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The 555 PBX

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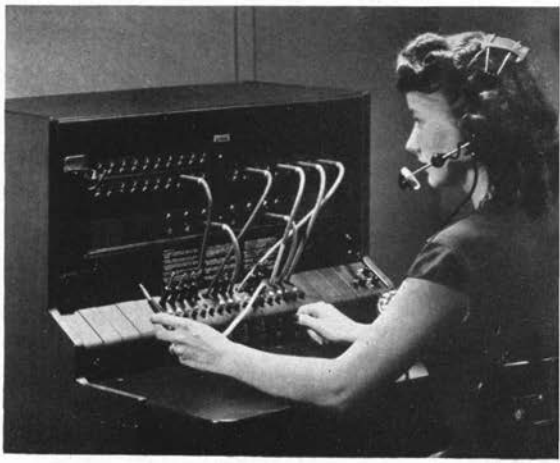
The 555 PBX is a non-multiple manual PBX switchboard designed to replace the present standard 551* and the earlier 550 boards in capacities up to 120 lines. The latter two types have long been familiar landmarks in offices generally and in department stores, small manufacturing plants, and hotels all over the country, and during the war even substituted as emergency central offices and toll switchboards.

Until interrupted by the war, development work had proceeded on the 555 board to a point where trial installations were made in the territories of several Associated Companies. The response by both the subscribers and the companies was very favorable, and resulted in the decision to complete development as soon as conditions would permit. Since the end of the war, steps have been taken to put the new switchboard in production at the Kearny plant of the Western Electric Company and units are now available for use in the Bell System.

The 555 PBX has a capacity of 120 lines, fifteen cords, and thirteen trunks. By use of a longer double-pulley cord available as an option, two of these boards may be placed side by side, and thus provide double this capacity. With over-all dimensions of about four feet high by two and one-half wide, it is somewhat wider than the 551, but its design is more modern in appearance, and many outstanding improvements are incorporated.

A front view of this new board is shown in Figure 1. It will be noticed that the cord circuit equipment—plugs, lamps, and ringing and talking keys—are in a sloping and short vertical section, and that a large unencumbered horizontal shelf, which on

Fig. 1—Front view of one of the new 555 PBX's



*RECORD, *July*, 1928, *page* 363.

previous boards was the key shelf, is available for writing or other work the attendant may be carrying on when not operating the switchboard. In the first row of the vertical jack section are the trunk jacks and lamps, and above these are the jacks and lamps for extensions. There is space for six extension jack strips, and these may be of either ten or twenty jacks per strip. With the wider spaced jacks, the entire space will be filled by sixty extensions, while by using the closer spaced jacks, there is room for 120 extensions. The dial shown at the right is used in dial system areas, and a handset —for which a mounting is evident at the left—may be used by the attendant if desired instead of the new 52A operator's telephone set shown.

One of the interesting features of this new board is the provision of the cord and trunk circuits in removable plug-in units. This makes it possible to avoid tying up excess equipment to take care of future expansion, since additional units may be added as necessary. One of the cord units is shown in Figure 2. Such a unit may be easily removed or added in a few moments merely by releasing two fasteners at the rear and disconnecting or connecting a plug. Central-office trunks and various types of tie trunks are similarly arranged as shown in Figure 3. The attendant's telephone circuit is also arranged in a plug-in unit. Besides taking care of the addition or removal of units, this plug-in feature will greatly assist maintenance. In case of serious difficulties on a particular unit, a spare tested unit can immediately be inserted, thus cutting down any service interruption to a minimum. However, the construction of the units is such as to make most of the apparatus accessible from the rear of the board, making it possible to inspect all relay contacts and most key contacts without removing the unit.

Such unit construction also lends itself to the most efficient and economical assembly-line manufacture, and the latest designs of apparatus and materials are used. All units employ die-cast and molded plastic parts not only to facilitate manufacture but also to permit maintaining the precise limits necessary for easy placement and removal in the switchboard.

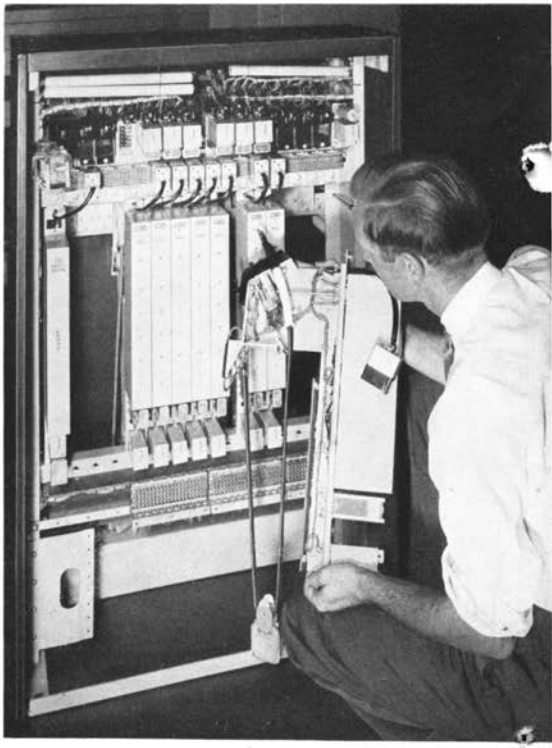


Fig. 2—Rear view of the 555 showing one of the cord units being removed

Another feature of the new board is the supporting of all equipment from an inner welded steel frame evident in Figure 4. Wood panels of either light oak or mahogany are secured to the frame by slide fasteners and screws, and may be put in place or removed in a few minutes. The wood casing members and the writing shelf are shipped in a separate package, and thus possible damage during shipment or installation is minimized. Surfaces subject to wear are afforded special protection. The jack panel and writing shelf have a facing of phenol fiber, and the edges of the end panels, which are of plywood, are faced with an extruded plastic strip that is glued in place.

In their operating features, the circuits of the 555 PBX provide essentially the same functions as the conventional switchboard. Lamps are lighted as signals from

the central office or extensions, and cords are used to complete the connection between the central office and the extensions, or between two extensions. However, the key operations used to accomplish these functions are entirely different from those of the usual lever type. For answering and talking, the lever of the cord key is turned to the right in a rotary manner in a vertical plane, and ringing is accomplished by push buttons located in the sloping section. The talking key is pushed inward to establish a through-dial or night connection and in this position is locked in place, minimizing the chance of accidental restoration of the key when the PBX is unattended.

Except in the smaller sizes, PBX boards have heretofore often required a local battery to maintain the operating voltage within satisfactory limits. By taking advantage of the most improved equipment and using a new switchboard lamp with a very wide operating range, the 555 has been designed to operate satisfactorily with voltages between 16 and 50, and thus under ordinary conditions will not require a local battery. Power and ringing current will both be supplied over cable pairs from the central office. A hand generator of a new and more powerful type is provided to supply ringing current in emergencies. Another improvement of the new board is the incorporation of extended trunk and station ranges, making possible the use of less long line equipment than was formerly required.

Any of three types of supervision may be provided by the cord circuits. On extension-to-extension calls, supervision is obtained independently from each extension. On central-office calls, "through" supervision is normally provided: the central-office operator gets the disconnect signals directly from the station. By a simple strapping change, however, conversion to "non-through" supervision is readily obtained. With this arrangement, the PBX attendant gets the disconnect signals, but this is not transmitted over the trunk to the central office until the PBX attendant disconnects the cord. By adding one optional relay, automatic discrimination on central-office calls can be achieved, thus providing "through" supervision on all outgoing telephone calls and "non-through" supervision on incoming calls.

A germanium varistor* of small size is provided as protection across the windings of each of the relays on the sleeves of the cords to reduce the potential which would otherwise be impressed on the cord sleeve when the plug is taken from the jack. The current drawn by the varistor is of the order of only 0.1 milliampere, which is much lower than would otherwise be required by the usual non-inductive relay winding employed for this purpose, and contributes to the lowered current requirements of the switchboard. An equally efficient condenser-resistance combination would oc-

*RECORD, *December*, 1948, *page* 485.

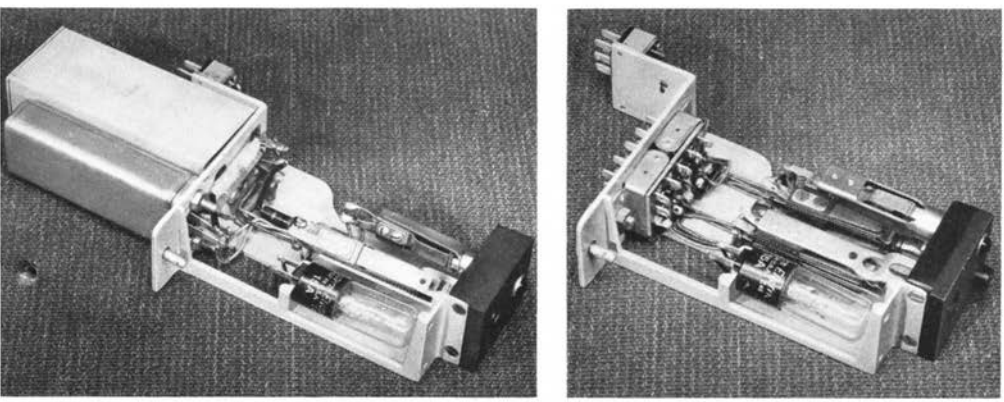


Fig. 3—Central-office trunk unit, left, and a ring-down tie trunk, right

cupy considerably greater space. However, the principal factor contributing to the low-current requirements is the use of UA-type relays instead of E-type relays.

Other new features included in the 555 are a master splitting key for handling "announcement" calls, and automatic grouping at times of light load when two positions are used. By operating the master splitting key after the called station has been rung on an incoming central-office call, the attendant can communicate privately with the called station. Position grouping at times of light load is accomplished automatically when the attendant's plug is removed from the telephone jacks, rather than by the usual grouping key operation. A UA-type relay rather than the conventional AC relay is employed as the ring-up relay, operating on ringing current rectified by a varistor. Two thermistors are provided in the circuit to prevent false operation of the ring-up relay on transient surges on the trunks, and to furnish the high impedance of the ringing bridge across the trunk required for the transmission of high-speed dial pulses from the PBX dial. This ring-up relay being across the trunk at all times eliminates the need for a similar relay in each cord circuit, since the re-ring signals are indicated on the trunk lamps instead of the cord lamps.

Like most new systems developed by the Laboratories, the 555 is a product of cooperative effort by many engineers. Among the author's associates who made significant contributions are R. L. Lunsford, V. I. Cruser, J. G. Ferguson, F. W. Treptow, O. C. Olsen, L. J. Bowne (retired), W. Bennett, R. W. Harper, A. Tradup, and P. V. Welch.

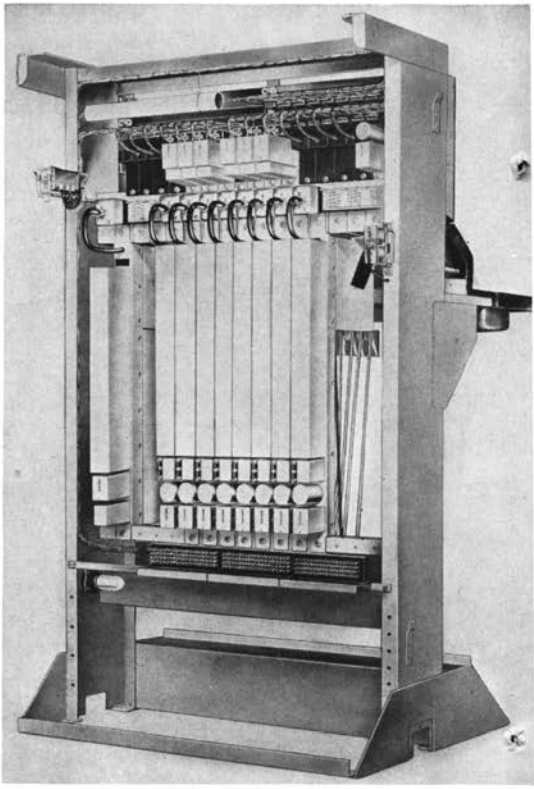


Fig. 4—The 555 board from the rear

THE AUTHOR: G. F. SOHNLE joined the Laboratories in 1921 as a technical assistant in the Systems Development Department. After completing the training course, he transferred to the equipment development group as a trial installation engineer, and later as an analyzation and PBX equipment development engineer. He continued his studies in the evening at the Polytechnic Institute of Brooklyn, receiving the E.E. degree in 1933. During the war years he engaged in the engineering of long transmission lines for the Armed Forces, and in the development of airborne radar. Following the war, he resumed PBX development work, and at present is engaged in developing equipment for automatic message accounting.