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An Answering Set for Telephone Subscribers

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Design requirements are suggested for a device which will answer a telephone call and give a recorded message when the called subscriber is absent. The way in which these requirements are met by the Post Office Answering Set No. 1 is described.

INTRODUCTION

FOR many years it has been possible for subscribers connected to certain exchanges to arrange for incoming calls to be intercepted at a manual board and for callers to be referred to an alternative number. This service is particularly valuable to subscribers such as doctors, who can expect to receive urgent telephone calls at any time and who are thus relieved of the necessity of ensuring that someone is always available to answer them.

Unfortunately, this transfer-of-calls service cannot be made available to all subscribers who might wish to use it, and there is a need for an automatic answering device which can be associated with the telephone installation whenever it is not convenient for calls to be answered personally.

GENERAL DESIGN CONSIDERATIONS

It was considered that an answering machine for subscribers' use should provide the following facilities:

(a) The user should be able to record the message he wishes the caller to hear, and change it as required.

(b) The subscriber's telephone should be used to record the messages, and the recording process should be no more difficult than making a telephone call.

(c) The user should be able to check the recording he

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has made by listening to it in the telephone receiver.

(d) The message capacity of the machine must be adequate, but not greater than can conveniently be used fully. To help in this respect, there should be an indicator showing the time available throughout the recording process.

(e) A caller should be able to hear the whole message at least once, even if part of its transmission is interrupted by pay tone from a pay-on-answer coin box.*

(f) Connexion of the machine must not interfere with normal use of the subscriber's installation, and all incoming calls should ring a telephone bell.

The machine described in this article is not required to record the caller's message; other approved machines are already available which will do this.

ANSWERING SET NO. 1

Physical Features

An answering device, developed commercially to meet a Post Office performance specification, has been adopted and coded as "Answering Set No. 1". It is an a.c. mains-operated machine using standard tape-recording techniques and is shown in Fig. 1 together with a Telephone No. 706.

The moulded case of the answering set, which follows the general configuration of the Telephone No. 706, is approximately 12 in. wide, 6 in. high and 9 in. deep; it is two-tone grey in colour.

Only two controls are needed to operate the set; these are a function-selector switch having the four positions "Off", "On", "Check" and "Record", and a press button which starts the machine when a recording is to be made or checked. Three indicators are provided. One of the two small circular windows shows a pilot light when the mains supply is connected, the other shows a moving

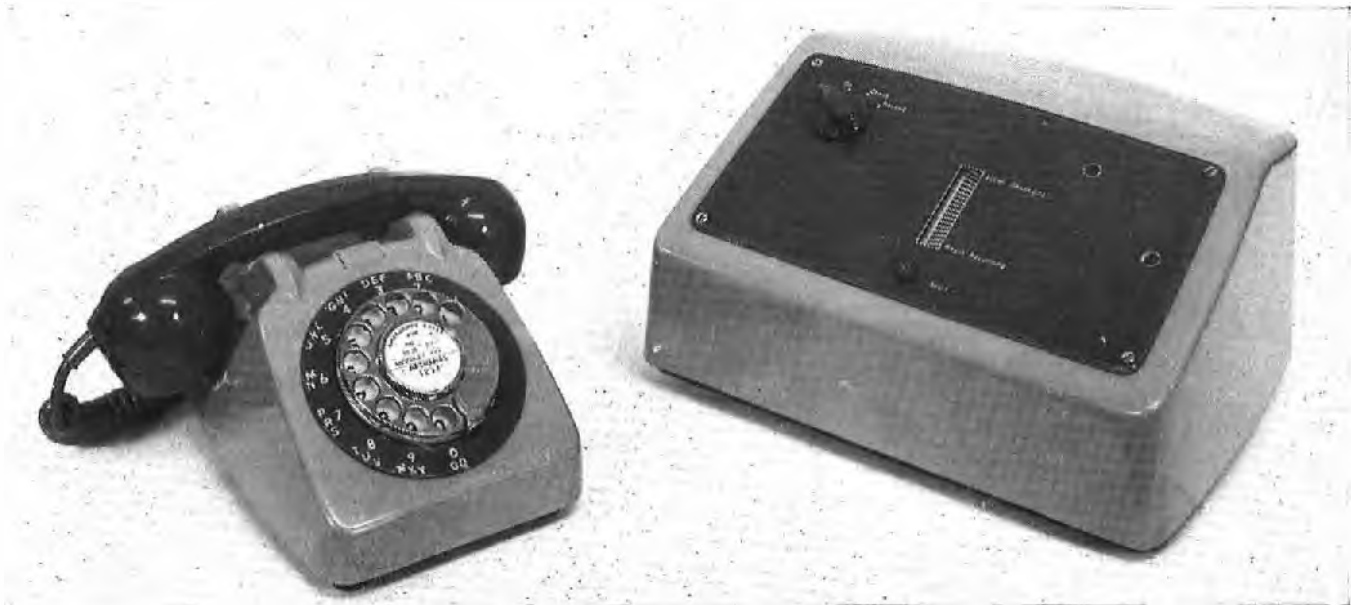


FIG. 1—ANSWERING SET NO. 1 WITH TELEPHONE NO. 706

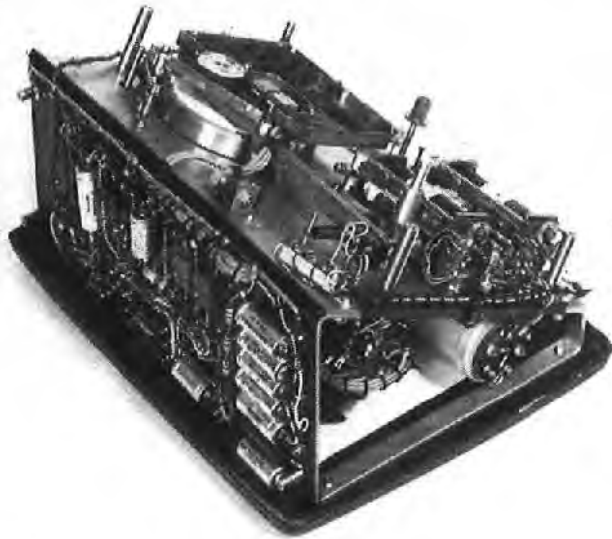


FIG. 2.—CHASSIS OF ANSWERING SET

pattern when the tape driving system is in motion and so acts as a warning against switching the set to a new function before the previous one is completed. The third indicator is the central rectangular window, showing an edge-lit scale marked "Begin Recording" and "Finish Recording"; a pointer moves between these marks during the recording process.

Fig. 2 shows the machine's wedge-shaped chassis, with the cover removed from the tray in which the tape is stored. The sloping panel carries most of the components for the control circuit, and the vertical rear member carries the electronic circuits. A conventional driving system is used for the tape, giving a linear speed of $1\frac{1}{4}$ inches per second. The loop of tape is slightly longer than is necessary for a 20-second message and the excess portion is thickened so that it displaces the tape pinch-wheel at the end of each cycle of operation. The pinch-wheel is mounted at one end of a pivoted lever, so that a small movement of the wheel is mechanically magnified and operates two microswitches held in contact with the other end of the lever. The pinch-wheel also carries a pattern which can be seen through one of the windows in the control panel.

The flywheel of the tape driving system carries a concentric plastic disk in which is moulded a spiral groove running from the centre to the rim. A nylon stylus tracks this groove and, by a cranked lever system, moves the pointer linearly over the time-indicator scale.

To prevent electrostatic attraction between the convolutions of tape in the storage tray, the tape is wiped immediately after passing the pinch-wheel by a metal strip solidly bonded to the chassis.

The set is connected to the associated telephone and exchange line by a 6-way cord terminated on a strip, which is exposed when the base of the set is removed.

Electrical Features

Electrically, the set is in three parts:

(a) *The answering circuit*, which includes the function-selector switch and control relays

(b) *A record/replay amplifier*, together with the h.f. bias oscillator and the erase and record/replay heads

(c) *A power unit*, which supplies h.t. and l.t. to the

record/replay amplifier, smoothed d.c. of 50–60 mA for the telephone transmitter and partially smoothed d.c. for relay operation.

Facilities

The Answering Set No. 1 can be associated with most of the telephone instruments used by the British Post Office and can be directly connected to any type of exchange service line except C.B.S.1 and shared-service lines.

Incoming calls are answered about 7 seconds after the receipt of ringing current; it is undesirable for the machine to answer too quickly. Calls are answered by the connexion of a transformer winding having a resistance of 120 ohms and presenting an impedance of about 600 ohms to the exchange line. Transmission of the recorded message begins immediately after answering, and a 20-second recording is played twice. If the recording capacity has been fully used, the second transmission begins within 2 seconds of the end of the first. After the repetition, the machine disconnects itself from line and is immediately ready to answer the next call.

The message is recorded by speaking normally into the handset, and it is desirable to use the whole of the recording capacity by talking until the time indicator disappears from view. The recorded message can then be played back into the telephone receiver.

When automatic answering of calls is not required, the set can be disconnected by switching to "Off". In all positions of the selector switch, it is arranged that a telephone bell is included in the line circuit.

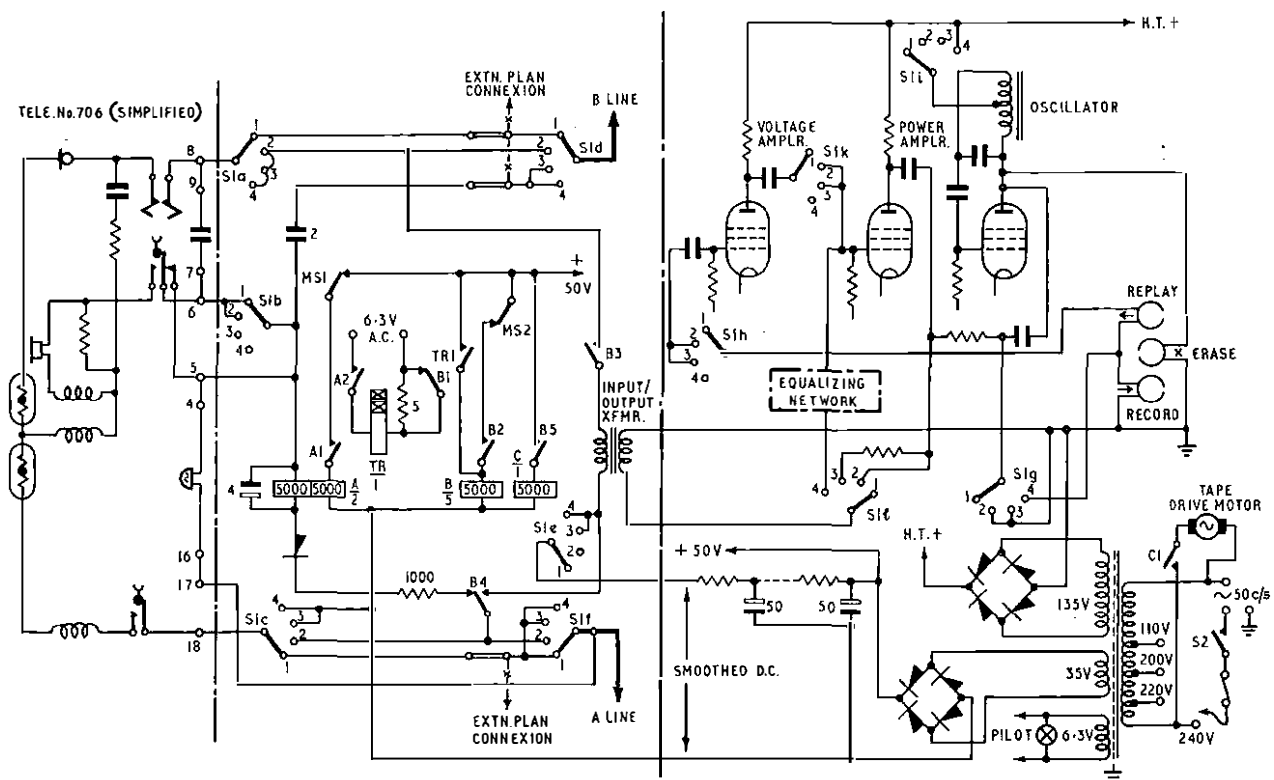
Circuit Description

Fig. 3 is a simplified diagram of the circuit of the Answering Set No. 1. The set is shown associated with a Telephone No. 706.

For automatic answering, the multiple-wafer selector switch is turned to "On". This connects mains to the set, via switch S2, and S1 connects relay A in parallel with the windings of the telephone bell. A small proportion of ringing current is rectified to operate relay A, which locks over its own contact via a microswitch, MS1. Contact A2 applies 6.3 volts a.c. to a thermal relay, TR, which operates in 5–7 seconds so providing the required pre-answering delay. The thermal relay contact operates relay B, which in turn operates relay C, so starting the tape drive motor. B3 and B4 connect the 120-ohm winding of the transformer to line to give the answering condition; B2 provides a holding circuit for B via the second microswitch, MS2. The tape is now in motion past the replay head, and the recorded message is transmitted.

When the tape loop completes its first cycle and the message has been transmitted once, the thickened portion of the loop causes both microswitches to open momentarily. The locking circuits of relays A and B are broken, but the latter relay remains operated because the thermal relay contact TR1 is still closed. As relays B and C remain operated, the tape motor continues to run until the microswitches are again opened by the thickened tape at the end of the second message transmission. Relay B now releases because TR1 has opened and there is no alternative holding path. The output transformer is disconnected from line by B3 and B4. When, in turn, relay C releases, the motor stops and the set is ready to receive the next incoming call.

While the set is switched to "On", normal telephone service is available from the associated instrument.



The function-selector switch S1 positions are 1—OFF, 2—ON, 3—CHECK, 4—RECORD
 FIG. 3—SIMPLIFIED CIRCUIT OF ANSWERING SET NO. 1 ASSOCIATED WITH TELEPHONE NO. 706

Making a Recording

The selector switch is turned to the "Record" position and connects the whole of the telephone transmission circuit to the input of the amplifier. It also switches smoothed d.c. to the transmitter. The user gets normal telephone speech conditions, including some side-tone, while recording and he unconsciously adjusts his voice to normal level without the aid of a volume indicator. The ringing circuit is switched via a $2\mu\text{F}$ capacitor in the set in order that ringing current from an incoming call can be applied to the telephone bell even if the switch is left in the "Record" position. While a recording is being made there is no connexion between the speech circuit and the exchange pair. In the amplifier, the selector switch applies h.t. to the bias oscillator, connects the input transformer to a power amplifier and connects the amplifier output, together with bias current, to the record/replay head of the tape system. At the same time, bias current is applied to the erase head to remove the previous recording.

The recording process commences when the "Start" button is pressed. This action sets the indicator pointer at the beginning of the time scale, and also operates relay B mechanically. As before, the tape drive motor is switched on, cycling the tape once until the micro-switches are opened; when this occurs, relay B releases and relay C cuts off the motor.

Checking the Recording

In turning the selector switch from "Record" to "Check", the only circuit changes are in the amplifier unit where the record/replay head is now connected to the input of a high-gain voltage amplifier, and h.t. is disconnected from the bias oscillator. Operation of

the "Start" button, as before, causes the tape to make one cycle during which the recording is heard in the telephone receiver but, because an attenuator is added to the amplifier output in this switch position, the recording is 3 or 4 db below the level which is available for transmission to line. By this means the user is able to hear the message at about the same volume as a local caller will hear it, and can satisfy himself as to its volume and clarity.

When standard direct-exchange-line service is required, the function switch is turned to "Off", disconnecting the mains supply, providing through circuits from the exchange pair and electrically dissociating the set from the telephone circuit.

Use of the Answering Set with Multi-Instrument Installations

To avoid complications in the wiring of extension-plan and similar systems, straps are provided in the set so that the exchange line can be intercepted when the function switch is at "On," while in all other switch positions the exchange pair is routed straight through the set. In these circumstances, a separate telephone instrument is provided for recording and checking.

Characteristics of the Record/Replay Amplifier

The recording amplifier can accept peak input signals of about 2 volts without distortion, i.e. it can accept the maximum speech voltage likely to be developed in the transmission circuit of a modern telephone; an equalizing network is included to reduce over-emphasis of sibilants.

The replay amplifier contains a compensating network giving a generally rising gain/frequency characteristic

which tends to offset loss of higher speech frequencies due to the comparatively low tape speed. The overall effect gives a substantially smooth frequency response over the range 600–2,200 c/s, falling by about 8 db at the extremities of the speech range of 300–3,400 c/s.

The speech voltage output to line closely follows the input level from the transmission circuit of the recording telephone, the variation being of the order of ± 2 db. The caller thus hears the recorded message at about the same strength as he would hear the called subscriber if the call were answered personally.

Power Consumption

The power consumption of the answering set has been kept low—a desirable feature since the set may be connected to answer calls over a long period and since

the subscriber provides the power. The consumption is approximately 15 watts in the standby condition and reaches a maximum of 36 watts when a recording is being made.

CONCLUSION

The Answering Set No. 1 caters for those subscribers who require a simply operated device which, in their absence, will give callers a message saying where or when they can be located.

ACKNOWLEDGEMENT

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