit;

and circuit connections from said mode and function recognition circuits for supplying control signals to said dictation unit to establish the mode of operation or to initiate the function involved.

11. The apparatus of claim 10 wherein:
said generating unit has a plurality of reeds selectively actuated by depressing associated buttons to generate the tones required;
a separate stop tone reed for generating the stop tone;

and means, including a magnet, responsive to release of any previously actuated button for actuating said stop tone reed.

12. A tone control arrangement, comprising:
tone responsive apparatus, said apparatus having control circuits for establishing a number of different operations in said apparatus;
a tone generating unit for generating signals of predetermined frequencies;
means for transmitting generated tone signals from said generating unit to said apparatus;
individual tone recognition circuits at said apparatus, said recognition circuits having a transistor connected for energization in series with tuned reed relays selectively responsive to one of said generated signals and holding circuit connections to latch any energized relay;
a stop tone circuit responsive to receipt of a predetermined stop tone signal for removing holding potential from any previously latched recognition circuit;
a transfer circuit responsive to energization of one of said recognition circuits to transfer generated signals to the input of said stop tone circuit;

and circuit connections from said recognition circuits for supplying control signals to said control circuits.

13. The apparatus of Claim 12 wherein:
a single transistor serves to energize any reed relay that becomes energized;

and wherein said stop tone circuit also includes a transistor and tuned reed relay responsive to two generated stop tones to remove holding potential from a latched recognition circuit.

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