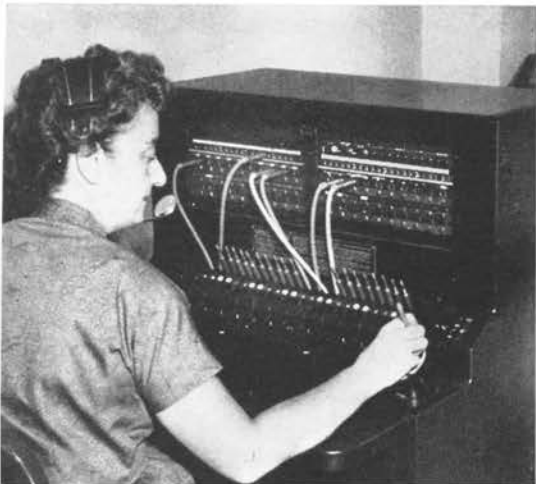# The 740-E PBX

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The manual attendant's switchboard that forms part of the 740-E private branch exchange.

For many years now, private branch exchanges of the dial type have been widely used as important adjuncts of Bell System service. The largest standard PBX is the 701-A°, which is capable of serving as many as 9600 station lines. Two smaller dial PBX's, the 740-A†, and the 755-A¶, serving a maximum of 88 and 20 station lines, respectively, have been available for the smaller installations, but many of the 701-A's have been installed where less than 88 lines are required because of their capability of expansion. The upper limit of 88 lines for the 740-A makes it uneconomical when the prospect of growth might call for its replacement by the 701-A.

Another feature that has sometimes made the 701-A preferable to the 740-A is its use of a manual switchboard for the attendant's position instead of the key turret used by the 740-A. On receiving an incoming call, the attendant at the 740-A PBX has to dial the station called even though the line is busy, since there is no indication of busy lines at the attendant's cabinet. When there are many incoming calls, this dialing may absorb an appreciable amount of the attendant's time, and many users, therefore, prefer a manual board so as to make more of the attendant's time available for other purposes.

°RECORD, *September*, 1929, *page* 36.
†RECORD, *August*, 1928, *page* 399.
¶RECORD, *June*, 1938, *pages* 332 *and* 336.

To avoid the need for installing a 701-A in place of a 740-A under these conditions, a manual board has sometimes been supplied with the 740-A, the combination then being known as the 740-AX.

To provide a small PBX that can not only readily be expanded to accommodate considerably more than 80 lines but that has a manual switchboard for the attendant's position, the 740-E PBX has recently been developed. Besides employing a manual board and permitting considerable expansion, the 740-E includes a number of other features new to the small PBX field, such as dial repeating type tie trunks from associated PBX's, and automatic line hunting.

Like the 701-A and the 740-A, the 740-E uses step-by-step switching. When there are not enough lines to require three-digit numbers, the 740-E employs only line finders and selector-connectors, as does the 740-A. The circuit arrangement is indicated in the simplified diagram of Figure 1. On its seven lower levels, the selector-connector acts as a connector: the first digit dialed selects the desired level, and the second digit moves the wiper around the selected level to the position of the called station. On the upper levels, however, the selector-connector acts as a selector: the single digit dialed selects the level, and then the wiper hunts over this level to find the first idle trunk. The number 0 level is generally reserved to reach the at-
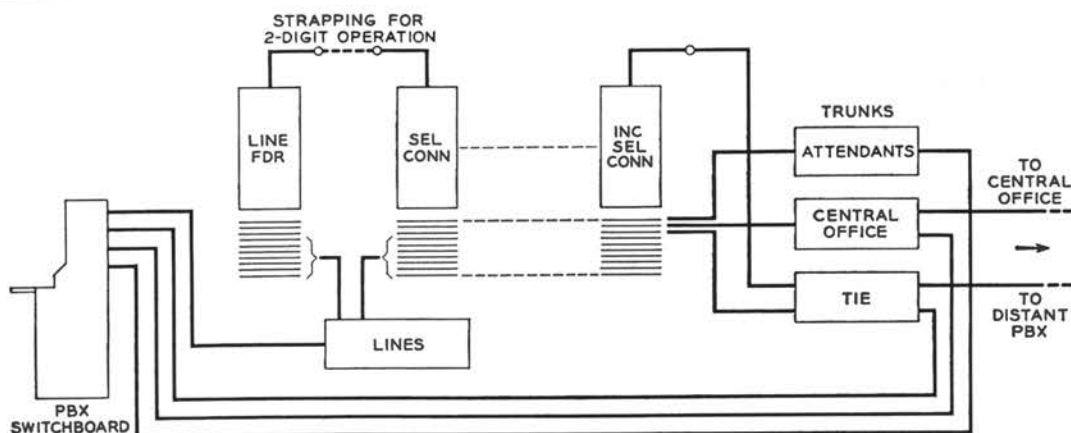
Fig. 1—Circuit arrangement of the 740-E where three-digit numbers are not required.

tendant, the number 9 level to reach central-office trunks, and the number 8 level to reach tie trunks. The 740-E, however, is not restricted to this particular use of the various levels. If there are more tie trunks than can be accommodated on a single level, for example, two levels, such as 7 and 8, might be used. It is also possible to use two digits for trunk designations. When this is done there might, for example, be three groups of trunks on a single level. Thus dialing 81 would cause the selector-connector to step to the 8th level and then to hunt over the first three trunks on that level; dialing 84 would cause it to step to the 8th level, then to the 4th position, and then hunt over the next three, and so on. Considerable flexibility is provided in the assignment and coding of all such trunks. Also incoming selector-connectors may be employed when it is desirable to permit
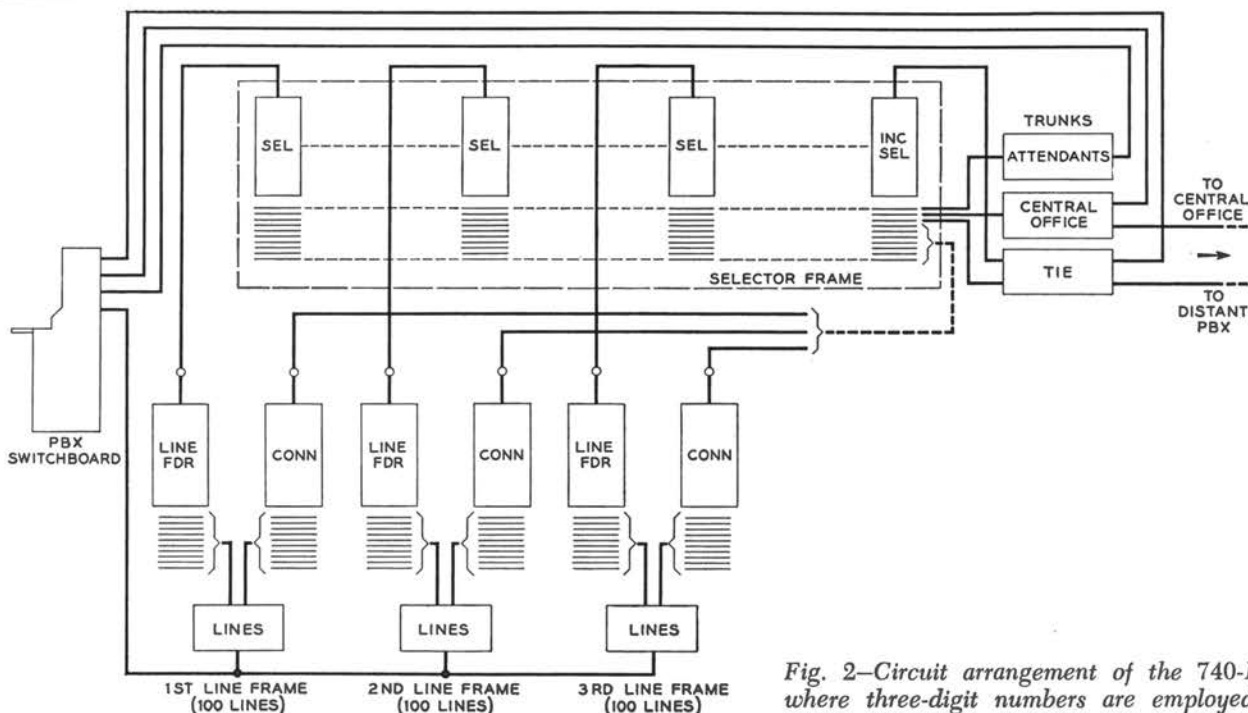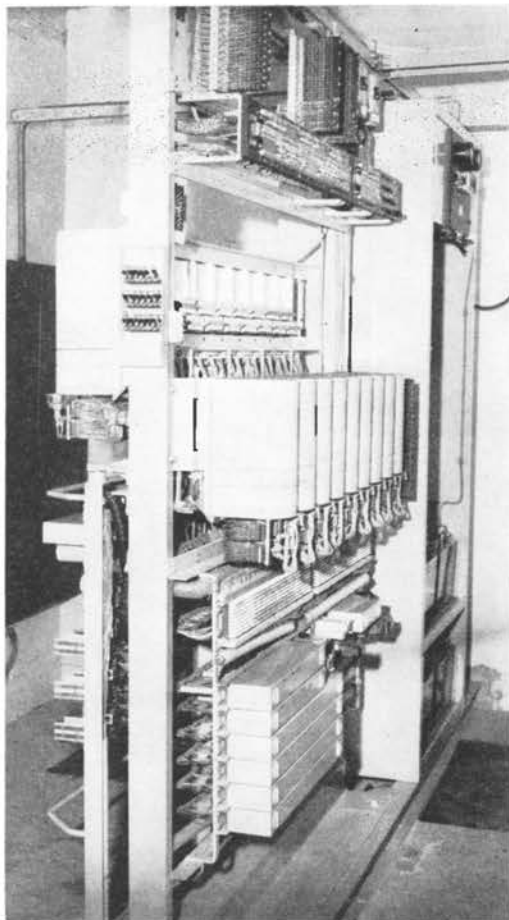

Fig. 2—Circuit arrangement of the 740-E where three-digit numbers are employed.
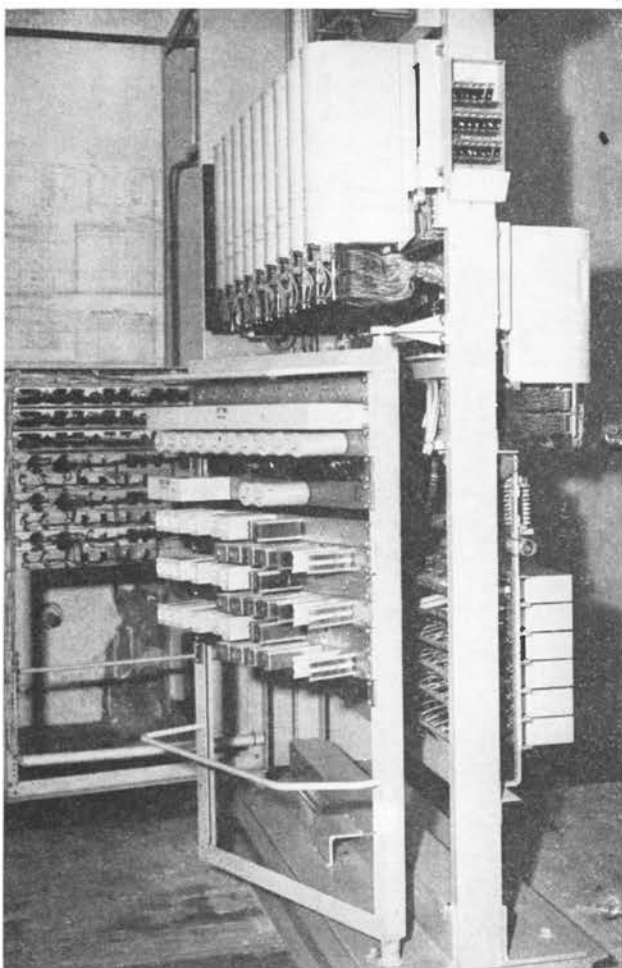
Front view of a line frame and its power supply.

local stations to be dialed directly over tie trunks.

For larger installations, three-digit numbers are employed, and selectors are added between the line finders and the connectors —the selector-connectors under these conditions may be arranged to act as connectors only, or may be replaced by connectors. The circuit arrangement for these conditions is shown in Figure 2. Here the digits 8, 9, and 0 are retained for tie trunks, central-office trunks, and the attendant, respectively, but for all local calls, three digits are used. When arranged for this type of operation, the 740-E has a nominal maximum capacity of 300 lines. One of the great advantages of the 740-E is that an installation may start out using only two-digit numbers and employ the circuit in Figure 1, and then expand to three-digit operation while the equipment is

in service merely by adding selectors between the points indicated in Figure 1.

This changing from two-digit to three-digit operation, and the application or removal of the many optional features provided is greatly facilitated by a bank of terminals just below the switches on the switching frames. Most of the options available can be obtained by strapping between these terminals. The connection from line finders to selector-connectors is made between sets of terminals in one of these blocks, and when selectors are added to secure three-digit operation, these jumpers are removed and replaced by cabling to the selector frame. Other changes possible by use of these terminal blocks include making non-assigned lines busy, making a line one of a "hunting"

Rear view of a line frame and its power supply.

group, and arranging a line for restricted service.

The 740-E PBX is arranged in standard "packages" that are wired, equipped, and tested in the shop. Only two types of switching frames are provided: line frames and selector frames. The former include line finders and selector-connectors, or line finders and connectors where three-digit operation is required, while the selector frames include only selectors. Six line frames are available: three with selector-connectors, and three with connectors. Only one selector frame is available. It is equipped with three shelves, but additional switch shelves may be added to the frame when required.

Besides the one or two types of switch frames, a complete 740-E installation includes a distributing frame, a power plant, and a manual switchboard. The power plant is the recently developed 105-C which in most of its features is like the 105-A already described in the RECORD*. For the attendant's position, the 556-A, non-multiple switchboard was developed. This is similar to the 555 type† in structure and general appearance, but has somewhat modified circuits. It will accommodate 180 lines in a single position or 380 lines in two positions.

*RECORD, *September,* 1928, *page* 28.
†RECORD, *April,* 1949, *page* 125.

To make the most efficient use of available space on the subscriber's premises, all the switch frames are made double-sided. In addition, swinging gates are provided on all line frames so that trunk and miscellaneous units may be mounted on these frames, and so that there will be adequate maintenance access to the rear of the relay units. Floor plans are available which specify the space required for the initial and ultimate needs of the subscriber.

To take full advantage of the standard "packages" of this new PBX, and to facilitate engineering, a new simplified order form has been devised that permits the various packages in any size PBX to be listed on a single page. Those items that depend on traffic conditions, such as trunks and additional equipment, are listed in a supplementary section of the order form.

The 740-E PBX is now in production, and it is expected that the reduction in the operating companies' engineering effort, the stocking of complete equipment units, and the reduced installation effort on a subscriber's premises, will enable service to be furnished more economically than was previously possible. The addition of the 740E PBX to the dial switching plant should therefore, find wide application among Bell System subscribers.

THE AUTHOR: R. D. WILLIAMS was graduated with a B.S. degree from Case Institute of Technology in 1945, spending three of his years there in the Navy V-12 program. He then entered midshipman's school and in August, 1945, became a radar officer on a destroyer. At the end of 1946, Mr. Williams joined the Laboratories, where he was engaged in trial installation of No. 5 crossbar. In 1947 he was concerned with equipment engineering on dial PBX and small community dial offices. Currently he is engaged in circuit engineering on step-by-step circuits and full selective ringing trial installation on ten party lines in small community dial offices.

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