

A transmission package for the 500 telephone set

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Transmission Apparatus Development



One design objective of the 500-type telephone set was that it be easy to assemble and wire in the factory. The 425A network designed for this set made an important contribution to this objective. In a single, sealed package it combines the induction coil, the talking and ringing capacitors, the dial radio interference filter and the sidetone balancing impedance°. Its terminal plate supplies the principal connecting block for the set.

° RECORD, July, 1934, page 347.

The circuit elements of the 425A network and the terminals which it provides to facilitate connections between other parts of the telephone set are shown in heavy lines in Figure 1. To maintain present sidetone levels with the more efficient instruments of the new handset a balancing impedance was required having the characteristics shown by the solid lines in Figure 2. The fixed resistance of earlier sets would meet these requirements only at one frequency. The desired resistance-reactance combination is of the form shown to the left of Figure 3. Involving among other elements a 2-mf capacitor, it would be large and expensive if built with conventional parts. G. A. Persons solved the problem by means of the equivalent auto-transformer network shown at the right of Figure 3. Its characteristics are shown by the dotted curves of Figure 2.

The inductance element L is furnished by the self-inductance of the (R-1) winding of the autotransformer. The resistance R_A is made up of the effect of losses in the autotransformer core, paralleled by the d-c resistance of the short-circuited portion of the winding stepped up by transformer action. By stepping down the impedance of a series capacitor-resistor combination (extreme right of Figure 3) a small 0.2-mf capacitor was made to do the work of the

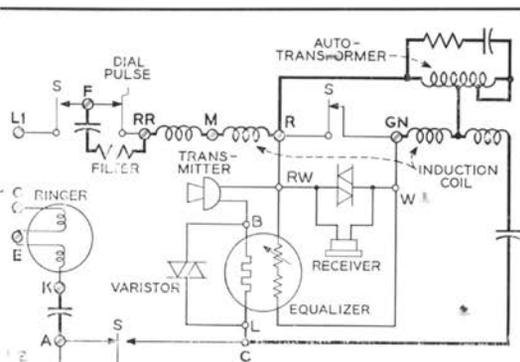


Fig. 1—Circuit of 500-type telephone set. Heavy lines denote circuit elements and terminals provided by 425A network.

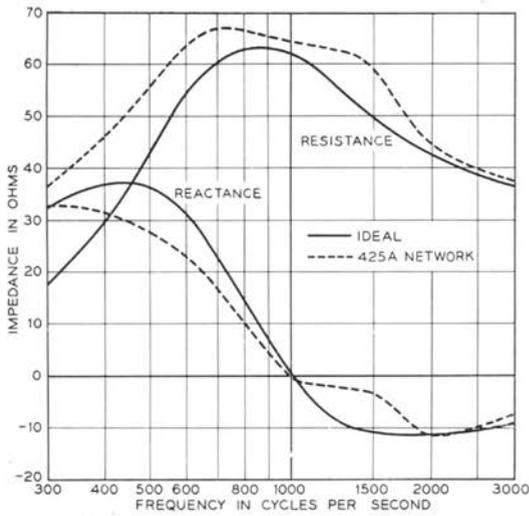


Fig. 2—Characteristics of anti-sidetone balancing impedance. The solid lines show the impedance required to maintain present sidetone levels for the more efficient instruments of the new bandset.

needed 2.0-mf unit. A further space saving was realized by utilizing the newly developed metallized paper capacitors† which are less than half as big as conventional foil-paper capacitors.

Packaging seven circuit components in one container (Figure 4) provides ease of mounting and wiring into the telephone

† RECORD, February, 1951, page 56.

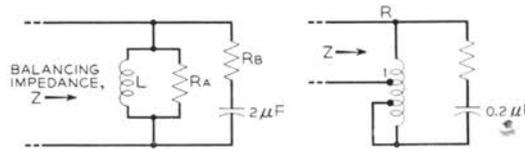


Fig. 3—Autotransformer network at the right and its equivalent impedance at the left.

set, minimum space requirements, excellent protection of the elements from damage, and low cost. The internal wiring is done under close factory supervision and control, and several external interconnections with their added cost and danger of error are eliminated. The package is automatically tested on the production line before being incorporated in the telephone set assembly. Careful design for long component life is essential since any element failure would necessitate replacement of the entire package.

To insure long, trouble-free life the induction coil and autotransformer windings are interleaved with cellulose acetate sheet and ample end margins are provided to avoid short-circuited turns or layers. The magnet wire is insulated with "solder-through" enamel to eliminate the danger of damage in enamel scraping operations and to avoid poorly soldered connections due to failure to clean the wire properly. It also provides cheaper soldered connections. The four capacitor units, being of



Fig. 4—Elements of the seven circuit components of the 425A network.

the metallized paper type, are "self-healing" in case of dielectric failure due to high voltage surges. The container is a sturdy steel can, and as a final safeguard the entire assembly is dried, and the can filled with moisture-excluding compound. In addition to providing mechanical protection, the can also serves as a magnetic shield to prevent crosstalk when the talking circuit is connected to one line and the ringer to another, as is necessary in some wiring plans.

The molded plastic terminal plate (Figure 5) is equipped with both solder type terminals for permanent connections and screw type to facilitate field changes where, for example, a change in the class of service is required. There are molded projections to hold the set wires in place during soldering. Accidental contact between cord tips or between the tips and adjacent terminals is prevented by means of terminals on different levels and molded stop-studs. Other molded studs prevent cord tips from

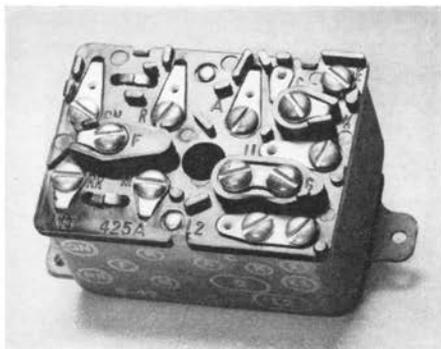


Fig. 5—Cover of 425A network was designed to make connections simple and accurate.

backing out from under the terminal screws when screws are tightened. The 425A network enables the 500 set to meet its circuit performance objectives as well as those having to do with space limitations, durability and manufacturing economy.



THE AUTHOR: W. R. NEISSER received an A.B. degree in 1925 from Bucknell University and a B.S. degree in E.E. two years later from the University of Pennsylvania. He worked for the New Jersey Bell Telephone Company for a few months on the extension of local telephone plant facilities, and in 1928 accepted a position with the Laboratories, where he has since been engaged in design work on small coils and transformers, principally those used in subscriber and operator sets.