

**Automatic Telephone Answering Device with
Conversation Recording Function**

The present invention relates to an automatic telephone answering device having a conversation recording function.

In conventional automatic telephone answering devices having conversation recording function, a channel for recording messages received during the absence of a called party is the same as that for conversation recording. As a result, inconveniences occur for playing these messages, and a tape is low in utilization efficiency, because the conversation recording is usually effected for a long period of time, whereas, in usual, the incoming messages received one after another during absence of called party are short in length, and hence, in the case of recording these messages in the same channel, recordable messages during absence are low in number if the tape has been almost utilized for conversation recording, and recordable time period for conversation recording becomes short after a number of messages have been recorded during the absence of the called party.

Accordingly, there have been problems which concern with utilization efficiency of tape, and ease of operation for playing and resetting.

The object of the present invention is to mitigate the above-mentioned problems in the prior art systems, and provide an automatic telephone answering device, which is arranged to automatically establish a state for conversation recording from the start point of a tape in the automatic telephone answering device, simply by turning up the tape (ejecting or removing it from the

device), and is provided with means for generating an alarm when the tape comes to an end thereof or upon elapse of a predetermined time period from the instant the conversation recording is completed, so as to enable a user to remember to turn up the tape and establish a standby mode.

According to the present invention, an automatic telephone answering device having a conversation recording function is provided.

An automatic telephone answering device having a conversation recording function comprising:

means for rewinding a tape up to its start position and then stopping same at that position ^{and} when a cassette is ejected, turned over, ~~and~~ inserted, ^{and} set for performing conversation recording;

means for performing conversation recording from the start position of the tape, said conversation recording means being operable to stop at a position at which the conversation recording has been completed to be ready for subsequent conversation recording;

means for generating an alarm if conversation recording is not performed again within a predetermined period; and

means operable to be set in an automatic answering mode for automatically answering and recording an incoming message having the conversation when the tape is ejected, turned over and inserted again, and operable to save the incoming messages recorded until the time the tape is ejected, turned over, ~~and~~ inserted, ^{then} and ~~to be~~ set in the automatic standby mode.

Embodiments of the invention will now be described by way of example only and with reference to the drawings, in which :-

Fig. 1 is a circuit diagram showing a preferred embodiment;

Fig. 2 is a view showing a location of an outgoing message portion on a tape;

Fig. 3 is a flowchart showing a process for recording an outgoing message onto a tape of 1 cassette type;

Fig. 4 is a flowchart for conversation recording onto a tape of 1 cassette type;

Fig. 5 is a view showing a distribution of recorded messages in the 1 cassette type of tape;

Fig. 6 is a flow chart for conversation recording onto an incoming message tape of the device of 2 cassette type; and

Fig. 7 is a flowchart showing operations from an

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operation of playing back an incoming message tape to an operation of setting same in a standby mode.

In the following, structures and functions of preferred embodiments of the present invention will be explained.

5 In Fig. 1, reference numeral 1 denotes a microprocessor (hereinafter referred to as a CPU) which is composed of Intel 8049 in the present embodiment. The CPU has data buses DB0 - DB6 as input terminals, ports P10 - P16 and P20 - P27 as output ports, a terminal $\overline{\text{INT}}$ as an interruption
10 terminal, and terminals TEST0 and TEST1 as input terminals. Reference numeral 2 denotes a keyboard section which has a button for recording an outgoing message on an outgoing message tape T-1 (not shown), a button for setting the present telephone answering device in a standby mode for
15 automatic answering/recording, buttons for rewinding and playing back an incoming message tape T-2 (not shown), etc. Further, reference numeral 3 designates a driving section for controlling rewind, normal wind, fast wind, stopping, etc. of the outgoing message tape T-1 in accordance with
20 coded outputs supplied from the output ports P20 - P23 of the CPU 1; 4 denotes a similar driving section for incoming message tape. Incidentally, in case that the telephone answering device requires only one recording tape on which both of the outgoing message and incoming messages from
25 callers are recorded, either one of the driving section may be omitted. Reference numeral 5 denotes a driver; Y-1 a loop forming relay of telephone line, which has a contact y1-1; 6 a filter of 40Hz, which is provided if the telephone answering device is of the above-mentioned single tape type,
30 for converting a rectangular wave of 40 Hz prepared by program and supplied from the output port P16 into a sine wave which is then recorded in a manner superimposed on the outgoing message; and 7 a record/playback switching circuit which comprises analog switches and relays, in which H level
35 and L level outputs appear at its P/R terminal for playback

and record operations, respectively, and H level and L level outputs appear at its 1/2 terminal for actuating heads RPH-1 and EH-1 for answer, and heads RPH-1 and EH-2 for reception, respectively. In the meantime, in the single type, the heads RPH-1 and EH-1 are employed for both of answer and reception. Further, reference numeral 8 denotes a microphone for recording the outgoing message; 9 and 10 amplifier circuits; 11 and 12 analog switches controlled by the output ports P13 and P12; 13 an amplifier circuit for transmitting the outgoing message onto the telephone line with an appropriate level; and 14 a waveform shaping circuit provided in the telephone answering device of 1 cassette type, for outputting a rectangular wave of 40 Hz which is to be recorded in a manner superimposed on the outgoing message, and then supplied through the terminal TESTO and detected by the CPU 1 during rewind and fast wind operations. Further, reference numeral 12 denotes a cassette inversion detecting switch which is operated to close if the cassette is turned up and then inserted for conversation recording, with the input terminal DB6 of the CPU 1 set at L level which is supplied through an NOR gate 13 to enable the CPU 1 to be interrupted. Furthermore, reference numeral L1, L2 denote telephone lines; 13 a telephone set; 14 a line transformer; 15 a ringing circuit for detection of an incoming call signal; 16 an off-hook detecting circuit for detecting an off-hook state of the telephone lines; 17 an OR gate; and 18 a first rotation sensor which detects pulses supplied from a rotary section which is operatively coupled to a tape reel, for detection of travel position of the outgoing message tape by the program. Reference numeral 19 denotes a second rotation sensor for incoming message tape, which sensor may be omitted in the case that the telephone answering device is of 1 cassette type. Further, reference numeral 20 is an eject switch operatively coupled to an eject knob (not shown), and operable to be closed, so that the tape is

stopped by program, not shown, when the tape is taken out.

The operation of the present telephone answering device constructed by the above-mentioned parts will be explained with reference to drawings and flowcharts of Fig. 2, et seq.

5 In this embodiment, the outgoing message is recorded on a middle portion of the cassette tape, as shown in Fig. 2a, so as to shorten an access time for switching to conversation recording mode mentioned later. Alternatively, as shown in Fig. 2b, the outgoing message may be recorded on
10 the start point side of the tape and followed by incoming messages which are recorded one after another on the tape. In the following, explanations will be given as to the case relating to a recording manner shown in Fig. 2a alone. A manner of recording shown in Fig. 2b was disclosed in
15 Japanese Patent Publication No. 61-24855, for instance, and thus an application of the present invention where the recording manner of Fig. 2b is adopted will be apparent from the disclosure in the above-mentioned Japanese Patent Publication and the following explanations.

20 The flowchart of Fig. 3 illustrates recording process of the outgoing message in the 1 cassette type device wherein the outgoing message and incoming messages from callers are continuously recorded in a single cassette tape. In this connection, at first, the CPU 1 is enabled for
25 interruption through the OR gate 13 and the interruption terminal INT, upon depression of a recording button (not shown) of the keyboard section 2 in Fig. 1, to advance the flowchart to the step 100 of Fig. 3. In this step, the output ports P14 and P15 are set at H and L levels,
30 respectively, which are respectively applied to the 1/2 and R/P terminals of the record/playback switching circuit 7 for rendering the record/playback head RPH-1 and the erasure head EH-1 actuated for recording. Next, in the step 101, the outgoing message tape driving section 3 is operated
35 through the output ports P20 - P24, so as to drive the cassette tape at its normal speed. In the subsequent step

102, after the start of tape, the interval of pulses generated from the rotary section coupled to the reel is measured by program. If the period of the thus measured pulse interval is equal to a predetermined value (which is
5 obtained by measurement or calculation of the pulse interval at the middle portion of the tape), the flowchart advances to the step 108 to initiate the recording of the outgoing message. If it is determined in the step 102 that the measured interval is inconsistent with the predetermined
10 value, the flowchart advances to the step 103. If the period measured by the first rotation sensor 18 is greater than the predetermined value, the current position of the tape is located at the side near its start position, and thus, in the step 104, the tape is subjected to fast wind toward the
15 middle portion thereof. On the contrary, if the measured period is less than the predetermined value, which indicates that the tape is at the side of its end, the tape is rewound toward its middle portion in the step 106. In each of the steps 105 and 107, a test is made as to whether the period
20 measured by the first rotation sensor is equal to a corresponding one of predetermined values actually measured or calculated beforehand for rewind and fast wind, which are different in magnitude from each other and from that of normal wind in the step 102. In either case, if the tape
25 has reached the middle portion, switching to the normal speed is effected in the step 108, and the rectangular wave of 40 Hz is supplied from the output port P16 in the step 109, to be converted into the sine wave by the filter 6, and then recorded together with the outgoing message supplied
30 from the microphone 8 in the step 110, as shown in Fig. 2a. Accordingly, in a tape portion on which the outgoing message is recorded, a continuous signal is detected even if the outgoing message is temporarily terminated. This guarantees an easy discrimination between the outgoing message and
35 incoming messages from callers. In addition, silence sections may be formed at the opposite ends of the outgoing

message. Upon depression of a recording stop button (not shown) after the outgoing message has been recorded completely, the flowchart advances from the step 111 to the step 112 to cancel recording mode and to stop the generation of the 40 Hz output (the step 113). Thereafter, the tape is rewound and played back to confirm the contents of the outgoing message, and hence is rewound up to its start position, to be stopped at that position (the steps 114 - 121).

10 In order to set the device in the standby mode for automatic answering/recording after the outgoing message has been recorded in the above-menioned manner, a predetermined button (so-called "AUTO" button) in the keyboard section 2 of Fig. 1 is depressed. Upon reception of an incoming call, 15 the outgoing message corresponding to a portion defined between $t_0 - t_1$ in Fig. 5 is transmitted, and an incoming message (ICM1 defined between $t_2 - t_3$ in Fig. 5) sent from the caller for the first time is recorded at a tape location following the outgoing message. After completion of 20 recording of the message of ICM1, the tape is rewound up to the point t_0 , to set the device in the standby mode. Upon reception of a subsequent incoming call, the OGM between $t_0 - t_1$ is transmitted, and the tape is subjected to fast wind up to t_3 , and an incoming message (ICM2) from the caller is 25 recorded on a section between t_4 and t_5 .

The flowchart of Fig. 4 illustrates a process for conversation recording which may be made during transmission of the outgoing message or during recording of an incoming message from a caller, where required.

30 In order to perform conversation recording, the cassette is to be turned up and inserted. In the present embodiment, a lug (in usual, which is not employed in the automatic telephone answering/recording device) for preventing recording and provided at the conversation 35 recording side is cut off. A notched portion of this lug causes the cassette inversion detecting switch 12 to close,

so as to generate an interruption request which is supplied via the OR gate 13 and to set the terminal DB6 at L level, to advance the flowchart from the step 200 to the step 201, where a detection is made as to whether an off-hook state of the telephone set 13 or that of the present automatic answering/recording device is established by the use of the off-hook detecting circuit 16. If the off-hook state is detected, the flowchart advances to the step 202 to test whether the incoming message is being recorded. If so, the final position of the incoming message is recorded in a memory (RAM) of the CPU 1 at the subsequent step 204. In the example of Fig. 5, the final position corresponds to the position of t7. Thereafter, the tape is subjected to fast wind up to the start position of the outgoing message (the steps 205, 206). Since the cassette has been turned up, the fast winding rather than the rewinding should be effected from the position at t7 of Fig. 5 to the position at t0. The position t0 is determined as a location at which a continuous sound of 40Hz during the fast winding is disappeared. Alternatively, the position t0 may be determined in accordance with a number of counts counted by the first rotation sensor 18. In the subsequent step 207, a determination is made as to whether a final position of conversation recording has been reached. Since the position for an initial conversation recording is located at t11 adjacent to the start position t0 of the outgoing message (OGM), the fast winding is terminated upon detection of such position (the step 208), and then the relay Y-1 is rendered off to disengage the loop circuit of the telephone answering device. Of course, the telephone set 13 is off-hooked prior to the off operation of the relay Y-1. Thereafter, the recording mode is established (the step 210), and the tape is started to be driven at a normal speed (the step 211). Under these conditions, conversation between the calling and called parties will be recorded until when a detection of on-hook of the telephone set 13 is made at the step 213, and

the recording position in the tape is recorded at the step 212. In the initial conversation recording (CONV1), the position at t12 is recorded as final position in a memory of the CPU1. This recording mode is cancelled when the
5 above-mentioned on-hook operation is effected, and then the tape is stopped (the steps 214 and 215). In the step 216, a timer of 20 seconds, for instance, is started to generate upon elapse of 20 seconds (the steps 217 and 218). The above is provided as a countermeasure to remember the user
10 to turn up the tape because the automatic answering/recording mode as a primary intended function of the device will not be achieved if such tape turning-up operation is forgotten. In the meantime, as shown in the flowcharts of Figs. 7 and 8, no alarm may be generated during operations
15 of rewinding and playing back the tape for listening to contents recorded in the conversation recording, whereas the alarm may be generated if no tape turning-up operation is performed even after the tape is stopped. Further, the alarm may be generated in a condition that the tape has come
20 to an end thereof, where a constant output is generated from the first rotation sensor and the recording position to be recorded in the step 212 is kept unchanged.

In the following, the flowcharts of Figs. 6 and 7 showing a second embodiment will be now explained. This
25 embodiment is applicable to a device of the type using two independent cassette tapes for outgoing and incoming messages. By the way, portions of this embodiment which are in common to the above-mentioned embodiment will be explained in a simplified manner. As in the above-mentioned
30 1 cassette type, an interruption request is generated when the cassette for incoming message is turned up and then inserted for conversation recording during the automatic answering or recording operation of the telephone answering device. As a result, the program advances to the step 300
35 of Fig. 6, where a determination is made as to whether the input terminal DB6 of the CPU 1 is at its L level. If so,

the program advances to the step 301 where the telephone lines L1 and L2 are in an off-hook state, and then to the step 302 to test whether an incoming message from a caller is being recorded. If the outgoing message is being transmitted, the outgoing message tape is stopped (the step 303). If the incoming message tape is in its recording mode, where the cassette has been turned up and inserted as mentioned above, the final recording position is recorded in the memory of the CPU 1. To be noted, if the automatic answering is being effected, the final recording position is recorded in the memory upon retraction of the telephone answering device. In the subsequent step 305, a determination is made as to whether the tape should be rewound or fast wound for setting the tape at its start position to effect the conversation recording of present time, such determination being made in accordance with a relationship between final position of the incoming message and that of the previous conversation recording. For instance, if the two incoming messages have been recorded in the incoming message tape and the conversation recording will be effected for the first time, the rewinding of the incoming message tape is started at the step 306. In the subsequent step 308, a test is made as to whether the tape has been rewound (or fast wound) to the final position of conversation recording which is stored in the memory of the CPU 1. If so, the DC coupling at the telephone answering device side is disengaged (the step 309), and the tape is driven at a normal speed in the recording mode so that conversation between the both parties is started to be recorded at the inverted side of the incoming message tape (the steps 310 and 311). This conversation recording is continued until when the telephone set 13 is on-hooked, and the position of conversation recording is recorded in the memory of the CPU 1 during the recording to set the tape at its start position for the subsequent conversation recording (the steps 312 and 313). Further, upon on-hook of the

telephone set, the tape is stopped and the recording mode is cancelled, and an alarm is generated upon elapse of 20 seconds if the cassette is not turned up again to ready for the automatic answering/recording mode (the steps 314 - 318).

The flowchart of Fig. 7 illustrates operations from an operation of listening to contents of conversation recording recorded in accordance with the flowchart of Fig. 6, to an operation of setting the device in the standby mode by turning up and inserting the tape after the listening operation. In order to listen to the contents of the conversation recording, at first, the user depresses a rewinding button of the keyboard section 2 in Fig. 1. Upon depression of the button, an interrupt request is generated to advance the program to the step 400; wherein the generation of the alarm is cancelled. Thereafter, the incoming message tape is started to be driven until the tape is rewound at the start position of the conversation recording to be listened to, and then the tape is driven at the normal speed and recorded contents are amplified by the speaker 11 (the steps 401 - 404). Just when this reproduction has been carried out up to the final position of the conversation recording, the incoming message tape is automatically stopped and the 20 second timer is started (the steps 405 - 407). Before the elapse of 20 seconds, a test is made as to whether the terminal DB6 of the CPU 1 has been restored to H level so as to test whether the cassette has been turned up again and set in its original condition (the steps 408 and 409). If the tape is not turned up and kept as it was, an alarm is generated upon elapse of 20 seconds, the alarm continuing for 20 seconds (the steps 409 - 412). If the cassette is turned up and inserted, the program advances from the step 409 to the step 413. As in the step 305 of Fig. 6, the rewinding or fast winding for setting the tape at the start position of incoming message is effected (the steps 413 - 415), and the tape is stopped

at that position (the steps 416 and 417), and, if required, the outgoing message tape is also set in its start point (the steps 418 and 419), and hence the standby mode is established. Namely, the device is automatically restored in the standby mode only by turning up the cassette, without the need of depressing an operation button.

As mentioned above, the present invention is designed to automatically set a tape at its start position upon inversion of the tape, so as to permit automatic conversation recording from the start position of the tape, in view of inconveniences in the prior automatic telephone answering device where conversation recording and incoming messages received by a reception means of the device are recorded in a single channel or a single tape. Further, the present invention is practically advantageous in that an alarm is generated when a predetermined period of time has elapsed from the instant the conversation recording is completed or when the tape has come to its end so that the user is allowed to remember to turn up the tape so as to set the telephone answering device in its automatic answering mode.

CLAIMS:

1. An automatic telephone answering device having a conversation recording function comprising:

means for rewinding a tape up to its start position and then stopping same at that position when a cassette is ejected, turned over, ~~and~~ inserted, ^{and} set for performing conversation recording;

means for performing conversation recording from the start position of the tape, said conversation recording means being operable to stop at a position at which the conversation recording has been completed to be ready for subsequent conversation recording;

means for generating an alarm if conversation recording is not performed again within a predetermined period; and

means operable to be set in an automatic answering mode for automatically answering and recording an incoming message having the conversation when the tape is ejected, turned over and inserted again, and operable to save the incoming messages recorded until the time the tape is ejected, turned over, ~~and~~ inserted, ^{then} and ~~to be~~ set in the automatic standby mode.

2. An automatic telephone answering device having a conversation recording function, according to claim 1, wherein the tape is prevented from starting and the alarm is generated, if the tape is set at or near the end thereof.

3. A method of recording messages on tape in an automatic telephone answering device as claimed in claim 1 or claim 2, said method comprising; subsequent to recording an incoming message, rewinding the tape to a start position, upon receipt of the next incoming call playing an outgoing message and then winding the tape to

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the end of the previously recorded incoming message to record the said incoming call, whereby tape utilization is enhanced.

4. An automatic telephone answering device having a conversation recording function, substantially as hereinbefore described with reference to and as illustrated in accompanying figures 1, 2a and figures 3 to 7.
