Pressure on start button prepares the 1A telephone answering set to record an announcement. During subscriber's absence, the set transmits the announcement to calling parties and records their replies.

The New Telephone Answering Set

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The feasibility of making a machine that could answer a man's telephone in his absence has long been studied in the Laboratories. By 1935 a machine that could do this had been put together and successfully operated, but only as a laboratory model. At that time, it was the best that could be done with available components, but it was far too bulky and complex for subscriber use. Recently, advances in the electronic and recording arts have permitted the development of a telephone answering set which is both compact and economical enough for home use. Among the important enabling factors was the development of a resilient magnetic recording medium. This makes possible a machine which is simple to set up and operate and which can play back clearly millions of times.

"This is The Alpha Manufacturing Company, MAin 2-1234. Your call is being answered mechanically by Bell System Automatic Answering Service. Please leave your name and telephone number and a message . . ." If you should hear a voice over the telephone giving a message like this, you would probably be making use of one of the latest Laboratories developments for extending the usefulness of the telephone.

Since the early part of this century, inventors have dreamed of a machine which would automatically answer a telephone in the absence of the subscriber, and to do so has been a laboratory possibility for many years. It is only recently, however,

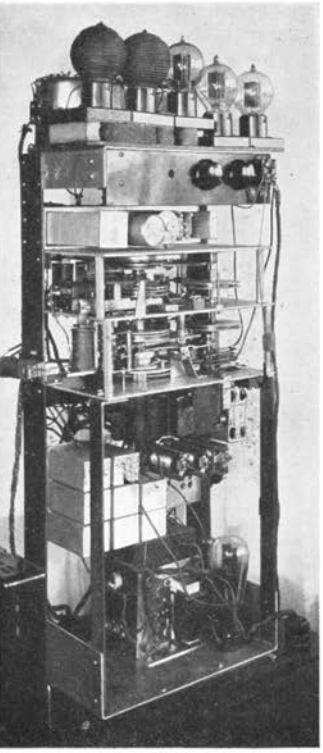

Fig. 1 – Telephone answering machine made by R. F. Mallina in 1935.

that both the art of recording and reproducing sound and the required materials of engineering have reached a stage such that the necessary equipment could be made sufficiently reliable, compact, economical and simple to operate.

Automatic answering devices have been given considerable study by the Laboratories and in the period 1930 to 1935 a working model was put together by R. F. Mallina, using a steel tape magnetic recorder. This machine, shown in Figure 1, would answer a call with a previously recorded message, record incoming messages, and in fact, perform practically all the functions of a modern telephone answering set. However, it was much too complex, expensive and bulky to be used commercially.

During the next ten years marked improvements were made by the Laboratories and others in electronic apparatus and in magnetic recording equipment. A Laboratories development which contributed importantly to the success of a commercial telephone answering set was the invention of a *resilient* magnetic recording medium by J. Z. Menard°. This form of magnetic record is capable of recording and reproducing a message millions of times with no appreciable wear or deterioration in either the recording medium or pickup head, and with no significant effect on the signal quality.

The 1A telephone answering set (Figure 2), about the size of a portable typewriter, is provided in conjunction with the usual telephone set at a moderate, monthly charge. The set is so connected to the line that the normal use of the telephone by the subscriber is possible whenever he so desires. But when he is away, and with the function knob (at left) turned to AUTOMATIC ANSWER, the set is automatically started by an incoming call, gives the calling party a message previously recorded by the subscriber, then records the incoming message, disconnects the telephone line and stops. The total message time available for incoming recordings is about 10 minutes, or twenty full length messages of thirty seconds each. In many types of central office areas the machine is under control of the calling party; that is, it will release if the caller hangs up before using the full 30 seconds recording time allowed.

Recording the announcement is a simple operation for the subscriber. He sees by the illumination of the Bell System Medallion that the set is switched on, turns the function knob to ANNOUNCEMENT DICTATE, and presses the START button below. When he sees a small red light under the word DICTATE, he starts talking, and then presses the STOP button as soon as he finishes, which may be any time between

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Fig. 2 – 1A telephone answering set.

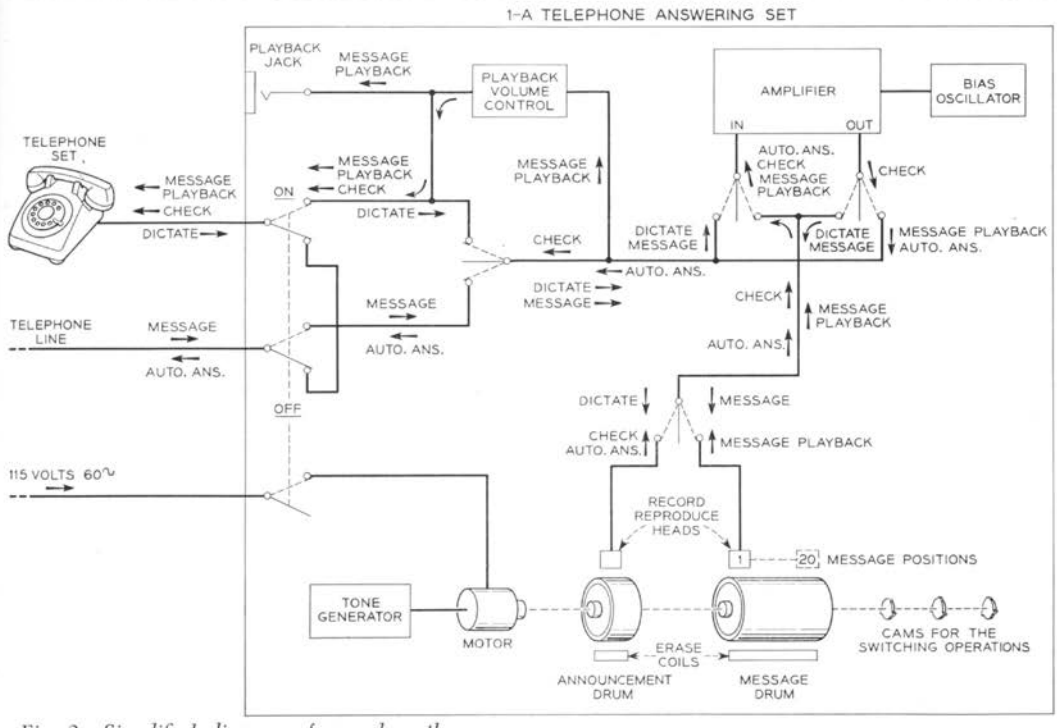

Fig. 3 – Simplified diagram of speech paths.

15 and 30 seconds later. Any previous message is automatically erased before the new message is recorded. He may listen to his recorded announcement by turning the knob to ANNOUNCEMENT CHECK and again pressing the START button.

After he is satisfied with his announcement, he turns the knob to AUTOMATIC ANSWER and sets the message scanning knob (at right, Figure 2) to zero. Around this knob is an indicator dial which shows how much of the incoming message space has been used. When this dial is also returned to zero, a "ready" light shows through the function knob opposite AUTOMATIC ANSWER, indicating that the machine is ready to answer incoming calls. All previous incoming messages are then automatically erased by the first incoming call. As noted in the opening paragraph, the calling party first hears the announcement and, after hearing a tone signal, dictates his message.

When the subscriber returns, he turns the function knob to PLAYBACK, the message scanning knob to zero, and presses the START button. He may then listen to the recorded messages through the receiver of his telephone handset (or, if he prefers, by means of a separate receiver) as many times as he wishes, without danger of erasing them. If the subscriber wishes to keep these messages on the drum, and there is still unused record surface available, as shown by the indicator dial, he places the scanning knob at the end of the last recorded message. This closes an auxiliary contact lighting the "ready" lamp, assuring the subscriber that succeeding messages will not be recorded over previously received messages.

A simplified diagram of speech paths for the various functions of the answering set is shown in Figure 3. Although most of the switches and relays are omitted, the paths of speech currents may be traced for the functions just described.

In designing the set to be as useful as

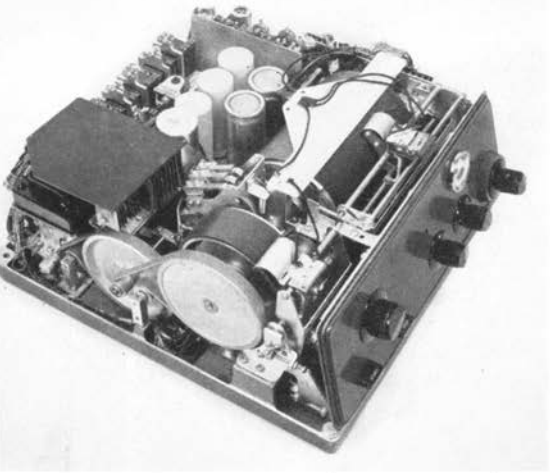

Fig. 4 – Answering set with cover removed. Announcement recording drum appears at center, larger incoming message drum at right.

possible, provisions have been made for using it with the various types of telephone sets and on either individual or selective ringing party lines. Since the subscriber may be called from telephones at great distances as well as from nearby stations, provision must be made for recording incoming messages having sound levels varying over a range of about 60 decibels. This is accomplished by means of an automatic volume control circuit in the recording amplifier. Since the same amplifier is used for playing back the recorded messages, the AVC circuit is disabled during this operation so that the subscriber may adjust the sound level to suit his own hearing.

The outgoing announcement message is recorded on a band of "magnetic rubber" on the smaller of the two drums (Figure 4). Long-life recording heads, specially developed for this project but similar to those used generally in commercial magnetic tape recorders, trace helical paths on the drums as the heads are moved laterally by lead screws. As soon as the carriage holding the announcement head reaches the end of the message, as determined by the time at which the subscriber presses the STOP button during the recording period, it operates a switch that controls relays and solenoids. These in turn stop the announcement drum, and return the head to the beginning of the outgoing message. The switch also starts the incoming message drum, and switches the amplifier from playing the announcement to recording the incoming message. It is positioned to operate just at the end of the announcement message, so that there is a minimum of silent time before the machine sends out a tone signal indicating that it is ready to record the incoming message.

Timing of the signal tones, and of the maximum incoming message length, is accomplished by cams driven by gears from the recording drum shaft. Since these cams

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THE AUTHOR: CLYDE R. KEITH has been particularly interested in sound recording and transmission apparatus. He was associated with carrier telephone research at the Laboratories from 1922 until 1928 when he transferred to the Western Electric Company in London and six years of installation and personnel training for sound recording systems. Following this he devoted fourteen years at Electrical Research Products to the development of sound recording equipment, including distortion measurement methods and control track recording methods. He served as consultant on sound recording, supervisor of E.R.P.'s development cases at the Laboratories, and liaison between the Laboratories and E.R.P.'s East and West Coast offices. Since his return to the Laboratories staff in 1951 he has been a member of the Audio Facilities Department and is currently working on telephone answering machines. Mr. Keith received his B.S. degree (1922) in physics and engineering from California Institute of Technology, and his M.A. degree (1925) in physics from Columbia University. He is a member of the I.R.E. and a Fellow of the Society of Motion Picture and Television Engineers.

must be instantly reset at any time after they are started (in case a calling party hangs up before the end of the maximum time), they are driven through a solenoid-operated clutch and returned by a spring. Such provisions keep both the line holding time and dead space on the record to a minimum, and allow a maximum number of messages to be recorded on the incoming message space.

Interlocking controls are provided so that a "don't answer" signal is given to the calling subscriber if the set is not ready to take the incoming message either because the incoming message capacity is exhausted or because the machine is incorrectly set. To insure correct setting of the machine a "ready" lamp is provided behind the function knob which lights only if the machine is ready for the particular function set. Thus, if the user turns the dial to AUTOMATIC ANSWER when he has left the message scanning knob in a position within the area of messages already recorded, the "ready" lamp will not light until the scanning knob is moved so that incoming messages will be recorded on unused space.

The various manual and automatic switching functions require seven relays and 43 mechanically operated switches. About half of the latter are in a pair of slide switches operated by the function knob, and most of the remainder are actuated by the timing cams or by the motion of the recording head carriages.

Telephone answering service is now being furnished widely throughout the Bell System. The users, particularly small businesses and professional people, are finding it helpful in a great variety of ways.

Patents Issued to Members of Bell Telephone Laboratories During August

Albersheim, W. J. — *Wave-Guide Elbows* — 2,649,578.

Barney, H. L. — *Voltage and Current Bias of Transistors* — 2,647,958.

Blair, R. R. — *Motor System for Controlling Pressure* — 2,649,560.

Cisne, L. E. — *Filamentary Cathode Support Structure* — 2,649,553.

Davey, J. R. — *Electronic Subscriber's Loop Telegraph Repeater* — 2,649,504.

Ellwood, W. B. — *Machine for Manufacturing Switches* — 2,648,167.

Felch, E. P., Jr. and Merrill, F. G. — *Magnetometer* — 2,649,568.

Harrison, C. W. — *Interstage Coupling Circuit for Wideband Amplifiers* — 2,649,508.

Hickman, C. N. — *Magnetic Recorder* — 2,648,589.

Kock, W. E., and Schimpf, L. G. — *Thermoelectric Translation Device* — 2,648,823.

Lewis, W. D. — *Pseudohybrid Microwave Devices* — 2,649,576.

McDavitt, M. B. — *Radiant Energy Signaling Station* — 2,649,541.

Mallina, R. F. — *Motor Driven Hand Tool for Making Wrapped Wire Connections* — 2,649,122.

Mallinckrodt, C. O. — *Transistor Circuit* — 2,647,957.

Mason, W. P. — *Electro-optical System* — 2,649,027.

Mason, W. P.—*Hall-Effect Wave Translating Devices* — 2,649,574.

Melick, J. M. — *Selective Plural Digit Indicator* — 2,648,830.

Merrill, F. G., see E. P. Felch, Jr.

Newby, N. D., and Vaughan, H. E. — *Apparatus for Generating Time Position Dial Pulses* — 2,648,836.

Pearson, G. L. — *Semiconductor Magnetoresistive Devices* — 2,649,569.

Peterson, E. — *Decoder for Pulse Code Modulation Communication Systems* — 2,650,299.

Radcliffe, F. E. — *Test Equipment and Method for Measuring Reflection Coefficient* — 2,649,570.

Reck, F. — *Tool for Effecting Solderless Connections Between a Wire and a Terminal* —2,649,121.

Robertson, S. D. — *Microwave Carrier Telephone System* — 2,649,539.

Teal, G. K. — *Preparation of Two-Sided Mosaic* — 2,650,191.

Townsend, M. A. — *Cold Cathode Electric Discharge Device* — 2,650,320.

Vaughan, H. E., see N. D. Newby.

Vroom, E. — *Selective Signaling System* — 2,648,831.

Wallace, R. L., Jr. — *Polyphase Oscillator* — 2,648,773.

Young, W. R., Jr. — *Noise Detection Circuit* —2,648,765.

Schimpf, L. G., see W. E. Kock.