

Stereo-Television in Remote Control

By H. R. Johnston, C. A. Hermanson, and H. L. Hull

THE STUDY of the possibilities of using three-dimensional television in conjunction with remotely controlled electric manipulators is part of a long-range development program being undertaken by the Remote Control Engineering Division of the Argonne National Laboratory.

Manipulation of objects in three dimensional space requires that depth perception be incorporated into any scheme used to view and control the means of manipulation. It is not sufficient to use ordinary two-dimensional television for this purpose since the ability to judge depth is almost entirely lacking.

A standard Du Mont television pick-up chain was employed in the development of stereo-television. The stereoscopic pair of images are placed side by side by a twin lens system onto the photocathode of the television camera tube. The images occupy the same space on the photocathode as a single image in standard two-dimensional television and they are transmitted simultaneously. At the receiving end of the stereo-television system, the two images

appear side by side on the face of a standard kinescope or television picture tube.

Two polarizing filters whose axes of polarization are at right angles to each other are placed immediately in front of the images on the cathode-ray tube. An observer wears a pair of polarizing spectacles so oriented that the right eye is permitted to see only the right-eye image and the left eye sees only the left-eye image.

A second method used to view the three-dimensional television pictures makes use of two television picture tubes. These tubes are arranged at right angles to each other and a semi-transparent mirror is placed so that it is at 45° with both tubes. Crossed polarizing filters are placed in front of each picture tube and the observer wears crossed polarizing spectacles. The observer is enabled to see the three-dimensional image by observing one image by transmission through the semitransparent mirror and the second image by reflection.

To test adequately the possibilities of the stereo-television system as a means of seeing objects in three-dimensional space, two mechanical Master-Slave manipulators were arranged so that the operator sat with his back to a wall, behind which the slave hands and the stereo-television were located. The operator faced the stereo receiver and saw a three-dimensional image of the manipulator "slave" hands and objects in the work area, while with his hands in the "master" controls he manipulated objects in the field of view. After a few

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minutes of indoctrination any person with normal vision can be taught to see and manipulate the objects in view from a remote distance. In another setup, an electrically operated manipulator was made to perform miscellaneous feats of lifting objects and pouring liquids from one beaker to another, while the operator controlled its movements from another room over 50 ft away.

The present system of stereo-television using one camera pickup tube, gives a stereo picture which has an aspect ratio of three high and two wide. This

may be undesirable for use in any permanent installation. In addition, the field of view is restricted, and the resolution is adversely affected.

A more desirable system would consist of the use of two television camera pickup tubes arranged side by side in a horizontal direction. The left pickup tube would supply a left-eye view to one of the receiving tubes of the dual viewer and the right pickup tube would supply the video signal for the second receiving tube.

ABSTRACT

The Orthogam Amplifier

By C. L. Townsend and E. D. Goodale

FOR SOME TIME it has been known that iconoscope film pickup tubes^{1,2} do not produce video voltages ideally suited for reproduction by a normal kinescope unless gradient correction is applied. A re-evaluation of the transfer characteristic required in the television transmission system for optimum picture quality was undertaken, to include conditions actually encountered in normal commercial broadcast operation.

A series of slides was produced, each having an "average gray" background (density about 1.2) and, centered in that area, a rectangular "window." Each slide was made with a different window density, to cover the range normally

encountered in practice. The slides were projected in succession, and in such a way that the same portion of the mosaic was used for each window. Oscilloscope readings of the voltages so generated showed a reasonably linear relationship with window density.

To determine the characteristic which is actually obtained in the existing recording-reproducing system, the "window" test was again used. A video voltage, representing the window and an appropriate background, was fed to the recording system. The amplitude of the voltage of the window proper could be precisely controlled to produce any value within the normal recording range, plus some excess into overload values, if desired. A recording was made of this signal, and the film processed normally. That film was then reproduced on an iconoscope system, and the output voltage values noted on an oscilloscope.

Abstract by Clyde R. Keith of a paper by C. L. Townsend and E. D. Goodale, Engineering Dept., National Broadcasting Co., Inc., RCA Bldg., Radio City, New York 20, published in *RCA Review*, vol. 9, no. 3, pp. 399-410, Sept. 1950.