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VOICE-CONTROLLED DICTATION-RECORDING SYSTEM

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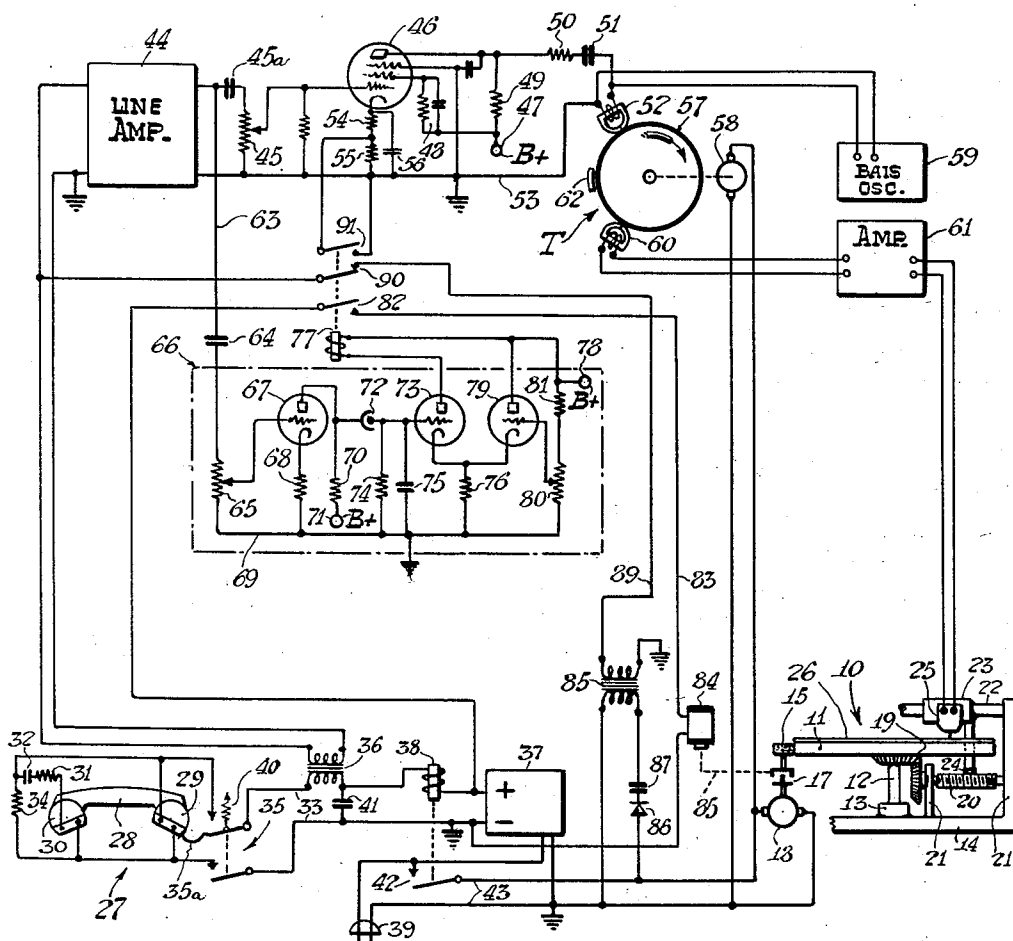


Fig. 1

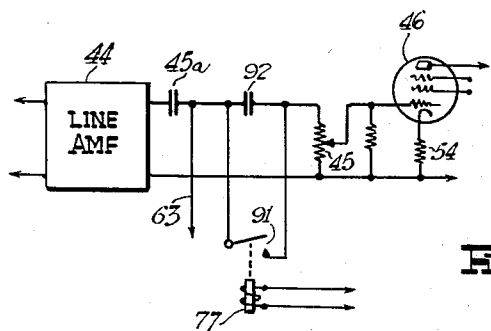


Fig. 2

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VOICE-CONTROLLED DICTATION-RECORDING SYSTEM

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7 Claims. (Cl. 179—100.1)

This invention relates to improvements in dictation-recording systems in which the starting and stopping of the dictating machine is controlled automatically by the voice signals spoken into the microphone. The invention is particularly applicable to remotely-controlled recording systems and is herein described in connection therewith but without intending any unnecessary limitation thereto.

The advantage of controlling a dictating machine by the voice signals being recorded is that the dictator can direct his full attention to the subject matter of his dictation. A particular advantage of voice-controlled operation arises in connection with remotely-controlled dictation-recording systems wherein a dictator selects an idle machine through a linkage apparatus by a dialing process, in that when the machine is started and stopped by the voice signals the linking apparatus is greatly simplified. However, to simplify the description, I do not herein show my invention in connection with any dial linkage system.

A general problem with voice-operated dictation-recording systems is in recording each bit of spoken dictation from the very beginning. In other words, there should be no delay as between the instant the first bit of dictation arrives at the dictating machine and the instant the machine is started. Since there is unavoidable delay in starting the machine by the voice signals, due to inertia and other effects, it has become the practice to delay the transmission of the voice signals for a period at least as great as the delay characterizing the starting mechanism and preferably for a considerably longer delay period. Such transmission delay is accomplished conveniently by using a magnetic recording system operating on a continuously-moving endless record medium to record thereon at one point, pick up therefrom and feed to the dictating machine at a later point, and to erase at a point between the recorder and reproducer.

When such transmission-delay apparatus is used there is desirably provided a stand-by signal, such as a low-frequency hum, which is fed back to the dictator's receiver to apprise him whenever the dictating machine is stopped. Since the telephone-type apparatus has the receiver and microphone connected in the same line, this warning signal is then fed also to the transmission-delay apparatus where it is recorded continuously while the dictating machine is stopped. When the dictating machine is next started responsive to a voice signal spoken into the microphone, the warning signal which stands already recorded on the magnetic record medium of the transmission-delay apparatus is fed to the dictating machine and there recorded in advance of arrival of the voice signal for a period equal to the delay period of the transmission-delay apparatus less the delay period of the starting mechanism. Over the last portion of this hum period equal to the delay period of the starting mechanism, the voice signal appears and is recorded by the dictating machine with the superimposed hum. For

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instance, for a transmission delay of 150 milliseconds and a start delay of 20 milliseconds, the dictating machine when started by a voice signal spoken into the microphone will first record the hum signal for a period of 130 milliseconds, then record the hum and voice signal for a period of 20 milliseconds prior to the recordation of the pure voice signal. This recordation of bursts of hum signal preceding the voice signal is very annoying and distracting to a transcriber. Of course, to the extent that drop-out of the starting mechanism is delayed at the ends of bits of spoken dictation, the operation is more nearly continuous and bursts of recorded hum are avoided. Practice has shown it desirable not to delay dropout of the starting mechanism by more than 5 seconds. Thus, any cessation in speaking dictation to the microphone for a period of 5 seconds or more would result in a burst of stand-by hum being recorded prior to the voice signal.

It is an object of my invention to provide a simple means for overcoming the aforementioned disadvantages so that none of the stand-by hum signal is ever noticeably recorded on the record of the dictating machine regardless of the duration of any cessation of voice spoken into the microphone.

Another object is to provide a very simple and economical means which is effective to suppress the transmission of the stand-by hum signal to the transmission-delay apparatus without noticeably impairing the quality or intelligibility of the voice signals recorded by the dictating machine.

Another object is to provide such a suppression means which is frequency-sensitive to afford a much stronger suppressing effect in the lower frequency spectrum bearing the hum signal than in the upper frequency spectrum bearing the frequencies which impart intelligibility to the voice.

These and other objects and features of my invention will be apparent from the following description and the appended claims.

In the description of my invention reference is had to the accompanying drawings, of which:

Figure 1 is a schematic circuit diagram of a dictation-recording system embodying my invention; and

Figure 2 is a fractional view of a portion of the above circuit diagram modified to illustrate another form of my invention.

For simplification of description, my invention is herein described in connection with a dictation-recording system having a directly interconnected remote dictator's station and dictating machine. Such a system may, for example, be of the type disclosed in the pending Somers et al. application Serial No. 247,244, filed September 19, 1951 (now patent number 2,757,238 dated July 31, 1956), and to which reference may be had as to details.

The present system comprises a dictating machine 10 (fractionally shown) comprising a record support 11 in the form, for example, of a turntable having a center shaft 12 journaled at 13 in the frame 14 of the machine. The turntable is driven from a driving wheel 15 frictionally riding on the periphery of the turntable. The driving wheel is coupled through a clutch 17 to a motor 18. Connected by gearing 19 to the shaft 12 is a feed screw 20 journaled at its ends in standards 21 on the frame. Mounted for movement across the turntable on a support comprising, for example, a cross rod 22 is a carriage 23. Mounted on this carriage is a feed nut 24 engageable with the feed screw to provide a progressive traveling movement of the carriage as the turntable is driven. The carriage carries a recording device 25 engageable with a record 26 on the turntable to describe a spiral recording track thereon.

A remote dictator's station 27 is provided with a hand set 28 of the usual telephone type having therein a carbon button microphone 29 and a receiver 30. A communication circuit 33 leads to this station through an on-off station switch 35. Connected across the communication circuit at the station is the carbon button microphone and a resistor 34 in parallel as well as the receiver through a series resistor 31 and blocking condenser 32. In the communication circuit beyond the station is an audio transformer 36 the secondary of which is connected to the input of an amplifier system as will appear. Direct current is provided to the station to energize the carbon button microphone from a rectifier-filter 37 through a control relay 38. Alternating current power to the rectifier filter is provided from a power source indicated by the terminals 39.

Normally the station switch 35 is held open by resting the handpiece on an extension 35a of one pole member of the switch. When the handpiece is removed, the switch is closed by a spring 40 to start flow of direct current in the line 33 through the relay 38, primary of the transformer 36, microphone 29 and resistor 34 in parallel. The microphone is then energized so that it will provide audio signal current in the communication line responsive to a voice spoken into the microphone. This audio current is by-passed from the relay 38 by a condenser 41. The relay is operated by the direct current in the line when the station switch is closed to operate a switch 42 in the power line 43 leading to the motor 18 so that the motor is started as soon as the handpiece is removed from its support.

The audio signals are fed from the secondary of the transformer 38 to the input of a line amplifier 44 only diagrammatically shown. In the output circuit of this line amplifier there is a volume control 45 the movable tap of which is connected to the grid of a voltage amplifier tube 46 comprising the only stage of a "recording amplifier." D. C. voltage is supplied at a terminal 47 marked B+. This terminal is connected through a parallel resistor-condenser combination 48 to the screen grid and through a load resistor 49 to the plate of this tube. A circuit leads also from the plate serially through a resistor 50, blocking condenser 51 and coil of a recording head 52 to a ground wire 53 of the amplifier stage, the recording head being part of a transmission-delay apparatus T hereinafter described. From cathode to the ground wire 53 are two resistors in series, a resistor 54 of normal value and a resistor 55 of above-normal value, the two of which are paralleled by a single condenser 56. As will appear, the resistor 55 is provided to reduce the gain of the amplifier tube by overbiasing the grid, but this resistor is shorted out during operation of the dictating machine to restore the gain to normal value.

The recording head 52 of the transmission-delay apparatus T is mounted in close juxtaposition but not in contact with a magnetic drum 57 driven continuously by a motor 58 connected also across the power line 43. Feeding also into this recording head is a high-frequency bias current from an oscillator 59 according to usual practice. The drum 57 is provided with a peripheral coating of a powdered magnetic material so that it will receive and bear a magnetic pattern corresponding to the audio signals fed to the recording head. At about three-quarters turn around the drum from the recording head is a reproducing head 60 mounted in close juxtaposition but not in contact with the drum, and between the two heads there is an erasing head 62, which may be simply a bar magnet mounted likewise in juxtaposition but not in contact with the drum, the purpose of avoiding contact of the heads with the drum being to avoid wear. The drum is rotated typically at about five revolutions per second—i. e., one revolution every 200 milliseconds—with the result that the transit time on the drum from the recording head to the reproducing head is about 150 milliseconds. Since every bit of dictation spoken into

the microphone is recorded on the drum by the recording head and is not picked up until it reaches the reproducing head, there occurs a 150 millisecond delay in the transmission of all signals to the dictating machine. The function of the erase head 62 is to remove the magnetic pattern constantly ahead of the recording head so that the recording head is enabled constantly to record the signals fed thereto from the recording amplifier 46.

The voice signal energy from the line amplifier 44 is also fed through a line 63 including a blocking condenser 64 to an input volume control 54 of a relay amplifier 66. The movable contact of this control is connected to the grid of a tube 67. The cathode of this tube is connected through a bias resistor 68 to a ground line 69 and the plate is connected through a load resistor 70 to a terminal 71 marked B+ and designating a source of D. C. plate voltage. Signal current from the plate is fed through a neon bulb 72 to the grid of a second amplifier tube 73. Connected from this grid to the ground line 69 are a resistor 74 and condenser 75 in parallel. As will appear, this resistor-condenser combination operating in conjunction with the neon bulb 72 provides a drop-out delay for maintaining the voltage on the grid of the tube 73 for a predetermined period after cessation of dictation spoken into the microphone. The cathode of the tube 73 is connected through a resistor 76 to the ground line 69 and the plate is connected through the coil of a relay 77 to a terminal 78 marked B+ and designating a source of D. C. plate voltage. Associated with the amplifier tube 73 is a second tube 79 having its cathode connected in common therewith and having its plate connected directly to the B+ terminal 78. The grid of the tube 79 is connected to the adjustable tap of a rheostat 80 connected through a cut-down resistor 81 from the B+ terminal 78 to the ground line 69. The function of the tube 79 is to adjust the cathode bias of the tube 73 according to the positioning of the tap of the rheostat 80.

The relay 77 has a switch 82 connected in the circuit 83 of a clutch-operating solenoid 84 connected mechanically to the clutch 17 as designated diagrammatically by the tie line 85. This solenoid may be connected across the D. C. source from the rectifier filter 37. When the dictator speaks into the microphone 29 to provide an audio signal in the communication circuit 33 above a preset threshold level exceeding any likely noise level, the audio signal is fed through the transformer 36 and line amplifier 44 to the relay amplifier 66. In this relay amplifier the signal is first amplified by the amplifier stage 67 and is then fed through the neon tube 72 to the grid of the stage 73. The neon tube requires about 60 volts across it to render it conductive but the major portion of this voltage is provided constantly by the D. C. plate voltage source 71. When the signal voltage is fed to the relay amplifier the peaks thereof from the plate of the tube 67 will add to the normal plate voltage to override the threshold voltage on the neon tube and cause the peaks to be fed to the grid of the tube 73. The tube 73 is biased by the associated tube 79 to provide constantly a preset level of plate current through the relay coil 77 which is however insufficient to operate the relay. Typically, this constant current supply may be 2 ma. and the relay may operate at 5 ma. In response to the signal voltage peaks fed through the neon tube to the grid of the tube 73, the condenser 75 is charged and the grid voltage is built up to increase the plate current to the value required to operate the relay. When the relay operates the contacts 82 thereof are closed to cause the solenoid 84 to engage the clutch 17 and start the dictating machine. Through proper adjustment of the rheostat 65 and bias control rheostat 80, the relay will operate in response to dictation spoken into the microphone at or above the aforesaid threshold level. However, because of the charge-up time of the delay line 74-75 and because of inertia effects, the operation of

the relay will typically be delayed by 10 to 30 milliseconds.

The audio signals fed from the line amplifier 44 through the recording amplifier 46 to the recording head 52 are there recorded on the magnetic drum 57, then picked up by the reproducing head 60 and fed through the amplifier 61 to the recording device 25 of the dictating machine. Because of the delayed transmission of the signal energy to the dictating machine being much greater than the delay in the operation of the starting relay 77, the dictating machine will be started before the audio signals arrive to assure that each bit of dictation is recorded from the very beginning.

Whenever the dictator stops speaking into the microphone, the voltage across the neon tube falls and the tube becomes immediately non-conductive. The charge on the condenser 75 is then captured except for its discharge through the associated resistor 74. The time constant of the circuit 74—75 is so set in combination with the bias setting on the tube 73 that the tube 73 will maintain a current for about five seconds sufficient to maintain the relay 77 operated after the feed of signal energy to the tube 73 ceases. Thus, interruptions in the voice spoken into the microphone 29 for periods not in excess of about five seconds will not cause the dictating machine to be stopped.

In voice-controlled systems of the character herein described it is desirable to provide a signaling means to apprise the dictator as to whenever the dictating machine is stopped. This is particularly important because it warns the dictator whenever he speaks in too low a voice into the microphone as well as when the system is out of adjustment to prevent him from continuing to speak dictation with the misimpression that the machine is operating. In order that a positive signal will be given to the dictator it is desirably fed through the communication line 33 to the receiver 30. Such signal is derived preferably from the A. C. power line 43 through a rectifier 86 and a condenser 87 to a voltage cut-down transformer 88, the purpose of the rectifier being to break up the 60-cycle voltage into higher frequency components, and of the condenser 87 to reduce also the voltage level. From the transformer 88 the hum signal is fed to the receiver 29 through a line 89 to the audio transformer 36 serially including a pair of contacts 90 of the relay 77. The contacts 90 are closed when the relay is not operated and opened to cut off the signal the instant the relay is operated. Since the hum signal appears in the system only when the dictating machine is stopped, it is referred to as a stand-by signal.

Since the hum signal is fed into the same line as that leading from the microphone, it will be recorded by the transmission-delay apparatus T during stand-by. Although the hum signal must have a level below the threshold level of the audio signals required to start the machine, else it would operate the relay to start the machine, it will nevertheless be recorded at an audible level by the transmission-delay apparatus T. Accordingly, there will occur the following sequence starting with the instant a voice signal is spoken into the microphone above the threshold level required to start the dictating machine: During the first 20 milliseconds representing the delay in the operation of the relay 77, the dictating machine remains stopped but the voice signal is recorded on the drum 57 together with the hum signal; for the next 130 milliseconds the dictating machine will receive and record only the hum signal; for the next 20 milliseconds it will receive and record both the voice signal and the hum signal; and thereafter it will receive and record the pure voice signal without any superimposed hum signal. Thus, each time the dictating machine is started it will record a burst of hum signal ahead of the voice signal.

By my invention I eliminate effectively the recording of the signal hum by the dictating machine without impairing the quality or intelligibility of the recorded voice

signals. In accordance with my first embodiment shown in Figure 1, this is accomplished by reducing the gain of the recording amplifier 46 the instant the dictating machine is stopped so that during stand-by the hum signal recorded by the transmission-delay apparatus 56 is at such low level that when picked up by the reproducer 60 and fed to the dictating machine it is there recorded at a level below the threshold of audibility. However, the instant the dictating machine is started the gain of the recording amplifier 46 is restored to normal. Such control over the gain of the amplifier 46 is accomplished simply by adding the resistor 55 in the cathode circuit of this amplifier and providing the relay 77 with another set of contacts 91 which are connected to short the resistor when the relay is operated to start the machine and to reintroduce the resistor when the relay drops out to stop the machine.

Since the level of the voice signal required to operate the relay 77 is necessarily greater than that of the hum signal in order that the hum signal will not itself ever be effective to operate the relay 77, the voice signal will override the hum signal and be recorded on the drum 57 at a level above the threshold of audibility; nevertheless, until the relay 77 is operated the voice signal will be recorded at a subnormal level. The sequence of results now obtained with my invention following the instant a dictator speaks into the microphone to start the machine is therefore as follows: the voice signal is recorded on the drum 57 from the start at a subnormal but still audible level but the hum signal is recorded below the level of audibility, and as soon as the relay is operated the hum signal is cut out and the gain is restored to normal. This results in the dictating machine never recording the hum signal at an audible level but during the first 20 milliseconds or thereabout, representing the delay period in the operation of the start relay 77, the voice signal will be recorded at a subnormal but still audible level. Experience has shown that this slight reduction in the level of the recording of the voice signal during the first instant, as whenever the machine is restarted after having been stopped, does not introduce noticeable distortion or impair the intelligibility of the recorded signals.

In the alternative embodiment of my invention illustrated in Figure 2, the level of the signals fed to the transmission-delay apparatus 56 is reduced by introducing an attenuating element in the line instead of reducing the gain of the recording amplifier 46. Preferably, the attenuating element is a condenser 92 connected in the line as between the line amplifier 44 and the volume control 45, there having been already a blocking condenser 45a in this line as shown in Figure 1. However, the condenser 92 has a much smaller capacity than that of the condenser 45a, being typically about one-tenth of the value of that condenser. Moreover, the particular value of the condenser is chosen in relation to the resistance of the volume control 45 so that the condenser 92 will attenuate substantially the hum frequencies in the lower audio spectrum and will have little attenuating effect on the frequencies in the higher audio spectrum which impart intelligibility to the voice. There is accordingly only the resistor 54 in the cathode circuit of the amplifier tube 46 since this amplifier is now to operate always with normal gain. The contacts 91 are however now connected across the condenser 92. The result is that when the relay 77 drops out to stop the dictating machine the condenser 92 is introduced into the circuit to attenuate the hum signal below the level of audibility as aforescribed. However, the higher frequencies imparting intelligibility to the voice are still transmitted at about normal level. When the dictator speaks into the microphone to operate the relay 77 and start the dictating machine, the condenser 92 is shorted out so that the entire audio frequency spectrum is transmitted at normal level but at the same time, as before, the hum signal is cut out. Thus, instead of suppressing

the entire frequency spectrum of the voice during the initial instantaneous period equal to the delay period of the starting mechanism, there is now the advantage that it is only the lower portion of the audio spectrum that is recorded at subnormal level to suppress the hum signal. In other words, when a dictator speaks into the microphone to start the machine, the higher frequency components which impart intelligibility to the voice are recorded at normal level from the start.

The embodiments of my invention herein particularly shown and described are intended to be illustrative and not limitative of my invention since the same are subject to changes and modifications without departure from the scope of my invention, which I endeavor to express according to the following claims:

I claim:

1. In a dictation-recording system including a dictating machine and a dictator's transducer, the combination of control means for starting and stopping said dictating machine; an audio circuit for connecting said transducer to said machine; an electrically-operable device connected to said audio circuit and operated by audio signals therein produced by dictation spoken into said transducer for operating said control means to start position; means controlled by said electrically-operable means for feeding a warning signal into said audio circuit to apprise the dictator when said control means is in stop position; and means for causing the signal energy in said audio circuit to said dictating machine to be at a reduced level when said control means is in stop position.

2. In a dictation-recording system including a dictating machine and a dictator's microphone and receiver, the combination of an audio circuit for connecting said microphone and receiver to said dictating machine, said audio circuit including serially therein a transmission-delay device for retarding the transmission of all signals fed to said dictating machine by a predetermined period; means responsive to voice energy spoken into said microphone for starting said dictating machine within a predetermined time-delay period less than said first-mentioned period; and means operatively coupled with said starting means for feeding a warning signal to said receiver when said dictating machine is stopped and for concurrently reducing the level of said warning signal fed to said transmission-delay device.

3. In a dictation-recording system including a dictating machine having a revoluble record support, a record-cooperable translating device, and drive means for causing the translating device to scan a record on said support; the combination of a dictator's station including a receiver and microphone; an audio circuit for connecting said microphone and receiver to said dictating machine including an amplifier and transmission-delay device; said delay device comprising a moving, endless, magnetizable record member and recording, reproducing, and erasing heads positioned therealong in sequence, whereby energy fed to said dictating machine via said delay device is delayed by the transit time of the magnetic record member from the recording head to the reproducing head; a start-stop relay for said drive means normally in stop position and operable to start position by signals in said audio circuit upon elapse of a predetermined delay period following the instant the dictator speaks into said microphone; said delay period being less than said transit time in said transmission-delay device whereby said drive means is started before audio

signals reach said dictating machine; means controlled by said start-stop relay for feeding a warning signal into said audio circuit ahead of said transmission-delay device for reproduction by said receiver when said drive means is stopped; and means for reducing the warning signal fed to said dictating machine to an effectively inaudible level.

4. The combination set forth in claim 3 including an amplifier in said audio circuit between the point where the warning signal is fed thereto and said transmission-delay device; including means for reducing the warning signal fed to said dictating machine by reducing the gain of said amplifier.

5. The combination set forth in claim 3 including an attenuating element in said audio circuit beyond the point where the warning signal is fed thereto, and means controlled by said start-stop relay for shorting out said attenuating element when said relay is in start position.

6. The combination set forth in claim 5 wherein said attenuating element is a condenser serially connected in said audio circuit and wherein said warning signal is composed of frequency components in the lower audio spectrum, said condenser having a value adapted to attenuate substantially the transmission of the lower audio frequency components and to transmit without substantial attenuation the higher audio frequency components.

7. In a dictation-recording system including a dictating machine having a recording circuit and a drive mechanism, and a dictator's station including a handpiece provided with a receiver and a microphone, the combination of an audio circuit for connecting said microphone to said recording circuit, said audio circuit including serially therein a transmission-delay device comprising a continuously-moving, endless magnetic record member and a recording head, reproducing head and erase head spaced sequentially therealong for recording constantly signals from said microphone and delaying the transmission thereof by the time of transit of the record member from the recording head to the reproducing head; an electromagnetic start-stop device for said drive mechanism; means including an amplifier for connecting said microphone to said start-stop device for operating the device to start position responsive to voice energy spoken into said microphone above a given threshold level, the operation of said device being characterized by a delay substantially less than the transit time characterizing said transmission device; means controlled by said start-stop device for feeding a warning signal into said audio circuit ahead of said transmission-delay device for reproduction by said receiver to apprise the dictator when said drive mechanism is stopped, said warning signal being recorded by said transmission-delay device while said drive mechanism is stopped and being fed to and recorded by said dictating machine for a moment ahead of the arrival of a voice signal initiating operation of said start-stop device; and means controlled by said start-stop device for reducing the level of the signals fed via said transmission-delay device to said dictating machine to depress the warning signals recorded by the transmission-delay device to a level below the threshold of audibility while said drive mechanism is stopped and for restoring the level of the signals recorded by said transmission-delay device to normal while said drive mechanism is running.