Miniature transducers and modern electronics have been combined to give the Bell System two new lightweight telephone headsets to be used by operators. Both kinds of headsets are designed for comfort and have improved transmission performance.

Telephone Headsets With a New Look

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IN THE NEWLY DECORATED OFFICES housing the traffic service position system (TSPS), the bulky 52-type operator headsets appear as much out of place with the carpeting and soft lighting as the old breastplate headsets used at the turn of the century. Modern times call for modern designs and as the attractive TSPS consoles replace the old cord switchboards, new lightweight headsets are also replacing the old 52-type sets. The Bell System has introduced two new lightweight headsets, called 60A and 61A, to fulfill the needs of telephone operators today.

The 61A is a personalized headset very small in size. An ear insert, which couples the receiver to the ear, is custom-molded to fit the ear of each operator and to support the headset. And since it no longer uses a headband, the new headset doesn't rumple the hair when the operator takes it off and puts it on. The operator talks through an adjustable, transparent tube, which directs the voice to a miniature transmitter located in the ear capsule. A cord connects the ear capsule to a plug containing a transmitting amplifier. Attached to the cord is an adjustable lanyard that protects the operator against any jolts on the cord or forces being transmitted to the ear.

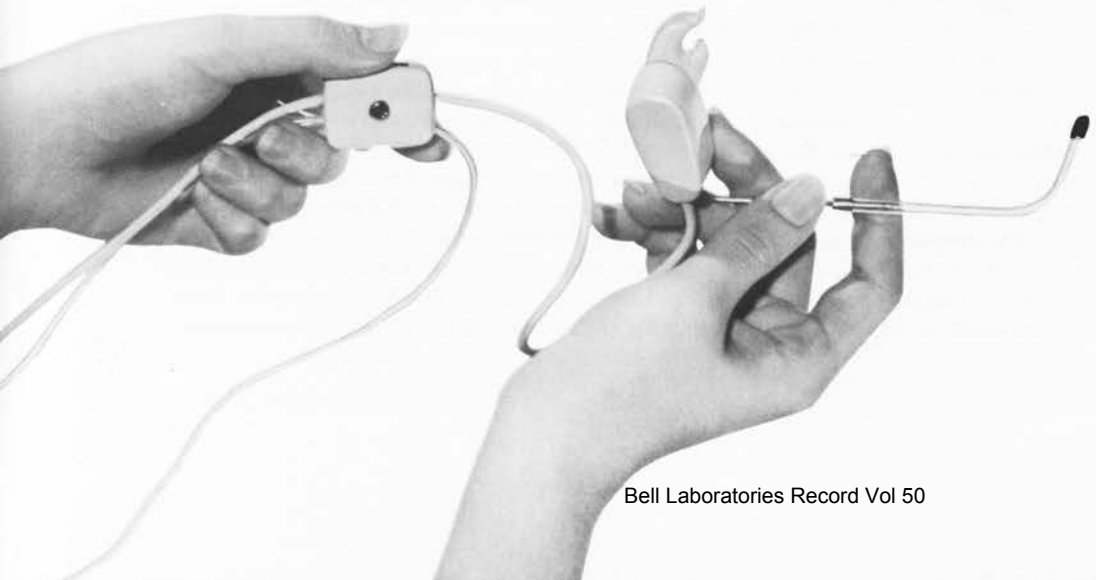
Since custom-molded ear inserts add an expense to headsets that might not be justified for short-term employees, a second headset, 60A, was designed. This headset employs an ear capsule, about the same size as the one on the 52-type headset, that is held onto the ear by a lightweight spring headband. The ear capsule contains a new receiver a little more than 1½ inches in diameter and the same miniature transmitter used in the 61A headset. Other features of the 60A headset are identical to the 61A.

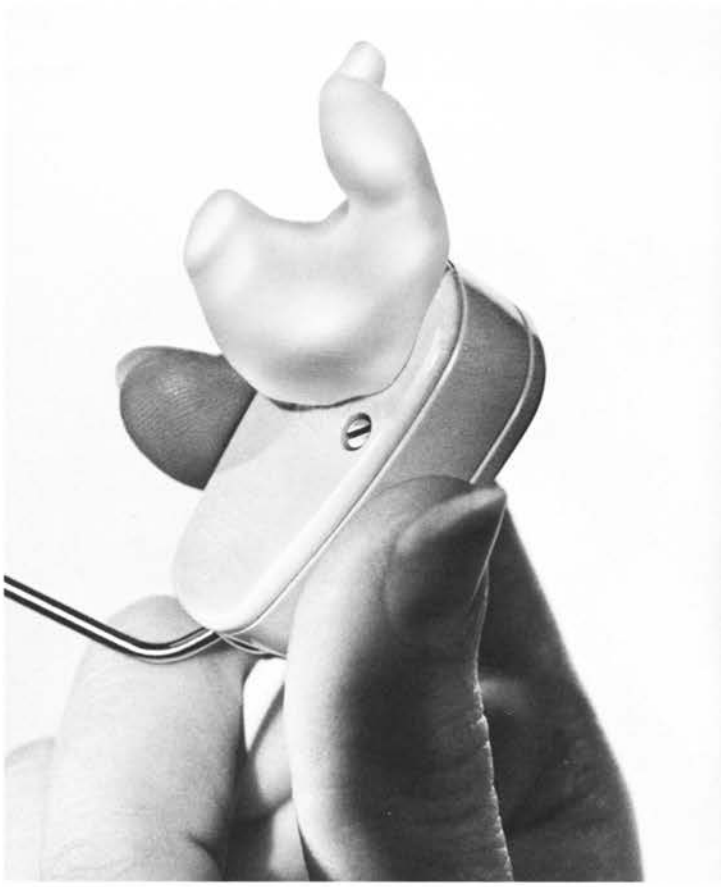
Bell Labs began developing these headsets at

Holmdel, N. J., in 1963, by investigating various possible lightweight designs. Four designs were finally chosen for field trial in 1965. Results showed that operators preferred sets similar to the 60- and 61-type sets over all other types of headsets. Work then began on components that would meet the requirements of the Bell System for transmission performance and reliability.

The development included a new miniature transmitter, a miniature and regular-size receiver unit, two ear capsules, two amplifier housings, and an amplifier. The ear capsule in the 61A headset contains a transmitter and receiver unit packaged in a sealed plastic case. The physical design of this receiver and transmitter capsule was particularly important since mechanical, magnetic, and acoustic coupling could affect the performance. If coupling is too great, a high-pitched tone may develop, which will be heard by both the operator and the person to whom she is talking. Unwanted acoustic coupling is removed by mounting the transmitter and receiver units in separately sealed compartments.

Susan J. Kaplan of Bell Labs, Murray Hill, N. J., demonstrates two new operator headsets designed at the Indianapolis location. The 60A set (top) has an ear capsule about the same size as the one on the older 52-type model, and is held onto the ear by a lightweight spring headband. The second headset, 61A (right), is yet smaller in size and is worn without a headband. A cord (below) connects the ear capsule to a plug containing a transmitting amplifier. Attached to the cord is an adjustable lanyard that is worn around the neck.





The operator adjusts a transparent tube (above), through which the voice is sent to a miniature transmitter located in the ear capsule. The ear insert (right) is custom-molded to fit the ear of the operator. Silicone rubber kits are supplied to allow each office to produce custom earmolds as required. The earpiece is soft and flexible and can be used several hours after molding.

Attached to an opening in the transmitter compartment is the speech-tube assembly. The assembly comprises a metal tube with a ball joint and a plastic tube, which slides along the metal tube. Thus, the length and angle of the speech tube can be quickly adjusted. The end of the plastic tube contains a porous metal disc for absorbing acoustic resonance in the tube and a wound-wire tip that softens harsh sounds generated from words starting with explosive sounds such as the letter "p".

The cord is attached to the ear capsule through a connector on the end of the cord and contact springs on the capsule. The custom-molded ear insert is attached by a snap which also serves as the sound port to the receiver compartment.

The ear capsule of the 60A headset is similar in shape to that of the 52-type headsets except it has been elongated slightly to hold the miniature transmitter and receiver units. The transmitter is carefully mounted to eliminate coupling from the receiver unit and is attached to a speech-tube assembly identical to that of the 61A headset. Unlike the 61A headset, which is inserted into the ear, the ear capsule of the 60A headset is held against the ear by a new lightweight headband which is attached by a yoke-and-gimbal assembly in such a way that the capsule can pivot and rotate for proper fit.

The new miniature transmitter and receiver units differ only in the design of the coil and acoustic chamber in back of the diaphragm. Both units are about 0.5 inch in diameter and 0.2 inch thick. Known as electromagnetic transducers, these units convert acoustic signals to electrical signals and vice versa. An electrical signal is generated by the coil when the diaphragm is energized by an acoustic signal and, conversely, an acoustic signal is generated by the diaphragm when an electrical signal is applied to the coil. The transducers have a rugged design so that they will operate reliably for many years.

The transmission characteristics are such as to produce intelligible and natural speech. Frequency response is similar to that of a normal customer telephone, except that distortion has been reduced to a minimum. The overall transmission characteristics of the headset are governed by the speech

tube, transmitter, amplifier, and sidetone circuit. The transmitter characterizes the general shape of the frequency response, the speech tube amplifies low frequencies, and the amplifier filters out low and high frequencies while also boosting low frequencies. The transmission response therefore has a smoother, more desirable shape than that of other headsets.

The headset amplifier adds about 45 dB or 55 dB of gain to the transmission path and operates over a wide range of voltages and currents. This type of dual-gain amplifier was necessary because the efficiency of the carbon transmitter used in 52-type headsets varies with the amount of available current. Although the operator telephone circuits used in central offices and at some larger PBX locations have a local battery supply that provides adequate current for good transmission levels, the available current is severely limited on most PBX consoles and all jack-equipped station sets by other circuits. In these circuits, the output of the 52-type headset is about 10 dB below the desired levels. To correct this difference, amplifiers with 10 dB of gain have been added to all PBX consoles and jack-equipped station sets. Thus, for the lightweight headsets to work interchangeably with 52-type headsets, their output levels had to be lowered by 10 dB. This adjustment in level is done automatically by a circuit in the headset amplifier which detects the amount of current available from the operator or telephone circuit and changes the amplifier gain appropriately. Thus, correct transmission levels are always maintained so additional adjustments are unnecessary.

Another requirement that added to the complexity of the amplifier was the need to attenuate low-level input signals, such as background noise and speech from operators working nearby. Although this attenuation is inherent to a small degree in the 52-type headsets due to the nonlinear characteristics of the carbon transmitter and its tendency to reduce weak signals, such characteristics are not exhibited by electromagnetic transmitters. Instead, a circuit was added to the new headset to attenuate signals in the amplifier when sound pressure drops below a predetermined level.

The receivers in the new headset generate acoustic output levels comparable to normal telephones and about 2 dB greater than the 52-type headsets. The frequency response of the lightweight headsets has also been improved over the old headsets by cutting off low-frequency noise from the line. In addition, the high-frequency audio output in the 61A telephone headset has been increased to simulate the normal amplification that takes place in the auditory canal of the ear, which is eliminated by the earmold.

The speech-tube assembly comprises a metal tube with a ball joint and a plastic tube, which slides along the metal tube. The end of the plastic tube contains a porous metal disc for absorbing acoustic resonance and a wire tip that softens harsh sounds.

Germanium varistors are used with the receiver units of both the 60A and 61A headsets to protect the operator's ear from high acoustic pressures. These varistors, connected in parallel with the receiver unit, break down or short circuit at voltages such that outputs from the receiver never exceed 120 dB.

The new receiver unit in the 60A headset is designed to replace all other Bell System receiver units in the future. The design of the receiver—a bipolar, electromagnetic unit—is the result of a joint effort by Western Electric and Bell Laboratories to develop an efficient and universal unit which can be produced economically by automated equipment. The first units were installed in the 60A headset. They are also currently being used in 52-type headsets as well as in other telephone apparatus, such as the TRIMLINE® telephone headset.

The lightweight headsets form a new family of units compatible with present plant equipment and signal levels and at the same time with improved transmission characteristics. The sets have been widely accepted by operators because they are light in weight and can be worn for long periods of time comfortably.