



## *An Experimental Picture-phone*

*H. L. Barney, at the left, demonstrates how one experimental model of a Picture-phone would be used. Camera lens is mounted above picture.*

A telephone that transmits pictures along with sound is being developed toward commercial feasibility, Bell Telephone Laboratories announced recently at a joint meeting in Los Angeles of the Institute of Radio Engineers and the West Coast Electronic Manufacturers' Association. An experimental "Picture-phone" system has been used to transmit recognizable pictures over various distances including transmission from New York to Los Angeles.

Experimental pictures vary in size from one by one and a half inches to two by three inches, and are viewed from one to two feet away. Unlike television, a new picture is displayed every two seconds. It has good black-and-white contrast and the person at the other end of the line is recognizable. Head and shoulders can be seen and facial expressions are readily apparent.

It will be possible for a caller's picture to be "dialed" like an ordinary telephone call, provided the switch on the picture equipment is turned on at both ends of the line. If the switches are off, the telephone call will be completed without pictures. The picture can also be turned on after a conversation is underway. It would be impossible for a customer to be seen by the caller unless his switch was turned on.

Operation of the Bell Telephone Laboratories Picture-phone system has been made possible by slowing down the rate of transmission of picture information to such an extent that the required bandwidth can easily be handled by conventional telephone circuits. The raster is made up of 60



*R. L. Miller examines picture strip from facsimile-type recorder being investigated at the Laboratories for possible use in receiver.*

lines, each of which may have a maximum of 40 dots. Thus, each complete frame may be thought of as being made up of 2,400 dots. If a single frame were transmitted each second, an over-all bandwidth of 1,200 cycles per second would be necessary. With the present system, one complete picture is transmitted every two seconds, requiring a bandwidth of 600 cycles per second.

This 600-cycle "video" band contains very low frequency components which might suffer undue attenuation during transmission over phone lines. Therefore, a carrier scheme is employed in which the "video" signal amplitude-modulates a 1,200-cycle carrier. The transmitted intelligence is then

a conventional amplitude-modulated double-side-band signal with a frequency range of 600 to 1,800 cps. This signal lies within the range of optimum transmission of telephone lines, and so can be treated exactly like a voice signal. It can be passed through repeaters, and transmitted via microwaves, coaxial cable, twisted pair, or open wire lines.

One possible line-up of components, which has been tested experimentally, uses a conventional TV camera of the type employed in industrial TV systems. This camera contains a Vidicon tube and the necessary horizontal and vertical sweep circuits for producing a raster. These circuits are so adjusted that the 60-line raster is obtained with one complete scan occurring every  $1/20$  second.

Since the transmitted picture repetition rate is only one every two seconds, a total of 40 scans is available in the two-second interval. One of these scans is arbitrarily selected and the remaining 39 are unused. The information in this scan is recorded on a magnetic drum which is rotating at a speed of 20 revolutions per second. All of the picture information for a single frame is thus recorded on a single rotation of the drum.

By means of suitable gating and timing circuits, this stored information is then picked off the drum at  $1/40$  the rate at which it was recorded. Thus, by the time it has turned 40 revolutions (an interval of two seconds), all the information from a single scan has been passed on to the modulator, and the drum is erased and made ready for the next picture. At this point, timing and synchronizing



*F. K. Becker demonstrates the use of another experimental Picture-phone arrangement being studied for possible further development.*

data are combined with the signal to be transmitted. Such data are added in much the same manner as synchronizing information is combined with a conventional TV signal.

It is possible to take advantage of the storage properties of the camera tube itself, and thus eliminate the magnetic drum memory system. By means of a suitable shutter arrangement, the image tube can be made to receive a momentary image once every two seconds, and then the whole two seconds used for the scanning procedure. The signal thus derived can be sent directly to the modulator. Sufficient experience has been gained with this technique to indicate that it is feasible.

A number of other possible transmitting and receiving systems are being investigated, and some of these are indicated in the accompanying photographs. Exploratory work is also under way to determine the combination of picture repetition rate and resolution which will make best use of the available bandwidth. In its present form, equipment for the Picture-phone is rather bulky and expensive, but avenues are being explored for reducing the size, complexity and cost.

The picture equipment is still being developed and evaluated, and is not ready for manufacture or commercial use. After further development, it could be offered as a separate, optional telephone service. The system was devised at the Laboratories by W. E. Kock, F. K. Becker, R. L. Miller and others.

*Left to right, R. L. Miller, H. L. Barney and F. K. Becker discuss tests on an experimental viewing unit.*

