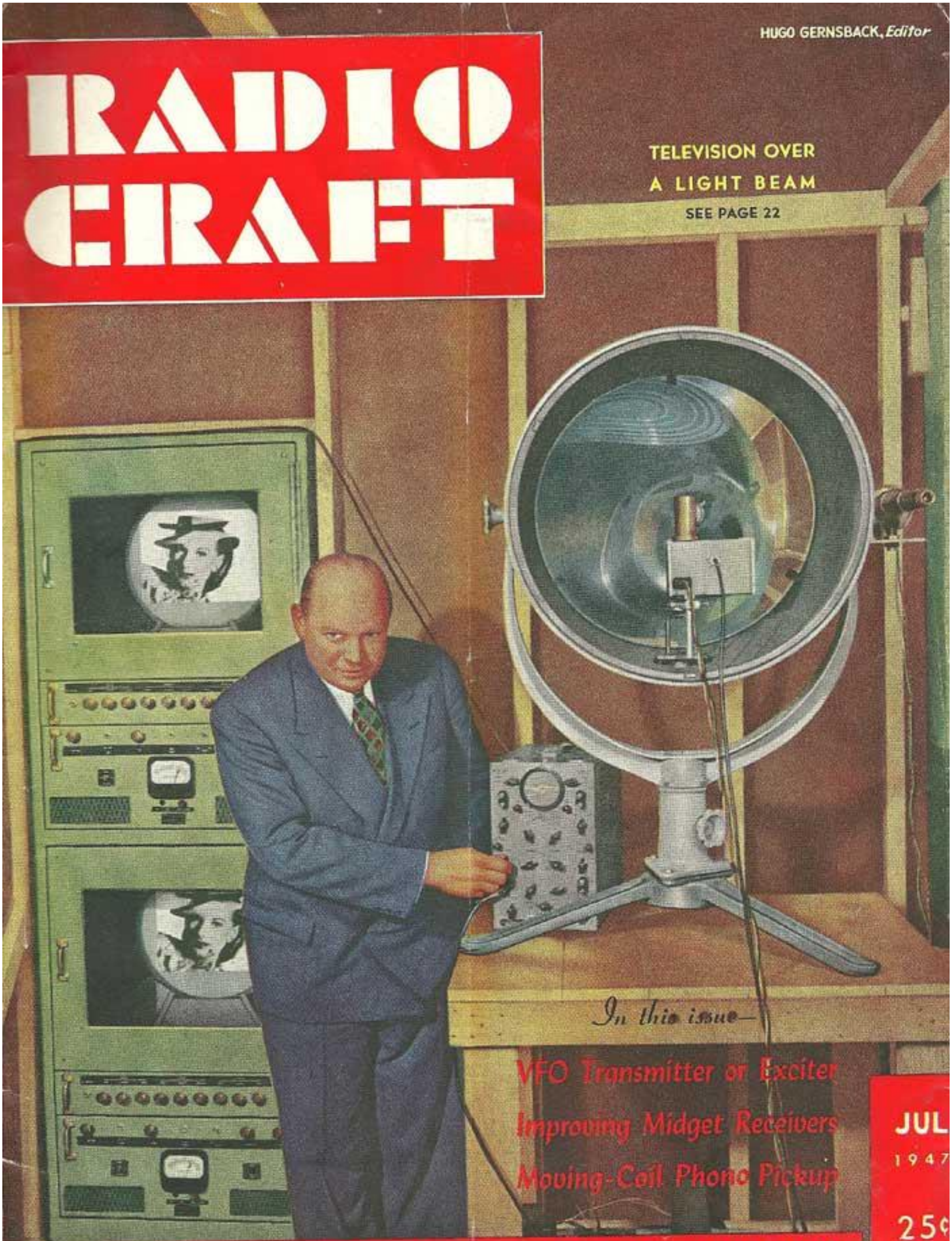
HUGO GERNSBACK, *Editor*

RADIO CRAFT



TELEVISION OVER A LIGHT BEAM

SEE PAGE 22

In this issue—

VFO Transmitter or Exciter

Improving Midget Receivers

Moving-Coil Phono Pickup

JUL

1947

25¢

CANADA 3

RADIO-ELECTRONICS IN ALL ITS PHASES

COVER FEATURE

Television Over A Light Beam

Light offers several advantages for directional television and radio relays

The transmitting end. Equipment is mounted in a parabolic reflector, like that of the receiving unit, which is shown on the cover.

THE history of radio communication is a history of ever-higher communication frequencies. The recently announced color television service, for instance, will work in a band near 500 megacycles. But the apparatus pictured on our cover operates at *600 million megacycles!* Yes, the only possible explanation is, of course, that these ultima-frequency waves are ordinary light!

Light offers several advantages for short-distance relaying of television programs, and possibly for other forms of dispersing information ordinarily carried by radio. Among the most important for television is the elmination of "ghosts," which are one of the worst bugbears at lower frequencies. Another advantage is privacy. Because of the extremely directional qualities of a ray of light, the beam can be focused exactly on the receiving station, with no possibility of undetected interception. This would adapt it especially to such applications as the transmission of television programs from a central light transmitter to local motion picture theaters for showing of pictures on ordinary theater screens. This even could be done in such complete secrecy that the program could not be snatched off the air by unauthorized receivers.

Although first demonstrated last November before the American Institute of Electrical Engineers and more recently before the Federal Communications Commission, photovision as a basic idea harks back to 1934 when Patent No. 1,984,673 was issued to Allen B. DuMont of Upper Montclair, N. J. That invention relates to electro-optical systems and particularly to a direct-vision television system quite independent of the usual electrical transmission channels. A feature of the invention is the employment of a high-powered light source which is capable of being viewed over very long distances. The light source is modulated in accordance with television signals. Originally Dr. DuMont proposed to use a high-powered light source such as a water-cooled neon lamp, or a lamp such as used for aerial beacons, and which are visible over distances of 15 to 25 miles.

With the advent of electronic scanning, Dr. DuMont revised his invention to transmit electrical signal-element equivalents in the modulated light beam. Such signal elements now comprise not only the modulation for lights and shadows of the image, but also the synchronizing pulses for the positioning of the pictorial lights and shadows on the usual cathode-ray screen, with the full wealth of detail which electronic scanning provides.

Special cathode-ray tube

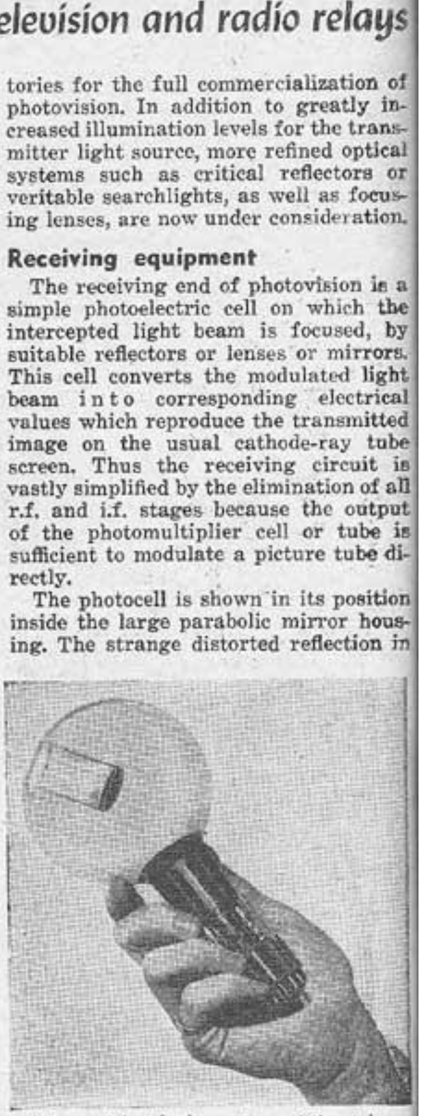
Since the practicality of *photovision* depends on a powerful yet highly responsive light source, it was necessary to develop an entirely new type of cathode-ray tube with a fixed, intensity-modulated beam that can be varied up to 5,000,000 times per second. In the earlier demonstration equipment, this tube, which is shown at right, produces a dull, light-green spot less than 1 inch in diameter on the fluorescent screen. It seems uncanny that such a source of illumination can transmit television pictures over considerable distances despite full daylight.

The phosphor used for the screen is one of the new materials under development, with a delay time less than one-tenth that of calcium tungstate (P5), heretofore the fastest standard phosphor. The screen has an efficiency approximately 60 percent that of the highly brilliant P1 phosphor. However, other phosphors capable of producing far greater intensities—yet with the necessary extreme response speed—are under development in the DuMont Laboratories for the full commercialization of photovision. In addition to greatly increased illumination levels for the transmitter light source, more refined optical systems such as critical reflectors or veritable searchlights, as well as focusing lenses, are now under consideration.

Receiving equipment

The receiving end of photovision is a simple photoelectric cell on which the intercepted light beam is focused, by suitable reflectors or lenses or mirrors. This cell converts the modulated light beam into corresponding electrical values which reproduce the transmitted image on the usual cathode-ray tube screen. Thus the receiving circuit is vastly simplified by the elimination of all r.f. and i.f. stages because the output of the photomultiplier cell or tube is sufficient to modulate a picture tube directly.

The photocell is shown in its position inside the large parabolic mirror housing. The strange distorted reflection in the mirror will be seen to be the image of the cell's shield can, with its corrugated top and lens opening on the inner side.



The special cathode-ray transmitting tube.

The equipment shown on the cover and in the photographs represents a workshop setup, and the informal position of the photocell is due to the fact that it is most convenient not to have a permanent mounting during experimental work. Amplifier equipment, mounted for convenience in the transmitting parabola housing, of course would be mounted below or behind the parabola in permanent equipment.

Meanwhile the sound component of

(Continued on page 69)

TELEVISION OVER A LIGHT BEAM

(*Continued from page* 22)

the telecast program is handled by a second light beam comprising the modulated light source at the transmitter, and the second photomultiplier cell at the receiver, feeding into the conventional loudspeaker system. In the demonstrations the two light beams have been paralleled and directed so close together as to overlap in part at the receiving end, yet each is directed by adjustable lenses and mirrors on to the respective photocells. The video and audio reproductions are on a par with the usual electrically transmitted television systems.

The equipment demonstrated so far has established that photovision is practical. Further research promises to make the system applicable to many fields of transmission of images and sound. For example, in the transmission of color television, four color channels may be independently modulated with the red, green, blue, and sound signals for a composite simultaneous color television system. Use of filters at the receiving point allows selective separation of all these signals even though transmitted from a single sending point.

Very recently DuMont engineers have been testing photovision equipment over distances of several miles. Even with the not yet perfected equipment now available, promising results are being obtained with both video and audio signals. The remarkable thing is that the seemingly dull light spot on the transmitting cathode-ray tube can be picked up several miles away by suitable focusing means, despite bright sunshine, and translated into pictures and sound. Fog is still an obstacle, but further developments may largely circumvent such interference. Full-scale commercial equipment has been evolved in the past few weeks and will soon be demonstrated as photovision steps out of the laboratory and makes its bid for a place in everyday telecasting.

The highly directional characteristics of this communications medium, coupled with its privacy feature and reliability, makes it very probable that it will find many uses in other fields of communication, such as broadcast relaying and point-to-point telegraph or telephone.

Radiocraft, July 1947