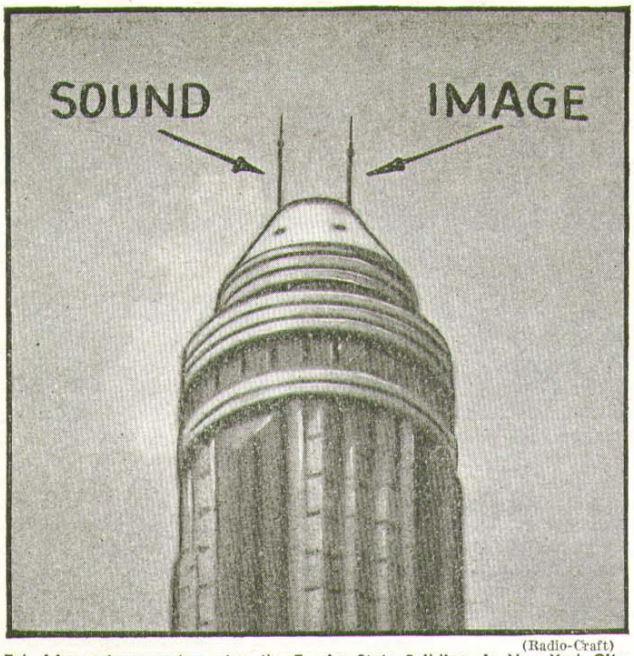


(Radio-Craft)

Television antenna system atop the Empire State Building, in New York City. The height thus attained, 1,250 ft., affords an estimated television range of about 40 miles. This photo, made by means of a camera equipped with a special telephoto lens, was taken especially for RADIO-CRAFT. Note that these antennas are continually being changed as new ideas are tried—at "W2XF."

NEW DEVELOPMENTS IN TELEVISION

Will we have television in 1937? Just what are some of the technical obstacles confronting the technician? The author presents a few of these questions—and their answers.

R. D. WASHBURNE

Jerry—Yes, television is advancing by leaps and bounds. We may have it before another year.

Angeline—How nice! I have always wanted to see what static looks like.

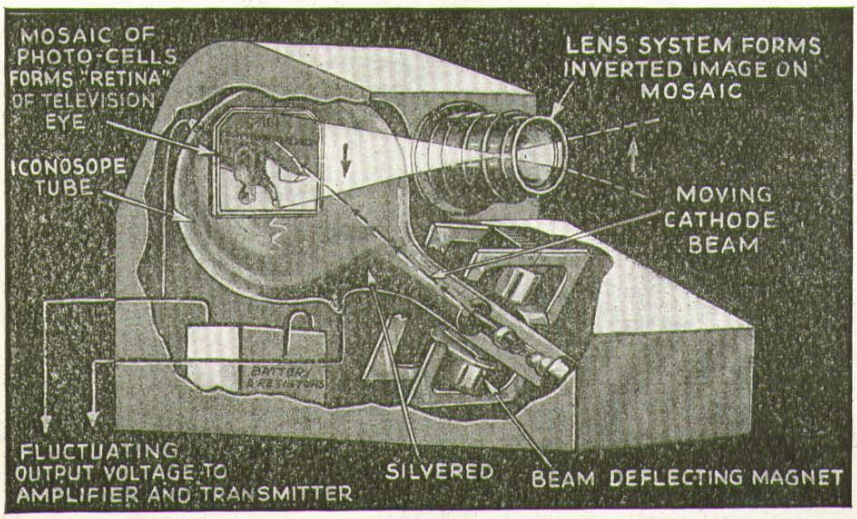
Permission—The Pathfinder

SKELETONS in the television family closet, we are inclined to believe, induced Angeline—the heroine in the *bon mot* that serves as a prolog to this story—to unconsciously disparage television.

One such skeleton is the Nipkow disc, to which practically all writers allude before they've concluded a television article. Unfortunately, the Nipkow disc in time did manage to earn for itself a rather unsavory reputation for poor image fidelity (among other characteristics), that like a bad name has hung on despite the fact that modern mechanical systems bear little resemblance to the parent development! Early Nipkow devices were large, unwieldy things. Ranging in size from 2 to 4 ft. in diameter, they shivered and shook, as they whirled at speeds which seemed to augur decapitation for anyone venturing into the same room with the contraption! Today, you find mechanical systems incorporating units, functioning on the Nipkow principle, that fit into the palm of the hand; and the moving parts are so well coordinated that their vibration is hardly perceptible. The "static" (flecks and streaks of light, etc.) we learned to expect in the early days as being an accepted evil where the Nipkow principle was involved, is a thing of the past; your modern image (either transmitted or reproduced by any one of several mechanical systems) is almost free of the transient phenomena that so effectively marred earlier performances.

Another skeleton concerns the cathode-ray system of television. Is "peasoup"-green the only color in which we may expect to view images produced by means of a cathode-ray tube?; what about black-and-white, or even color images? Is it possible to secure images as big as, let us say, the cover of *Radio-Craft* magazine? Will it always be necessary to look at the end of the tube; or is it possible that the image could be projected to points beyond the end of the tube? Are these tubes expensive—fragile—short-lived?

Most of the answers to these questions—and many more on the same topic—have appeared either in past issues of *Radio-Craft* or in the current issue, but we will reproduce them here in condensed form. The greenish tinge is preferred because it is the least expensive fluorescent powder, and because it produces the greatest optical effect with the least amount of power-supply and signal-input energy. But a black-and-white image is yours for the asking, if the factors above mentioned are excepted. Color television, too, is available—but the technical problems at this point become highly involved (see Allen B. DuMont's article on the subject, in August 1935 *Radio-Craft*).



A phantom view of the Zworykin "Iconoscope" or cathode-ray camera for television image pick-up, indoors or out. The "mosaic" is an area of millions of tiny photo-cells that form a "retina" upon which is focused the image of the subject being televised. The moving cathode beam discharges all these photo-cells, successively, as the screen or "retina" is scanned. The resulting discharge voltage fluctuation is then fed to the output circuit (transmitting equipment, etc.).

The matter of size appears to be a moot subject in connection with cathode-ray equipment; and this again brings up the topic of image projection. To this observer it appears that 3 families of investigators are evolving—one leaning toward larger and larger tubes for either direct- or reflected-image reception; a second toward smaller and smaller tubes of proportionately greater brilliancy, for projected-image reception; and a third or "centralist" group, best represented by RCA, which adheres to the middle path between the preceding two, by offering a moderately bright, reflected image measuring about 5 x 7 inches.

Whether any of these tubes will be expensive, fragile, or short-lived, appears at the present writing to be almost entirely contingent upon the cognition of the equipment owner—if he understands the apparatus, and manipulates it accordingly, the cathode-ray tubes will be found to be *relatively* inexpensive, sturdy and long-lived; but if

they are used without due regard for certain fundamental considerations, then the reverse may be true. In time, ways and means will be found to reduce this human element to a minimum. Continued investigation of the cathode-ray tube is enabling the transmitting and receiving technician to iron out all those little quirks that formerly served as sources of distorted, erratic image reception. A blanket indictment of "static" is no longer considered to close the case, when mal-performance is encountered. Instead, faulty image reproduction is the signal for all manner of test equipment to be put into operation, until the real cause of the trouble is definitely cataloged.

Still a third set of bones that has contributed to an apathetic condition on the part of Mr. (and Mrs.) John Q. Public has been his own lack of imagination. Having sated his appetite on a diet of Mickey Mouse films and cabalistic symbols, for the past 5 years, he has ceased to realize even remotely the possibilities of the art so clearly outlined in this month's editorial. Perhaps it is easier, now, to comprehend sister Angeline's relief at the thought of being able to "see what static looks like."


SKY T

Television In

By ORRIN E. DUN

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NEW YORK WORLD-T

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Let us now leave Angeline and Jerry to their uncertain ideas about television, and look into the whys and wherefores of the items that made the newspaper headlines shown at upper-right, pg. 75.

These headings refer to plans by NBC-RCA to develop a commercially practicable television system by perhaps Fall, 1937. Part of the promise held forth in the *New York Times* item of last year, was fulfilled last month when, as the lower group of newspaper headings indicate, RCA demonstrated experimental television transmission and reception on 6 to 7 meters, *narrowcast* ("beamed" or directed) between two points about a mile apart, at Camden, N. J.

The performance of the 30-W. beamed output of W3XEP, the transmitter used in sending to the single receiving point, was said to be approximately equivalent to that which may be expected from W2XF, the recently-constructed 10-kw. ultra-short wave audio-visual (television) *broadcast* transmitter perched a quarter-mile in the air, atop the Empire State Building in mid-Manhattan, New York City; experimental operation of W2XF on the scheduled opening day, June 29th, will inaugurate the field tests forecast in the remaining portion of last year's *Times* item.

(Continued on page 120)

(Pictures, Inc.)

An amazing sequence of operations is here illustrated in this unretouched photograph. The original, as a 6 x 8 in., 240-line (24-frame) image, appeared on the end of a cathode-ray tube in the television laboratories of Philo T. Farnsworth. It was then sent over the nation-wide network of the Associated Press Wirephoto Service.

NEW DEVELOPMENTS IN TELEVISION

(Continued from page 75)

EMPIRE STATE BUILDING TRANSMITTER

It is estimated that the power of W2XF will be sufficient to develop a field strength of 5 microvolts, at 1 meter height; this is the rated input sensitivity required for good image reproduction in residential areas.

Just how much shadow effect exists, due to the tall steel buildings in the metropolitan area, nobody knows—that's one of the reasons for these preliminary tests.

The purpose of operating this experimental transmitter, in conjunction with a number of special, experimental receivers assigned only to engineers of the company for checking various performance characteristics, is to take television out of the laboratory in an effort to determine within the next 18 months or so, if possible, just what obstacles are yet to be overcome, before commercial television can be instituted, in the face of the following problems:

1. Short range.
2. The difficulty of securing intercommunication between network stations.
3. Suitable program selection, arrangement and production.
4. Commercial profit.
5. Static interference (particularly from automobiles).

Any transmissions that take place, for some time to come, can only be on an experimental basis, since *the Federal Communications Commission has not as yet granted a single license to any company for commercial visual (television) broadcasting.*

THE RCA EXPERIMENTAL-TYPE TELEVISION RECEIVER

It is probable that almost identically the same experimental receiver design will be employed in receiving the signal from this station, as was used during the recent press demonstration in Camden. The set in question has been described in the daily press, but for completeness its general details will be repeated insofar as the writer can recall them.

The set is designed for reception of 343-line images, interlaced, and 30 frames per minute. When transmitting film programs, a special "intermittent" in the transmitter speeds the action and sound, slightly, as the normal 24-frame movie film is sped through the mechanism at 30-frame speed. This makes it very convenient in most instances to secure the framing frequency from the 60-cycle electric light power supply that is common both to the transmitter and to all the receivers. (Thus, where the receiver is operated from a power supply not connected into the same power system as the transmitter, an additional filter system will be required in the receiver in order to select a framing frequency from the received signal.)

The receiver proper utilizes a total of 32 tubes, plus a 9-in. cathode-ray tube, for combined image and sound reception, at an estimated cost (per *experimental* set) of $500 to $1,000. The total current consumption of this experimental receiver is about 350 W. The cathode-ray tube mounts vertically in the console cabinet, the image being viewed on a mirror set into the lid of the receiver and tilted "open" 45 deg. This mirror is of chromium-plated steel, which eliminates the double-reflection effect of silvered glass. The cathode-ray tube operates at 6,000 V., but the current drain being only a fraction of a milliampere any shock a Service Man might experience under exceptional conditions would not be excessive. A shatter-proof glass coverplate over the tube protects it. Although a special cathode-ray tube is used in this set a very similar type is available on the open market at a cost of about $100. The conservative life rating of this tube is about 500 to 1,000 operating hours. Audio and visual signals are sent over the one television channel, with a blank safety zone between the two as shown in the accompanying illustration.

It is very easy to tune this receiver, not even a tuning meter or other visual indicator being required; tuning-in the sound for best reception automatically and *exactly* tunes in the image frequency. A broad-band R.F. and first-detector circuit amplifies both image and sound; but individual I.F. amplifiers are provided for the visual and image signals. The front of the cabinet is provided with 1 tuning knob, 3 image-receiver controls, and 3 sound-receiver controls. The receiver tunes over a frequency range of 40 to 84 megacycles (approx. 7.5 to 3.5 meters), thus tuning-in 4 "visual broadcasting" (television) bands. On the top-inside of the opened-up cabinet is ranged, along the front, a row of 7 controls for adjusting the cathode-ray tube circuits for best operation. Once adjusted, there is little additional adjusting; it is understood that a commercial model, for private use, would have but few of these adjustments.

The actual television programs we may expect to sometime see and hear over sets of this general type subdivide as follows:

1—Studio; 2—Outside; and, 3—Film.

Ralph R. Beal, Research Supervisor, RCA, made some interesting remarks in connection with such programs, last month. He was speaking at The American Museum of Natural History, in a symposium on television held under the auspices of The American Institute. The following data, taken from the writer's notes of this New York meeting are supplemented by notes made at the earlier talk and demonstration at the RCA factory in Camden.

TELEVISION STUDIO WORK IN FUTURE

Television in many respects is closely allied to the moving picture industry, from which latter, more experienced field much may be learned. However, the very *contrasts* between television and movie technique become more evident when *comparisons* are drawn.

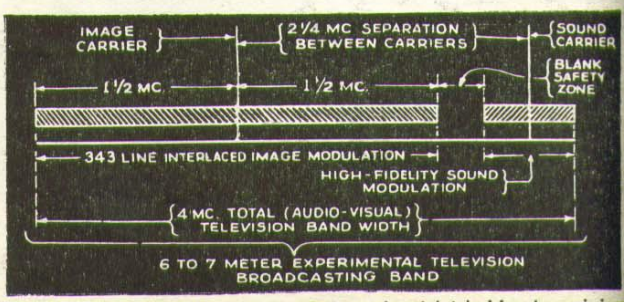
For instance, it is usual to put in perhaps 8 hours of preparatory work, getting everything "all set" for a "shot" of only about 15 minutes duration, using "stand-ins" so that lighting, etc., may be properly adjusted; only then do the actual performers go onto the "set," and then for only about 3 minutes at a time. In television, substantially the same intense lighting arrangement is used as on the movie "lot," but the television performers will be expected to stay under the lights until the program is fully completed—which may be a matter of 10 or 15 minutes, at least!

Such extreme demands are going to require, among other things, special cooling systems that will be noiseless, yet function to keep performers under the Klieg lights (or their equivalents) as cool as possible; it would be fatal to the esthetic effect of many programs, should the performers become beaded with perspiration!

Perhaps the use of infra-red or ultra-violet light will solve the lighting problem, since the television camera can be made to respond to either "illuminant." (The use of infra-red "light" in wired television, in Germany, is described on the Pictorial Page of this issue.)

Make-up, too, is an almost unexplored field of television. True, the art of make-up is a very old one in Hollywood, but here again television-land and movieland are but distant cousins.

Let's look at it this way. The movie camera records light variations on a *chemically*-sensitive surface—the film; the television camera is concerned with changes on an *electrically*-sensitive surface—the photoelectric cell (or its



General relation of frequencies in RCA experimental television transmissions. The safety zone is limited by the image-sound modulation.

equivalent). Now, the film does not respond to light variations with respect to the various colors of the spectrum, to quite the same degree as the light-sensitive cell. Just as it is possible (in the case of the film) to obtain a film that will be exceptionally responsive at the red end of the spectrum, or at the blue end, as desired, so too it is possible to obtain light-sensitive cells that favor either end of the spectrum. Just what range, and ratio of color and light intensity response will be found best suited is a matter of conjecture. (The make-up procedure under infra-red light would be entirely different from that to be used in ultra-violet light.) Whatever is eventually decided upon (and the choice may include several types, to meet individual conditions), you may be sure that the make-up man is going to have his hands full, learning just how, and how much to lay on the various colors so that the reproduced image will have the proper halftone shadings between the extremes of light and dark.

Thus it is plain to see that even the *experimental* angle of television is rapidly opening new opportunities for employment. The television development laboratories are fast approaching a point where the services of others besides research engineers will soon be in demand to aid in the presentation of visual programs.

Harry R. Lubcke, Director of Television of the Don Lee Broadcasting System, in "Television as a Profession," in the January, 1936, issue of *The International Photographer*, states further:

"The present positions in the radio field throughout the country embrace the posts of director of television activities, television engineer, television operator, and television technician. . . . This group of positions will gradually expand to include the television continuity writers, program directors, producers, advertising salesmen and executives."

In concluding this article the writer points out that the scene depicted on the cover of this issue of *Radio-Craft* is representative of an actual "action" television pick-up staged for RCA by the Camden, N. J. fire department, during the special demonstration previously mentioned. The Zworykin Iconoscope camera, of the type shown at lower-left, pg. 74, was used to televise the scene from a window on the second floor of one of the company buildings. (Except for the fire engines, some smoke, and an RCA ad. on the billboard—with, of course, 343-line definition—, this outdoor scene was identical to the 180-line image reproduced in the article, "A Modern Picture of Television," by Wilhelm Schrage, in the May, 1935, issue of *Radio-Craft*, pg. 673! Incidentally, the television receiver shown immediately above this photo, except that it has only 5 control knobs and these placed horizontally is almost identical in exterior appearance to the one used in the later demonstration.)

Radio Craft, August 1936