

## A DESCRIPTION AND GENERAL EXPLANATION

## TELEVISION



## THE FUTURE OF RADIO ADVERTISING

*"Seeing is Believing" and television may be a strong future help in getting sales. The photo shows models displaying merchandise over Sanabria's transmitter*

## ZWORYKIN'S LATEST INVENTION

*The Iconoscope mounted in a camera case on a tripod. The amplifiers are in the cabinets at the left. This device "sees" scenes to be transmitted*



**I**MPORTANT laboratory developments in the television art recently revived widespread public interest in the progress of sight broadcasting. Television for mass consumer use is being brought nearer perfection through constant research and experimental developments in various American laboratories. Although many radio experts' predictions during the past few years regarding television's "early" arrival were not fulfilled, public interest in the art has never diminished and each newly announced development has brought out expressions of a tremendous fan following in the field of visual transmission and reception.

Dr. Vladimir K. Zworykin, research engineer of the RCA-Victor Company, attracted the attention of radio experts throughout the world when he recently announced his invention of the television pick-up device known as the iconoscope. In disclosing some details of his device before the annual convention of the Institute of Radio Engineers in Chicago last summer, Dr. Zworykin explained that the iconoscope duplicated the action of the human eye.

Designed along the lines of an artificial eye, the iconoscope includes parts that correspond with the human retina and nerves. It required ten years of research on the part of Dr. Zworykin and his staff of associates to bring his original ideas of the iconoscope to its present state of perfection.

Dr. Zworykin describes the iconoscope as a vacuum device with a photo-sensitive surface of a unique type. This photo-sensitive surface is scanned by a cathode-ray beam which serves as a type of inertialess commutator. He says that a new principle of operation permits very high output from the device. The sensitivity of the iconoscope is approximately equal to that of photographic film operating at the speed of a motion-picture camera.

In its application to television, Dr. Zworykin states, the iconoscope replaces mechanical scanning equipment and several stages of amplification. The whole system is entirely electrical, without a single moving part. The reception of the image picked up by the iconoscope is achieved by the cathode-ray receiving tube known as the kinescope which Dr. Zworykin developed several seasons ago.

The inventor pointed out that the iconoscope opens up wide possibilities for applications in many fields as an "electric eye," which is sensitive not only to the visible spectrum but also to the infra-red and ultra-violet region.

An integral part of the iconoscope consists of 3,000,000 tiny photo-cells, held in a mica sheet measuring 4 by 5 inches. The cells are so small that they only can be seen under a powerful microscope. Full details of these cells have not been divulged. The sheet containing the cells is enclosed in a vacuum tube, sixteen inches long, with a bulb eight inches in diameter.

The light impulses of the television subject or scene are

By Merle S.

## THE KINESCOPE RECEIVER

*Zworykin's new cathode ray receiver. The picture appears on the ground-glass screen at the end of the tube*



# OF THE PRINCIPLES INVOLVED IN TWO NEW ADVANCES!

taken for the iconoscope through a common cinema lens. The light is then transformed, in the cathode-ray tube, by means of the electron beam playing on the 3,000,000 cells into electrical energy. In turn, this energy is picked up by the cathode-ray tube of the kinescope and transformed back into light energy, thus yielding a reproduction of the televised image.

Dr. Zworykin explains that in the iconoscope the picture acts on a photoelectric cell all the time, and there is provision in the structure which collects the energy of the light, or figuratively "memorizes" it, and then transmits it, point by point, twenty-four times per second. This method, he says, involves a new principle for storing electrical energy which might be called "electrical memory."

The inventor points out that, in ordinary television systems, every point of the picture acts on a photoelectric cell for a very short duration of time. This time, he said, was the order of one 1,500,000th part of a second. This duration, he added, is only obtained in the case of very good pictures. During this

period a photo-cell of the highest sensitivity will deliver only sixty electrons to the amplifiers, an amount so small that good amplification is impossible.

## Cummings

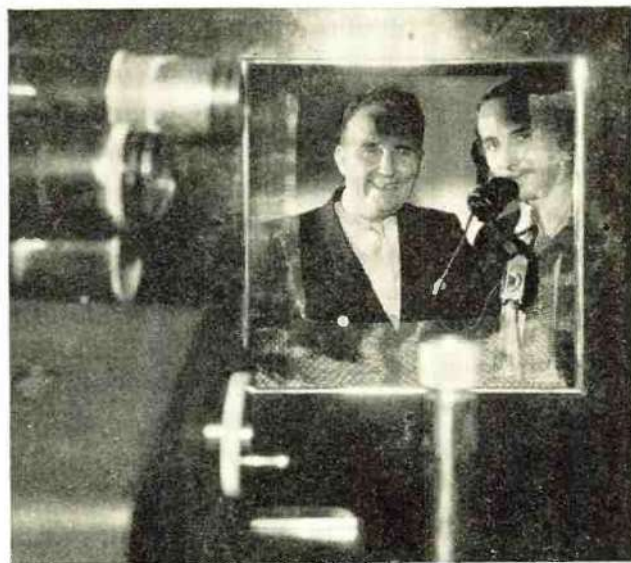
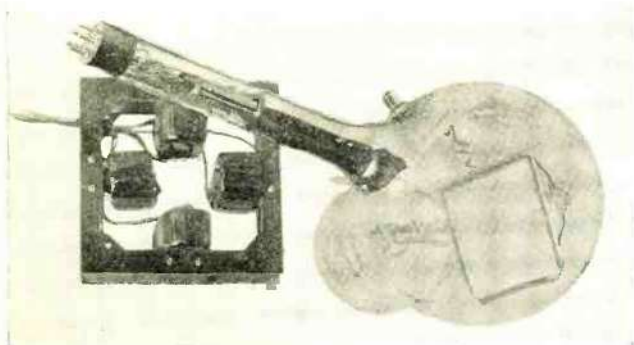
Thus, he explains, it can be seen that the amount of energy stored in the new photo-cell is, as compared with the old system, in the ratio of one divided by twenty-four as against one divided by 1,500,000, a "memory" some 70,000 times greater. At present he is able to obtain only ten percent efficiency, or 7000 times increase of output from the picture possible with the disk scanner under identical conditions.

The means which makes this possible is the utilization of a cathode-ray beam, which acts as a sort of electrical switch, connecting the 3,000,000 individual photoelectric cells in the iconoscope with the radio transmitter. The development is at such a point that it can perform substantially in the same manner as a motion-picture camera, which also projects twenty-four images per second. The iconoscope is so arranged that the mica sheet with the 3,000,000 photoelectric cells receives both the light from the image and the beam of electrons from the cathode. The entire apparatus consists of the cathode-ray camera mounted on a tripod and separate amplifier cabinets.

Another recent development that is attracting considerable attention is the designing of a carbon-dioxide arc lamp used by Ulysses A. Sanabria, the young Chicago television experimenter who has been in the limelight frequently during the past three years, for his efforts to perfect big-screen television receivers. Sanabria has developed this new lamp in conjunction with W. G. Taylor and L. P. Garner. He claims that the lamp yields the brightest source of modulated light known. Sanabria recently used his new lamp for a nine-day television show presented by R. H. Macy & Co., Inc., the prominent New York department store. Used (Continued on page 245)

### A MECHANICAL "EYE"

This is the close-up view of the complicated tube that functions as an "eye" and that really "sees" objects



### HOW IT FEELS TO BE TELEVIEWED

"Uncle Don" of WOR and an announcer looking in at the television window on the whirling mechanisms while their "images" and voices are being received elsewhere

### A RECENT DEMONSTRATION

Below is Macy's newspaper Ad of a television exhibit and the crowd that it attracted to view the demonstration. The large television screen may be clearly seen in the background



## DRAMATIC TELEVISION EXHIBIT

**Monday, 9:30 A.M. to 5:30 P.M.  
in Macy's 34th street windows  
—reproduced on the 5th floor**

The public is invited to this unusual demonstration for which there is no charge

# MACY'S



manufacturer announces 3-inch-diameter gain control plates. These dial plates provide definite attenuation reference points. They are made of heavy brass, silver finished, with etched black lines and numerals.

*Maker*—Central Radio Labs., 900 E. Keefe Ave., Milwaukee, Wis.

**Electro-Dynamic Speaker Unit**

*Description*—The latest Macy type GU-1 electrodynamic horn unit is designed for use with public-address and moving-picture equipment. The sound head and pot magnet



cover are fastened by 6-point suspension, assuring permanent alignment of the diaphragm, in spite of any rough handling it may receive. There is a special corrugation in the diaphragm providing a recess in which the voice coil is firmly held. The unit weighs 19 pounds and is ruggedly constructed to withstand hard usage and all manner of weather conditions. The frequency range of the unit is said to be from 50 to 8000 cycles. It is made to stand a peak load of 30 watts and is conservatively rated at 10 watts for continuous operation. The impedance of the voice coil is 16 ohms. The field winding is designed for operation at 6 volts, which can be supplied by storage battery or a suitable exciter. The unit is available on special order with a 110-volt d.c. field of 1000 ohms.

*Maker*—Macy Engineering Co., 1451 39th St., Brooklyn, N. Y.

**Miniature Featherweight Earphone**

*Description*—The new Trimm miniature earphone, especially designed for hearing-aid equipment, is available in any resistance



from 6 to 2000 ohms. It can also be used with a radio receiving set. This earpiece is held securely in place by means of a moulded hard-rubber adapter designed to fit comfortably into the ear, and is available with a combined volume control switch which is connected into the phone cord. The earphone is extremely small in size, measuring about 3/8 inch in diameter by 1/2 inch in thickness.

*Maker*—Trimm Radio Mfg. Co., 1528 Armitage Ave., Chicago, Ill.

**Television Advances**

(Continued from page 215)

in conjunction with a 45-line lens disk, revolving at the rate of fifteen revolutions a second, Sanabria achieved clear, sharp images five feet in height, projected on a translucent screen.

New Yorkers turned out at the rate of 20,000

# THOROUGHbred

## ... the FB-7

**THOROUGHbred** horses usually win. So do thoroughbred receivers. There is a pedigree behind the NATIONAL FB-7. NATIONAL CO. has been making Engineering Specialties since 1914. In 1922, it pioneered a fully equipped Radio Laboratory and entered the Radio field. Since then the name of NATIONAL has been synonymous with fine radio. Five full years ago, short-wave listeners heard around the world with the first NATIONAL Short-Wave THRILL BOXES. Each year since then NATIONAL Short-wave Receivers have been developed and improved. . . . Pedigree counts. The FB-7 is a winner.



**FB-7 Highspotted**

The FB-7 has a 7-tube superheterodyne circuit, with an electron-coupled beat-frequency oscillator which helps materially in tuning in distant foreign stations. Exclusive features include: Front-of-panel coil-change without disturbing shielding; Full-vision velvet-vernier dial; Tuning-chart on front panel; Class A power-pentode output . . . Loudspeaker operation with fine quality; "True-tracking" single control tuning; Calibrated volume-control; All adjustments made from top without removal of chassis from cabinet; No frequency-drift. Complete specifications given in our catalogue.

**"Air-Dielectric" Tuned I. F.**

Using the Type AT-500 NATIONAL Air Dielectric condenser tuned transformer with self-locking velvet vernier drives and improved litz-wound coils on Isolantite forms. Both peaking adjustments on top. Recommended in place of standard model with standard NATIONAL I. F. transformers, particularly for use in the Tropics and other locations with high humidity.

**Power-Operated**

The FB-7 operates on A.C. from the NATIONAL 5887 or 5880 Short-Wave Power Units, or if maximum undistorted output is desired, from the NATIONAL 5897 Power Unit; R. C. A. Licensed. Made also for 6 volt D.C. operation.

## NATIONAL FB-7 SHORT-WAVE RECEIVER



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Gentlemen: Please send me your latest 16-page catalogue. I enclose 6c in stamps to cover mailing cost.

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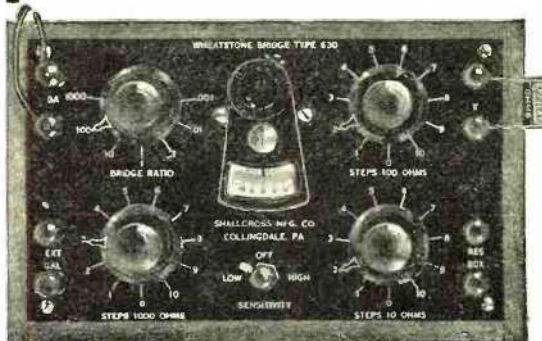
## The NEW Shallcross No. 630

**WHEATSTONE BRIDGE**

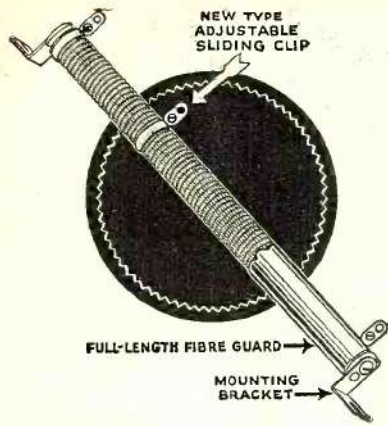
This inexpensive, rugged, and reliable instrument can be easily assembled by electrical technicians. Good accuracy is attained by employing a set of very accurate SHALLCROSS Resistors and a sensitive L & N Galvanometer.

Range, .01 ohms to 11.1 Megohms  
Send 6c in stamps for Bulletin 630-D containing full information and construction details.

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each day to witness the Macy demonstrations. The transmission equipment was set up in a street window, where it attracted huge sidewalk crowds throughout each day of the demonstration's run. It was necessary to draw curtains across the window to shut out the daylight when the actual transmission of images was going on.

The impulses of the images were conveyed over wires to a "television theatre" erected



### SANABRIA'S HUGE SCANNER

*The inventor stands on the platform in back of his completely shielded high-speed scanning disk*

on the fifth floor of the store. Thirty-two five-minute shows, each day, were presented before capacity crowds in the store. A public-address system was installed so that combination sight-and-sound programs could be conveyed to the "television theatre" from the window studio. Station WOR talent was used for many programs, and Roger Bower, an announcer of the Newark station, served as master of ceremonies for most of the programs.

A dark room behind the television screen contained massive reproducing equipment mounted on a platform level with the screen. The 48-inch-diameter disk, studded with 2 7/8-inch lenses, whirled before the carbon-dioxide arc lamp and the image was projected on the screen. The images were remarkably clear over distances of twenty feet and more. The pictures were *black and white*. There was a sort of bluish tint over the image, but it did not hamper the clarity of the view. The image seemed very much like a motion picture, but the scanner was limited to only "heads and shoulders."

Sanabria tells the writer that, although his scanner was only of forty-five lines, he used an "electrical retouching" system which gives the same effect as a 40-line scanner. He says that his new lamp is a distinct television improvement because it gives a brighter and steadier picture than earlier television apparatus and has a life of about 300 hours. During his earlier demonstrations, including his ten-foot screen exhibit of two years ago, the lamps would last only about thirty minutes.

The window transmitter was of the familiar scanning type. Each subject faced a frame of eight photoelectric cells, the scanning beam passing through the center of the frame.

Sanabria has already conducted television demonstrations in theatres and department stores from coast to coast, but his New York demonstration at the Macy store was the nearest his demonstrations ever came to commercial television programs, he said.

The department store capitalized on the presence of the large crowds at the television exhibit by displaying various types of sale merchandise over the television hook-up. It gave the visitors an idea of what type of commercial programs they might get when sponsored television periods arrive.

Models were seen on the Macy screen showing shoes, cameras, bathing suits and various other lines. The announcer gave a word description of each product as it was displayed before the electric eye of the television transmitter. When large objects were brought before the scanner, only portions could be shown at a single time on account of the limited picture range of the equipment.

Thus, considerable progress has been made in the laboratory and radio experts believe that the day of television for popular fan use is thus brought nearer. Some thirty experimental television transmitters are now in operation in the United States. About a half dozen operate on regular schedules.

The National Broadcasting Company is continuing experiments, many of them in conjunction with RCA-Victor, from the television station atop the Empire State Building in New York. Merlin H. Aylesworth, president of NBC and Radio-Keith-Orpheum, recently declared that Hollywood would be the base for all R-K-O and NBC television activity. The experiments at the Empire State Building are still of a secret nature and no statement concerning them would be given out by NBC or Radio Corporation of America officials. A demonstration of an R. C. A. television receiver was given privately to R. C. A. licensees several months ago. At that time a program of live talent as well as motion pictures was transmitted from the Empire State Building to the RCA-Victor offices about a mile away. The receiver was said to be built along the lines of Dr. Zworykin's kinescope. No word, up to the time of this writing, has been forthcoming from RCA-Victor as to when the firm will produce television sets for mass consumer use.

The Columbia Broadcasting System closed its New York television transmitter several months ago when it was decided by executives that it did not pay to continue the schedule of combination sight-and-sound



### NEW TELEVISION GLOW TUBE

*This is the glow tube developed by Taylor and Sanabria and described in the text of the article*

programs until better transmitting equipment was available and larger television audiences were assured. The CBS television presentations were conducted on regular daily schedules on an experimental basis. Last year, the staff engineers devised a system whereby sight-and-sound programs were presented on a single wave-band.

Dr. Lee De Forest, inventor of the three-element vacuum tube which revolutionized the radio industry, has established head-

(Continued on page 247)

## Electric Filters

(Continued from page 217)

design chart, then remembering that a half section of the filter will be formed by using twice the value of the condenser in the series arm and twice the value of the coil in the shunt arm.

The series-derived, M type, high-pass filter section is derived from the constant "k" filter section by equating the open-circuit and short-circuit impedances in such a way that the mid-series image impedance for the two structures are alike.\* In this way, the mid-series-derived filter section can be joined mid-series to a constant "k" filter without reflection losses in the transmission line. It has the advantages in that a steeper attenuation characteristic can be obtained and undesired frequencies can be suppressed very highly at the frequency where the shunt coil and condenser resonate. The shunt coil and condenser must always resonate below the cut-off frequency so that the shunt arm will be a positive reactance over the transmission band of the filter, otherwise we would not have a high-pass filter.

The mid-shunt derived high-pass filter is formed so that the mid-shunt image impedance is identical to the constant "k" high-pass filter, while the mid-shunt image impedance varies as shown in the design chart. This type of filter has a coil and condenser in parallel in the series arm and must always resonate below the cut-off so that the series arm will be a capacity reactance over the transmission band of the filter. It has the same attenuation characteristic as the mid-series-derived filter.

The design constant "a" for high-pass filters determines the steepness of the attenuation characteristics and is defined by

$$a = \frac{f_c}{f_{\infty}} \quad (9)$$

Where  $f_{\infty}$  is the frequency of infinite attenuation in non-dissipative filters. It is the frequency at which the shunt arm of the series-derived section resonates and at which the series arm of the shunt-derived section resonates. Just how the attenuation varies with different values of "a" is shown in Figure 7. The ordinates give the transfer loss in nepers so that it is necessary to multiply by 8.68 to obtain the loss in decibels. With this chart it is very easy to determine approximately what loss a high or low-pass filter will give at any frequency, once a tentative cut-off and "a" has been selected. When a final determination of these two constants is arrived at, the values of inductances and capacities are readily computed from the design charts Figures 1 and 6.

\*See page 244, "Transmission Networks and Wave Filters," by T. E. Shea. (D. Van Nostrand Co.)

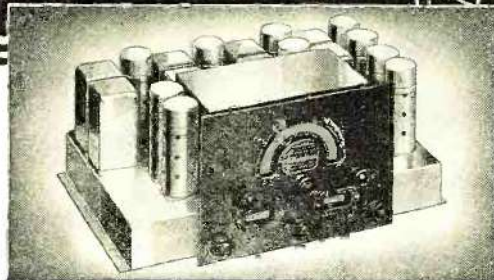
## Television Advances

(Continued from page 246)

quarters in California, where he is working on television. His object is said to be enlarge the images to theatre screen size.

It is understood that television experiments are continuing in many major radio manufacturers' laboratories. It has been hinted that many television achievements have been shelved until better economic conditions warrant television's mass introduction to the market. In all, considerable television progress has been noted and there is reason to believe that the not-distant future may see a wide exploitation of the art.

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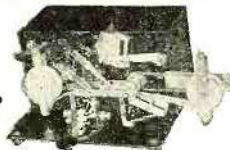
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This instrument completely eliminates the aerial and is guaranteed to give nationwide reception. In performance it will in all cases equal any aerial, and in most cases it greatly improves reception, with more power, selectivity and less noise. Size 1 1/2 x 4 inches. Attached by anyone in a moment (connects to ground and aerial post on set). Once connected, you will never need an aerial. (NOTE)—Radios in U. S. Gov't Navy Hospital are equipped with these units. Order today under money-back guarantee.

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