

## *The 507A and 507B PBX*

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The 507-type PBX is a key-operated manual switchboard intended to replace the 500B type, which has been in general use for many years. The older design has been widely used by small businesses where not more than twelve station extensions and five central office trunks were required. Following the war, the Laboratories undertook a thorough modernization of this switchboard, which is the last PBX in the Bell System using magnetic signals and drops as line and supervisory signals. The replacement of these magnetic signals and drops by lamps was of prime consideration and was made economically possible by the development of a low-current lamp.

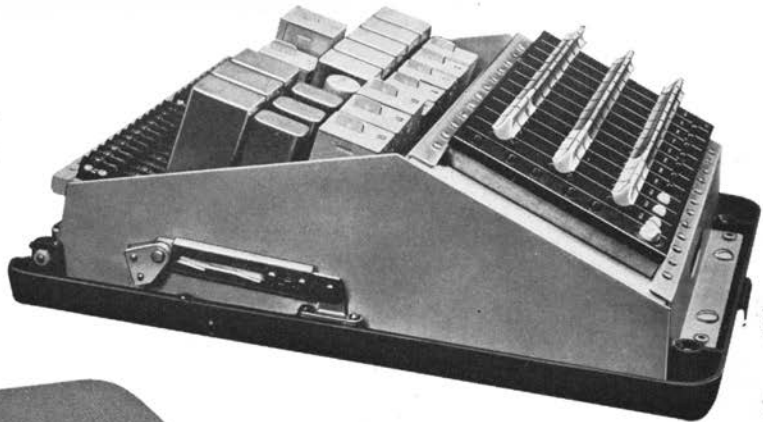
The 507A PBX, shown in Figure 1, has a capacity for three central office trunks

and seven extension lines, and the 507B PBX has a capacity of five central office trunks and twelve extensions. Both switchboards are provided with five connecting paths over which trunks are connected to extensions or which may be used for establishing extension to extension connections. Manufacture by the Western Electric Company of these switchboards was started in the second quarter of 1951.

The new PBX is a self-contained unit having modern styling and other features that make it compare favorably with present day commercial office equipment. The switchboard housing consists of lightweight die-castings finished in a beige-gray color with a fine wrinkle texture. The key handles have been especially contoured for maximum comfort and for ease of operation as well as to improve the appearance of the

\* RECORD, April 1929, page 331.

*Fig. 2—Removing the cover of the PBX exposes all the apparatus mounted on a metal chassis.*



*Fig. 1—The 507A PBX has capacity for three central office trunks and seven extension lines.*



*Fig. 3—The chassis is hinged, and may be lifted to expose the wiring.*



board. The use of lamps in place of magnetic drops and signals contributes significantly to the improvement of the over-all appearance. To further enhance the appearance of the board, the operating instructions have been provided on a pull-out slide located near the lower front edge of the PBX so that they are normally out of sight, and the cover locks are concealed under the designation strip, which is of the lift-off style similar to that provided on subscriber's key telephone sets only they are much larger.

Removing the cover exposes the sheet metal chassis, Figure 2, which mounts all apparatus including the keys, and is hinged so that it may be raised, Figure 3, to give access to the wiring, quite like the arrangement used for key shelves on conventional switchboards. The entire unit is surface wired with the aid of an ingenious wire retaining detail secured to the chassis. This detail supports the wires and provides a method of multiplying leads between keys without sewing or tying. The resulting wire loops permit removal of keys for adjustment and maintenance. A cable entrance hole is provided in the rear of the switchboard near the base to accommodate the house cable leads and the attendant's telephone-set cord, as well as the wiring for all optional equipment items. All external lead connections are terminated on screw terminals at the top rear of the chassis. The weight of the 507 PBX is approximately two-thirds that of the previous 506 board, and its volume less than one half.

Operation of the 507 PBX is essentially the same as of the 506 PBX except for the use of lamps in place of magnetic signals and drops. There are three keys in a vertical file associated with each trunk, with each extension, and with the attendant's telephone set. Those for the trunks are at the left and have light tan handles; those for the attendant's set also have light tan handles and are at the extreme right. Between these keys with light tan handles are keys with dark tan handles for the extensions. All key levers have three positions: up, normal, and down. The contacts of the operated positions of the two upper horizontal rows of keys, and the upper position

of the lower row, are multipled to form five connecting paths to which any of the trunks or extensions may be connected, as indicated in Figure 4. The down position of the keys in the lower row provides a hold position for trunks and a ringing position for the extensions. Below the keys is a horizontal row of line lamps, with white caps for the trunks and red caps for the extensions. At the left side of the cabinet is a vertical row of supervisory lamps with red caps for the five connecting paths.

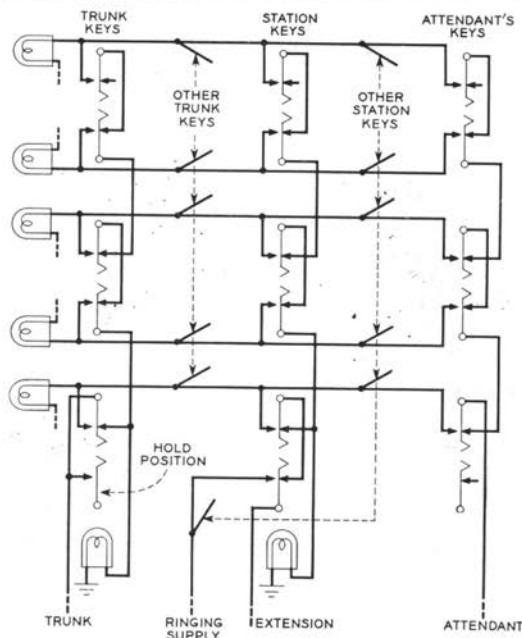


Fig. 4—Single-line diagram of the 507 type PBX indicating the arrangement of the trunks, extensions, and connecting paths.

When the line lamp of one of the trunks or extensions lights, the attendant operates one of the keys of her set to connect it to any of the five connecting paths that may be idle; and then operates the corresponding key for the calling trunk to connect it to the same path, and answers the call. If it is for an extension that is not busy, she operates the corresponding key for this extension to the selected connecting path, and then operates the lower key for this exten-

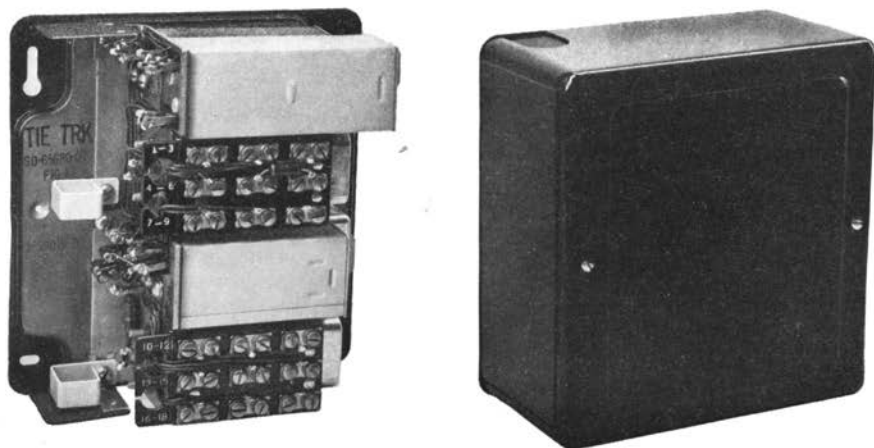


Fig. 5—The tie-trunk unit for the 507 PBX.

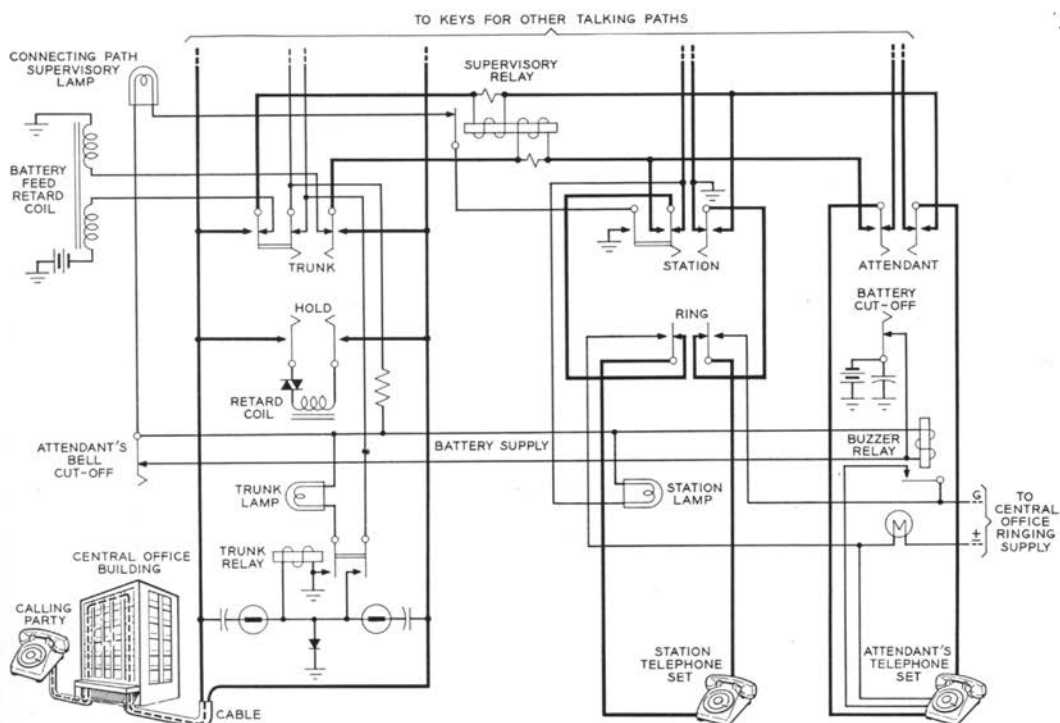


Fig. 6—Circuit schematic of the 507 type PBX showing circuit for one trunk, one extension, and the attendant's telephone set.

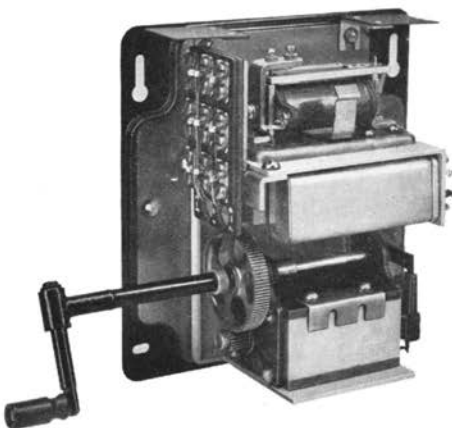


sion to the down position to ring. After the called station answers, the attendant restores her own key to normal. The same procedure is followed whether the call comes from a trunk or an extension. If the call is from an extension to a trunk, the procedure is similar except that ringing is not required, and the attendant may have to dial using the dial on her telephone set to establish the desired connection.

If the buzzer key at the lower left of the key panel is turned on, the ringer in the attendant's telephone set will ring whenever a lamp lights. This enables the attendant to give attention to other duties during periods of light traffic.

The supervisory relays associated with the five connecting paths in the PBX are each provided with two identical sets of windings, indicated in Figure 6, one of which is connected in the tip and the other in the ring lead so as to minimize noise and crosstalk, particularly on connections involving long off-premise lines where balanced transmission is quite important. Also the battery feed retard coils, one of which is required for each of the connecting paths, have been designed with a resistance high enough to be self-protecting on 48-volt batteries, eliminating the need for resistance lamps in these circuits which would otherwise be required.

The trunk lamp is under control of a ring-up lock-up relay and lights on incoming calls from the central office. The relay is operated by rectified ringing current from



*Fig. 7—Hand generator and buzzer unit for the 507 PBX, with cover removed.*

a half-wave germanium varistor rectifier, and is held up through a locking contact connected to the d-c battery supply. The rectifying circuit is provided with two series thermistors to guard against false operation of the trunk lamp during dialing or other momentary pulses, and blocking condensers are employed to isolate the rectifier circuit from talking battery.

The trunk holding bridge, which is applied manually by means of the trunk holding key, embodies a new arrangement of a low resistance retardation coil and a silicon-carbide varistor. This combination, because of the characteristic resistance of the silicon-carbide, provides a low resistance path during holding and a high resistance bridge

**THE AUTHOR:** After F. W. TREPTOW left Stevens Institute of Technology in 1918, he worked for several concerns before coming to the Bell Laboratories (then Western Electric Engineering Department) in 1920. His first assignment was that of draftsman in Apparatus Development, but shortly afterwards he transferred to Systems Drafting. In 1922 he became concerned with equipment engineering on dial systems, continuing in this work, which included No. 1 Crossbar development, until World War II. During the war, he was in charge of the mechanical design of several radar projects, including parts of the SCR 545 gun-laying radar, the AN/APQ-7 bombing radar, and the AN/APG-1 night fighter radar. Since the war, and until recently, he was in charge of the mechanical design of telegraph systems, key telephone equipments, and manual and dial PBX's. A short while ago, he was placed in charge of the large

and small step-by-step central office mechanical design, and continuing his work on manual and dial PBX's.



when shunted by a connected telephone. This occurs because the resistance of the varistor increases as the voltage across it decreases. The arrangement minimizes transmission losses due to the presence of a holding bridge on a completed connection if the attendant through oversight fails to restore the holding key. The station extension key at the extreme right of the board is equipped with a line relay, which under low battery-voltage conditions will permit a longer extension loop than the other keys.

Two auxiliary units have been made available for use with the 507 PBX, and local conditions will determine the need for either or both. A ring-down tie trunk unit so compactly designed that it will mount in a  $7 \times 7\frac{1}{2} \times 3\frac{1}{2}$ -inch apparatus box, Figure 5, has been provided for installations requiring direct connections with another

PBX. The wiring for the first station extension circuit of the switchboard is wired in such a manner that conversion for its use as a ring-down type trunk is accomplished simply by disconnecting some strap wires at the terminal strip and attaching the cable to the tie trunk. This is a considerable improvement over the tie trunk arrangement used in the present 506 PBX, which requires a costly wiring rearrangement in the PBX proper.

In cases where ac ringing power is not available, or where it is desired to cover failure of the regular ringing power, a hand generator is provided in a  $7 \times 7\frac{1}{2} \times 3\frac{1}{2}$ -inch apparatus box, Figure 7, which may be mounted on the end of the attendant's desk. This unit has been flexibly designed for either right- or left-hand operation as may be desired.