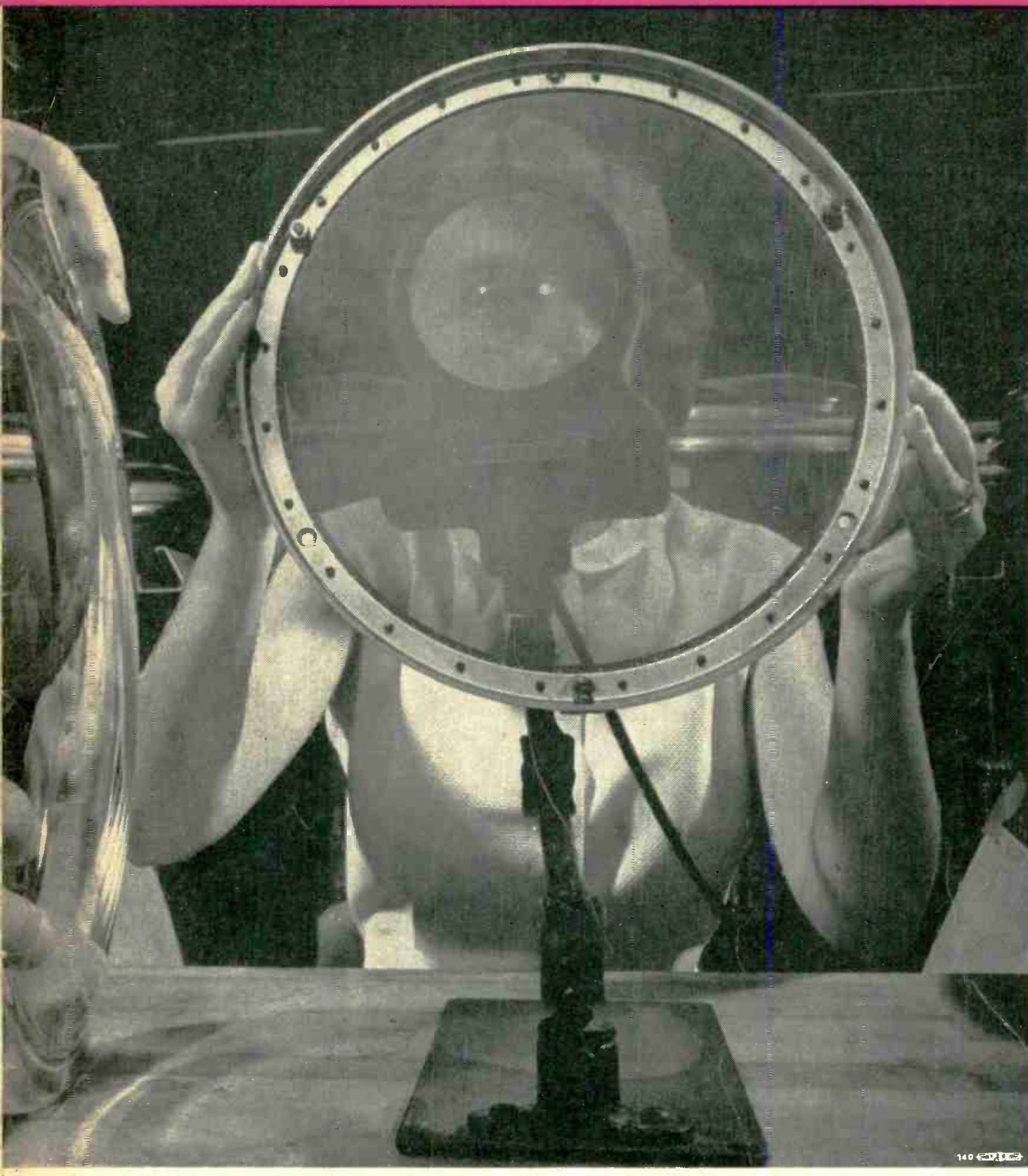
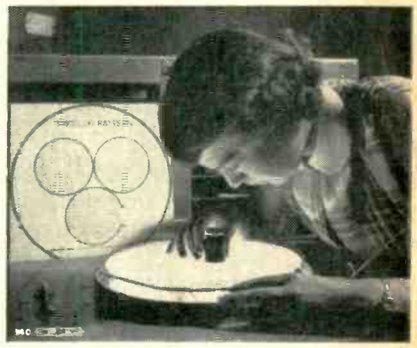
RADIO, TV and RECORDING

TECHNICIAN-ENGINEER

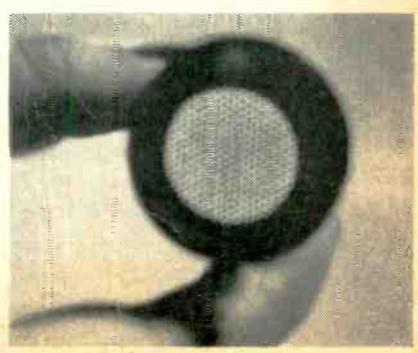
FEBRUARY, 1954

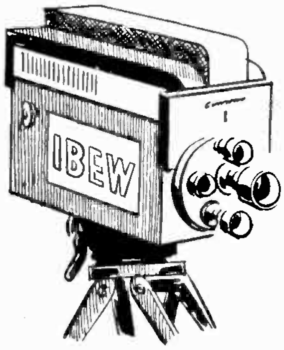




TUBES FOR COLOR TV

International Brotherhood Of Electrical Workers (AFL)





FCC fact sheet
reminds of the many
uses of radio.

Radio . . .

. . . from the cradle to the grave

THE Federal Communications Commission recently distributed a fact sheet of general information to the press which is somewhat "old hat" to the broadcast technician and engineer. It points out that radio usage, today, extends from the cradle to the grave.

For instance, there are radio facilities for calling doctors to the homes of expectant mothers. Radio-equipped vehicles sometimes deliver milk and pick up and return diapers, FCC assures us.

Going to the other extreme, radio is being used for dispatching vehicles in connection with the death and burial of the departed (to use the language of the government agency). It seems radio even keeps the funeral cortege moving properly in some of our super cemeteries.

Just to remind ourselves that this is the age of electronics, let us list a few of the uses of radio today:

To control city and highway traffic systems,

To direct movement of crews cleaning city streets, water mains, etc.,

To dispatch trucks to pick up garbage, dead animals, and other refuse,

To route rural school buses,

To aid beach and other recreational area patrols,

To contact workers on isolated ranches,

To direct the movement of machinery on large farms,

To look for oil on land and under offshore waters,

To spot schools of fish from moving planes and radio their location to fishing boats,

To direct motion picture crews on location,

To relay news between reporters on assignment and their newspaper offices,

To control model airplanes,

To communicate between the engine and caboose of long freight trains,

To control railroad track switches by the engineer of a moving train,

To transmit pictures and facsimile,

To direct fire fighters at the scene of a blaze,

To transmit orders from car hops to kitchens of drive-in restaurants,

To supervise and control valves, pressures and fluid levels along pipe lines,

To record sun spot cycles, measure radio propagations and study planetary reflection,

And to provide emergency communication in time of local, regional and national disaster.

Because of the "housing shortage" in the radio spectrum and the increasing demand for available frequencies by recognized radio services, the Commission is unable to allocate radio space for the exclusive use of—to quote one request—a machine "to take the kinks out of woolly hair." However, electronic hair-removing apparatus does function under rules which govern the technical operation of miscellaneous radiation devices in order to prevent interferences to radio communications.

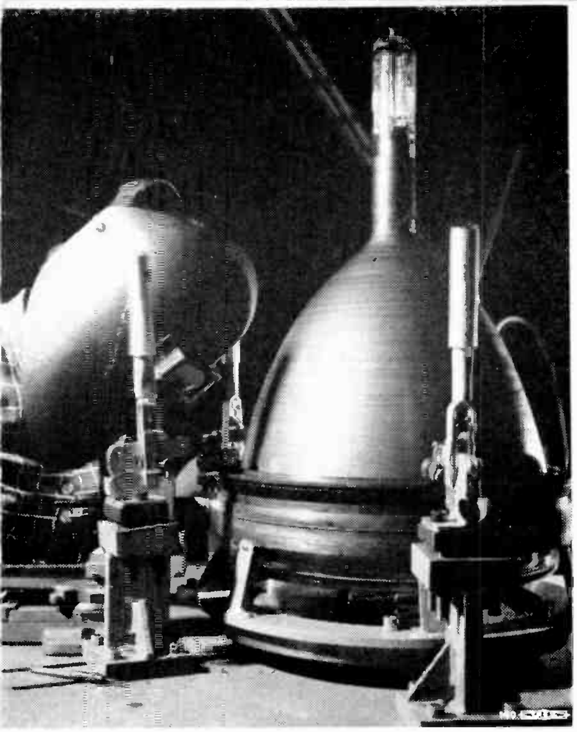
RADIO, TV and RECORDING
TECHNICIAN-ENGINEER
VOLUME 3 NUMBER 2
PRINTED ON UNION MADE PAPER

Published monthly by the International Brotherhood of Electrical Workers, AFL, 1200 Fifteenth St., N. W., Washington, D. C., for the men and women in the recording, radio and television industries.

D. W. TRACY, *President* • J. SCOTT MILNE, *Secretary*

ALBERT O. HARDY, *Editor*

Entered February 20, 1952 as second-class matter at Washington, D. C., under Act of August 24, 1912. Subscription Price: United States and Canada, $2 yer year, in advance.



GIRL IN THE IRON MASK: Shielded by a welding mask, a technician at RCA's Lancaster, Pa., plant joins the faceplate section of an tri-color television picture tube to the main cone.

The Race for COLOR TV

The FCC's acceptance in December of the National Television System Committee's color standards was the starting gun in a manufacturers' race for markets. Here's a first-lap report.

A VARIATION of who stole the ding-dong, who stole the bell, was spinning around the television industry during December and January.

It all started out when RCA ran a full-page advertisement in many big city newspapers saying that it had won the fight for compatible color television.

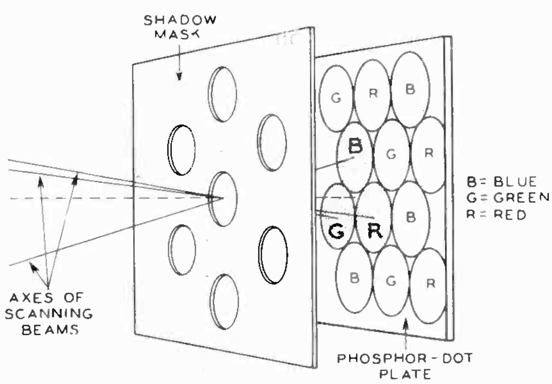
Rival television manufacturers saw the ad and feverishly put their own ad men to work. Philco countered with a full-page ad that patted everyone on the back, including the FCC, and gave the credit for color-TV to the National Television System Committee, an industry group that worked out about 20 different operating factors that go into a color signal. The standards are not the work of any one company, the Philco ad said.

Then came Admiral and Motorola with statements contradicting RCA's claims. CBS kept a subtle but dignified silence.

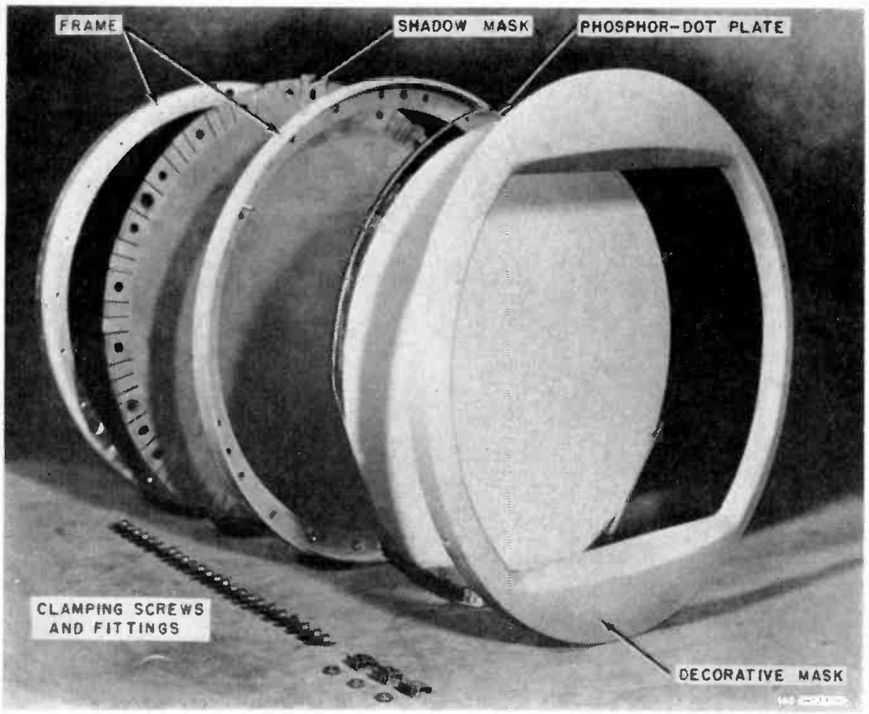
Actually, RCA was first with a practical, all-electronic system—an assembly of equipment that can generate, broadcast, and receive a color video signal. NTSC, meanwhile, can claim a first for setting the standards to which the equipment's operation must conform. The standards are what FCC actually approved. Any manufacturer whose equipment meets these standards can join the race for color TV.

Viewed objectively, RCA at least is entitled to full credit for the first national move to familiarize technical people with the new system—from principles of colorimetry to actual receiver service. The series of "Color Clinics" being conducted by slide-accompanied lectures, sponsored by RCA Service Company are no less than excellent. From an editorial point of view, we can highly commend the clinics and recommend your attendance. The lectures are complete, concise and authoritative as well as being on a practical level well within the reach of the average serviceman. Sufficient information on the "transmitter end" is included to instruct as well as fascinate our members employed in broadcasting.

On the next four pages we bring you some of the recent news releases of GE, RCA, and other manufacturers, as each in turn bids for the lead in the color race. No matter who gets the credit in this marathon, it looks like the color thaw has finally begun.



SCANNING ACTION of tricolor picture tube is so rapid that each of nearly 600,000 phosphor dots on tube's viewing screen is activated 30 times per second. As diagramed above, electron streams from tube's three electron guns are projected through each of nearly 200,000 tiny holes in shadow mask. Beam from "blue" gun strikes proper "blue" phosphor dot in triangular cluster of red, green, and blue dots lined up with given hole in shadow mask. Simultaneously, electron beams from "red" and "green" guns strike and "light up" their respective dots in same triangular cluster of the screen.



EXPLODED VIEW of RCA tricolor tube's viewing-screen assembly. The phosphor-dot plate, which serves as viewing screen, contains approximately 600,000 dots of phosphors. Dots are activated by electron beams, which are emitted by tube's three electron guns and projected through the nearly 200,000 tiny holes in the shadow mask. Each hole in the shadow mask is lined up with a triangular cluster of dots on the viewing screen—a red, a green, and a blue dot to each cluster. Each electron beam passes through each shadow mask hole and strikes its proper dot in each triangular group.

General Electric Considers Costs, Problems of Color TV

General Electric has announced that its television transmitting equipment will satisfactorily rebroadcast network color TV programs under the compatible system now recommended to the Federal Communications Commission by the National Television System Committee, without any additional equipment, provided the network signals arriving at the local station are of reasonable quality.

The company said its present transmitters and antennas will transmit NTSC color signals for black and white reception with no changes whatever. For color reception, only minor changes must be made to existing equipment.

Where network color signals of less than reasonable quality are received, the company said it will be necessary to add special color equipment to an existing station, to insure the best possible color transmission. The equipment includes a color stabilizing amplifier, gamma amplifier, color monitor, and several modification kits.

The extent of additional equipment an existing station may add will also depend upon the nature of color program service it wishes to provide.

General Electric anticipates that the growth of color television will proceed in definite steps. The first will be the production of color programs in the large cities by network origination stations, and the rebroadcast of these programs by local stations around the nation.

The second step will be the production of slide and film color programs by local stations, and finally, the production of live talent color programs by local stations.

Equipment which can be added to an existing station to provide the best possible rebroadcast of network color programs will cost less than $20,000, and will be available in the first quarter of next year.

To permit a local station to originate slide and film color programs, an additional $68,500 worth of special projection equipment must be added.

To originate live talent shows from its own studios, an existing station must add color studio cameras and switching equipment, at a cost of at least $70,000.

The company estimates its special color TV transmitting equipment will be available to existing stations by the end of 1954.

RCA Predicts Low Equipment Costs for Stations It Serves

Availability of compatible color television broadcast equipment this spring was indicated recently, in an announcement by the Victor Division of RCA that it will immediately accept orders for delivery of custom-built apparatus in the first half of 1954.

The equipment, which RCA will build to order for TV stations wishing to broadcast color programs at the earliest possible time, will be similar to that used for field tests in New York. It will be designed to operate in accordance with present signal specifications of the National Television Standards Committee.

As soon as final standards have been adopted by the Federal Communications Commission, it was pointed out, RCA began large-scale production of commercial-type color equipment designed for standard operation in TV stations.

RCA's announcement stressed the fact that present TV stations will be able to transmit compatible color network programs at relatively low cost, with a minimum of additional equipment, and with full use of their present black-and-white transmitting facilities. For stations wishing to originate local color TV programs of their own, RCA will also make available color slide equipment, 16mm color television film projectors, and studio-type TV cameras.

General Electric Presents Its First Receiving Tube Type

Development of its first receiving tube type intended primarily for use in color TV sets was announced in late December by the General Electric Tube Department.

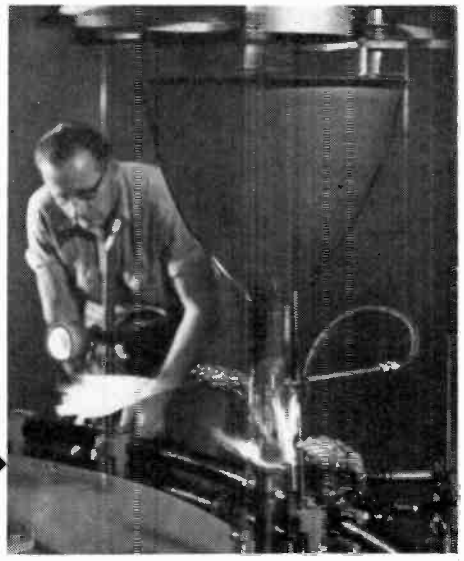
The tube, type 6BJ7, is a miniature triple diode. Its primary application is as the d-c restorer for the three signal channels of color receivers.

The 6BJ7 is one of several types which G. E. has in development to reduce the number of receiving tubes in a color set. The first sets on the market will require between 40 and 50, compared with an average of 20 in monochrome sets.

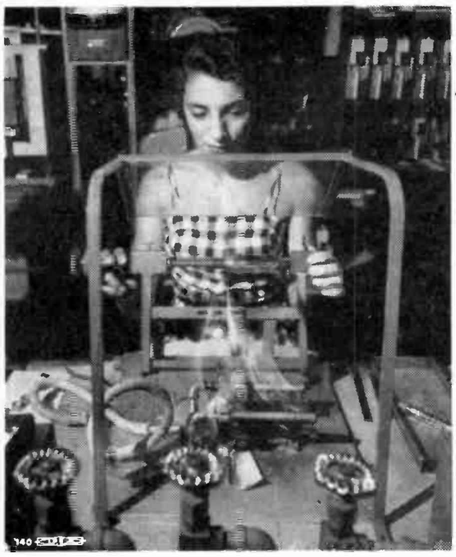
The electrical characteristics of each section of the 6BJ7 are similar to those of each section of the G. E. 6AL5 twin triode. It will be produced at the G. E. receiving tube plant at Owensboro, Ky., in the first quarter of 1954.

Maximum ratings for the 6BJ7 (design center values) are: peak inverse plate voltage, 330 volts; peak plate current per plate, 10 milliamperes; d-c output current per plate, 1.0 milliamperes; heater-cathode voltage (heater positive with respect to cathode), 100 volts; (heater negative with respect to cathode), 330 volts.

SILK-SCREENING technique is used to apply the phosphor dots to the glass screen of a tri-color picture tube. The phosphor material, beaten to the consistency of a thick whipped cream, is "squeezed through a gelatin stencil and deposited as dots onto their precise positions on the phosphor glass plate, which is fixed in place under the stencil. Three servings of phosphor material are applied to the plate, one for each of the three colors.



TRI-BARREL electron gun of an RCA tricolor television picture tube is shown above being sealed into the neck of a tube. Each gun has three separate barrels which produce the streams of electrons necessary to activate the red, green, and blue phosphor dots on the tricolor kinescope screen.



FIRE is an essential tool in the production of tricolor tubes. Above, the various parts of a tricolor electron gun, which produce the electron beams, are seen being assembled on a jig. When this assembly is fixed in place, the jig is lowered into the flame-covered bed in the foreground which provides the heat for simultaneously joining the various parts.

LEAK-PROOF: Tricolor television picture tubes are required to pass a series of rigid quality-control tests as the tubes move along the production line. Above, a technician puts the tube under vacuum to test the effectiveness of the weld which joins the main cone of the tube and its faceplate section.

RCA Announces Special Line Of Electron Receiving Tubes

A special line of RCA electron receiving tubes for color television was announced in January by the RCA Tube Department.

Five new tube types which promise greater flexibility in circuit design and a new level of operating efficiency for television equipment are now available to manufacturers of home color receivers and to color-TV broadcasters, according to D. Y. Smith, general marketing manager of the RCA Tube Department. They will also be available, via RCA tube distributors, for renewal use in the first commercial color-TV receivers, which are expected to appear on the market within the next few months.

Basic engineering and performance features of the new tubes follow:

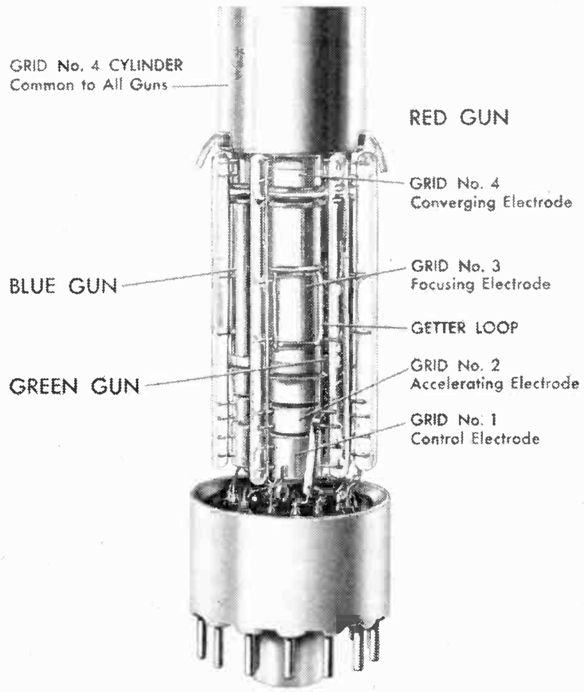
RCA-6AN8—A two-in-one tube of the nine-pin miniature type containing a medium-mu triode and a sharp-cutoff pentode in one envelope. The triode unit, featuring relatively high zero-bias plate current, is useful in low-frequency oscillator, sync-separator, sync-clipper, and phase-splitter circuits. The pentode unit, featuring high transconductance, can be employed as an if amplifier, video amplifier, agc amplifier, and reactance tube.

RCA-6BD4—A low-current beam triode of the sharp-cutoff type designed for voltage regulation of high-voltage, low-current dc power supplies. The tube has a maximum dc plate-current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 20 watts.

RCA-3A3—A half-wave vacuum rectifier tube of the glass-octal type utilizing an indirectly heated cathode. Designed for use as a rectifier of high-voltage pulses produced in scanning system of color TV sets, it is rated to withstand a maximum peak inverse plate voltage of 30,000 volts and can supply a maximum peak plate current of 80 milliamperes and a maximum average plate current of 1.5 milliamperes.

RCA-6BY6—A seven-pin miniature type pentagrid amplifier tube designed especially for use as a gated amplifier in TV receivers, and also as a combined sync separator and sync clipper. Tube design includes separate base-pin terminals for grids No. 1 and No. 3. Each of these grids can be used independently as a control electrode, and has a sharp-cutoff characteristic which facilitates good sync clipping and noise cancellation with relatively low values of input signals.

RCA-6AU4-GT—A half-wave vacuum rectifier tube of the glass-octal type for damper-diode service in color TV receivers, and in black-and-white receivers utilizing picture tubes having 90-degree deflection. Rated to withstand a maximum peak inverse plate voltage of 4500 volts, the tube can supply a maximum peak plate current of 1050 milliamperes and a maximum dc plate current of 175 milliamperes.



TRICOLOR ELECTRON GUNS provide the electron beams which activate viewing screen of tricolor picture tube. Electron beam emitted by "red" gun passes with fantastic speed through each of 200,000 tiny holes in tube's shadow mask and strikes its proper phosphor dot on viewing screen. Simultaneously, beams from "blue" and "green" guns pass through same hole in mask and "light up" their proper "blue" and "green" dots. In black-and-white kinescope, electron beam comes from single gun.

General Electric Signs Patent License Agreement with CBS

General Electric has signed a patent license agreement with Columbia Broadcasting System, Inc., granting G. E. the right to manufacture and sell color television apparatus developed by CBS.

Included in the CBS-developed equipment to be produced by G. E. are the single-tube "Chromacoder" color television camera and the "Chromacoder," introduced last October and now in use in regular CBS television color broadcasts under the National Television System Committee color standards adopted by the FCC on December 17.

The agreement also gives G. E. the right to produce the color cameras and related apparatus for industrial and closed circuit television use.

Dr. Frank Stanton, President of Columbia Broadcasting System, Inc., on signing the agreement, said: "CBS is proud to join in this manner with General Electric in the field of color pick-up apparatus. The extensive manufacturing facilities and know-how of G. E. will now be brought to bear on the CBS developments in color pick-up, and should result in important improvements in the CBS laboratory equipment which was introduced last fall. We are hopeful that G. E. will soon complete commercial apparatus which promises to broadcasters great savings and simplicity of operation in color—and hence promises to the public a more rapid expansion of color television."

Dr. W. R. G. Baker pointed out that G. E. engineers, working with CBS, are now intensively engaged in designing commercial prototypes of the "Chromacoder" and the "Chromacoder" cameras, developed by Dr. Peter C. Goldmark, Vice President of the CBS Laboratories Division.

"The cameras, which embody significant improvements devised by engineers of both companies," Dr. Baker said, "are already being built. Four have been ordered by CBS and will be delivered before March 1, 1954. A commercial prototype of the 'Chromacoder' is now being designed and G. E. plans to demonstrate it and offer it to broadcasters by the second quarter of the year."

Color TV Is 'Rainbow Around Our Shoulders,' Says Zenith Man

"The TV color 'rainbow 'round our shoulders' will get there by an orderly process, and not as the aftermath of a storm," H. C. Bonfig, vice president and director of sales for the Zenith Radio Corporation, has declared. He addressed a noon meeting of the Advertising Club of Minneapolis in session at the Nicolet on the subject of color television and its impact on the public.

High initial cost is an unavoidable part of the process of launching color, he indicated. Pointing out that it was only eleven weeks ago that color TV on its present standards was first presented to the FCC, Bonfig indicated that much technical progress has yet to be made before color TV sets are a commodity on the order of black-and-white TV.

"The set which we demonstrated for the FCC has the same size picture of all color sets demonstrated on the market up to now," he stated. "All those sets, as of today, have pictures that are no greater than $11\frac{1}{2}$ inches wide in greatest dimension. This can hardly be considered as satisfactory to a public that insists on 21-inch pictures in its black-and-white receivers.

"The first 100 color sets which we are making at Zenith are costing our company something more than $2,000 per set in prime labor and materials alone," Bonfig stated, declaring his belief that this would "hardly be a popular price."

He stated that the rising cost of commercial television time and production was of mounting concern, indicating his belief that stations were now in need, or would shortly be in dire need of auxiliary income. "The answer to this problem lies in subscription television," Bonfig declared.

Indicating that subscription TV, which provides a home box office, would not interfere with commercial television, Bonfig said that it was intended to supplement the station's income from commercial TV broadcasting efforts.

"Many top-rated attractions, such as championship boxing events, football games and the like, are disappearing from the home TV screens and into the theater TV circuits. Theater TV has already demonstrated its ability to outbid commercial television for major sports attractions, and this tendency is on the increase. The only way in which home television can realize its full potential as a national program service is to provide it with a box office that will help pay part of the cost. This principle is an old one in the magazine and newspaper field, where subscribers help offset part of the cost in subscription fees and newsstand purchases, and advertisers carry the rest of the burden," he said.

Bonfig stated that the Zenith Radio Corporation has five proved and tested systems of subscription TV ready to go, if, as, and when the FCC extends its permission.

THE FRONT COVER

THE BIG PICTURE

● QUALITY-CONTROL INSPECTIONS assure that specifications are met every step along the line during the production of tricolor television picture tubes. An inspector checks the mesh of a shadow mask through a powerful magnifying lens.

THE OTHER PICTURES—Top to Bottom

● PHOTOGRAPHY plays an important role in color-tube production. A technician inspects the glass negative of a shadow mask. The negative is required to produce a gelatin stencil which is later used during the placement of the color-dot array on the kinescope screen.

● COLOR-DOT structure of an RCA tricolor television picture is carefully inspected by a technician at the company's Lancaster, Pa., plant. The dot-pattern shown at left of the picture is a magnified representation of the pattern visible to the inspector through her magnifying lens.

● THE SHADOW MASK is an essential element of tricolor television picture tubes. Through the mask's microscopic holes are projected the streams of electrons emitted by the red-blue-green electron guns. The mask permits each beam to strike its proper phosphor dots located on the tube's viewing screen.

● COLOR-DOT pattern of an RCA tricolor picture tube as seen through a magnifying lens. The approximately 600,000 dots of phosphor material on the tube's screen are arranged in precise triangular groups—each group containing a red, a green, and a blue phosphor dot.

● LINE UP! Tricolor television picture tubes are seen awaiting their turn for a trip through the exhaust machine. In this operation, the tubes are "exhausted" to provide the necessary vacuum.

● CHECK UP: A tricolor kinescope undergoes in production many tests and double checks. A skilled technician electronically checks the phosphor-dot brightness of tubes as they approach the end of the production line.

All pictures accompanying this feature are from RCA.

Television Stations Under IBEW Banner

THE lifting of the freeze on television station construction a year ago gave a tremendous boost to the nation's newest entertainment and communications industry. There are 359 TV stations now operating, and above 22 more expecting to go on the air before the end of February.

The pace of new station debuts got off to a slow start in January, with only five beginning regular programming. The pace is picking up, however, and scores more should be ready before the end of 1954.

The International Brotherhood of Electrical Workers has already made a fine start as bargaining agent for technicians and engineers of the major network and independent stations, but there is much organizing work ahead. There are 113 stations under IBEW agreement. Let's have many more in '54!

ALABAMA

Birmingham .... WABT, WBRC-TV
Mobile .... WALA-TV, WKAB-TV
Montgomery .... WCOV-TV

ARIZONA

Phoenix .... KOOL, KOY-TV

CALIFORNIA

Bakersfield .... KAFY-TV
Fresno .... KMJ-TV, KBID-TV
Los Angeles .... KHJ-TV, KCOP, KNXT
Sacramento .... KCCC-TV
San Diego .... KFMB-TV
San Francisco .... KRON-TV, KSAN-TV
Stockton .... KTVU
Tulare (Fresno) .... KCOK-TV

COLORADO

Denver .... KBTV, KFEL-TV
Pueblo .... KCSJ-TV

CONNECTICUT

Hartford .... WGTH-TV
New Britain .... WKNB-TV

DISTRICT OF COLUMBIA

Washington .... WTOP-TV

GEORGIA

Atlanta .... WLWA, WSB-TV
Columbus .... WRBL-TV

IDAHO

Pocatello .... KWIK-TV

ILLINOIS

Belleville .... WTVI
Chicago .... WBBM-TV, WGN-TV
Peoria .... WEEK-TV, WTVH-TV
Quincy .... WGEM-TV
Rockford .... WTVO
Rock Island .... WHBF-TV

INDIANA

Indianapolis .... WFBM-TV
Muncie .... WLBC-TV

IOWA

Cedar Rapids .... KCRI-TV, WMT-TV
Des Moines .... KGTV
Fort Dodge .... KQTV

KANSAS

Pittsburg .... KOAM-TV

KENTUCKY

Louisville .... WAVE-TV, WHAS-TV

LOUISIANA

Baton Rouge .... WAFB-TV
New Orleans .... WDSU-TV, WJMR-TV

MARYLAND

Baltimore .... WBAL-TV, WMAR-TV

MASSACHUSETTS

Boston .... WBZ-TV, WNAC-TV

MICHIGAN

Detroit .... WXYZ-TV
Grand Rapids .... WOOD-TV
Kalamazoo .... WKZO-TV

MINNESOTA

Minneapolis .... WCCO-TV, WTCN-TV
St. Paul .... WMIN-TV

MISSOURI

Festus .... KACY
Hannibal .... KHQA-TV
Kansas City.... KCMO-TV, KMBC-TV, WDAF-TV, WHB-TV
St. Louis .... KSD-TV, KSTM-TV
Springfield .... KTTS-TV

MONTANA

Butte .... KOPR-TV, KXLF-TV

NEBRASKA

Lincoln .... KFOR-TV, KOLN-TV

NEVADA

Las Vegas .... KLAS-TV

NEW JERSEY

Atlantic City .... WFPG-TV
Newark (New York City) .... WATV

NEW YORK

Albany .... WROW-TV
New York .... WCBS-TV, WOR-TV, WPIX

NORTH CAROLINA

Winston-Salem .... WSJS-TV

NORTH DAKOTA

Bismarck .... KFYR-TV

OHIO

Cincinnati .... WKRC-TV, WLWT
Columbus .... WLWC, WTVN
Dayton .... WLWD
Toledo .... WSPD-TV
Youngstown .... WKBN-TV

OREGON

Portland .... KOIN-TV

PENNSYLVANIA

Harrisburg .... WHP-TV
Philadelphia .... WCAU-TV
Reading .... WEEU-TV, WHUM-TV
York .... WSBA-TV

RHODE ISLAND

Providence .... WJAR-TV

TEXAS

Dallas .... KRLD-TV
Fort Worth .... WBAP-TV
San Antonio .... KGBS-TV

UTAH

Salt Lake City .... KSL-TV

WASHINGTON

Bellingham .... KVOS-TV
Seattle .... KING-TV, KOMO-TV
Spokane .... KHQ-TV, KXLY-TV
Tacoma .... KMO-TV, KTNT-TV
Yakima .... KIMA-TV

WISCONSIN

Madison .... WKOW-TV
Milwaukee ..... WTMJ-TV, WCAN-TV, WOKY-TV

HAWAII

Honolulu .... KGMB-TV

FCC Considers Fees for Licenses and Authorizations

THE FCC proposed last month to charge radio and television broadcasters, electronics manufacturers, radio operators, and telephone companies fees ranging from $3 to $1,500 for applications for government licenses and authorizations.

The proposal was in line with a budget bureau directive last year that all government agencies issuing licenses set fees to cover the cost of services. The FCC invited comments by April 1 on its proposal.

Under the proposal, the FCC would charge $325 for applications for new radio and TV stations and all other "major" broadcast applications. These include applications to modify station construction permits, license applications, renewals of licenses, modifications of licenses, transfer of construction permits or licenses, and special service authorizations.

An FCC spokesman said he could not estimate how much the various fees would bring in.

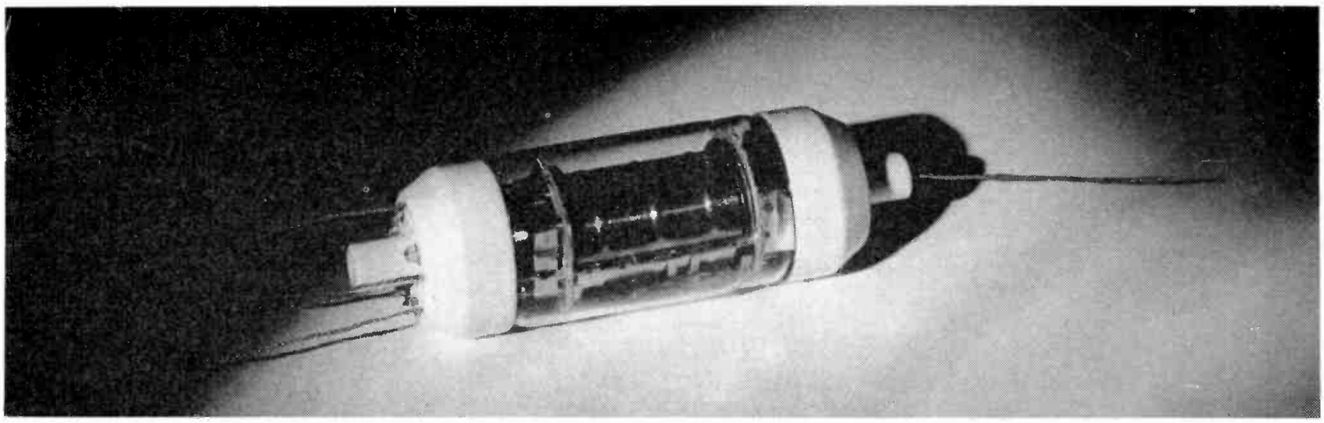
Under the proposal it would cost a minimum of $650 for operating a new radio or TV station—$325 for the application for a construction permit, and another $325 for a license application after the permit was issued. The stations would have to pay another $325 to renew licenses every three years.

All fees would have to be paid in full at the time applications were filed.

Other proposed fees include $50 for minor broadcast applications, including those for auxiliary broadcast stations and minor modifications of permits or licenses.

Other fees: $3, for applications for commercial operators' licenses, for restricted radio telephone operators' permits and for amateur radio, disaster, and civil emergency services; $10, for safety and special radio services applications; $20, for experimental services applications; $30, for applications for compulsory inspections of ship radio equipment; $150, for applications to build or extend telephone lines and for applications by all common carriers for certain exemptions from commission jurisdiction; $350, for applications to acquire or consolidate telephone companies; $30, for all other common carrier applications, and fees ranging from $100 to $1,500 for applications to approve radio and electronics equipment such as diathermy machines and various types of industrial heating equipment.

Commissioner Frieda B. Hennock dissented in part from the commission's proposal, saying she felt a public hearing should have been held before it was issued.



Three tubes like the one shown above will serve each repeater circuit of the Trans-Atlantic Cable. The tube is an unconventional pentode. In place of the usual base and grid cap, ceramic shells are used at each end, with the leads brought out to flexible braided strands to be permanently soldered in the circuit. When mounted in the repeater, the ceramic shells fit into rubber cushions.

ANSWER TO A MEMBER'S REQUEST

More About the Trans-Atlantic Cable

DEAR SIR:

When articles are published in the TECHNICIAN-ENGINEER please try to give us information that the technician will appreciate. For example, the January, 1954, issue, Page 6, "Trans-Atlantic Telephone Cable." Except for the two views of the cable amplifier the article was a duplicate of many more I have read recently on the subject, all written for the general public.

The first question I would raise and like more information about was missing in your article too, namely, . . . what kind of vacuum tubes are used? . . . how long is their filament life? . . . how is the cable repaired when a filament burns out?, . . . etc.

H. C. MATZINGER,
Riverview, Mich.

THUS CHALLENGED,

We went to the Bell Telephone Laboratories for answers to Brother Matzinger's questions. Bell offered the following reply:

"Up to the present time no technical material on the Trans-Atlantic Cable has been published beyond that contained in the original release to the press. However, as you are no doubt aware, it will probably be fundamentally similar in most respects to the Key West-Havana Cable which has been in operation for several years."

SO SAYING,

Bell Laboratories supplied us with technical data on the Key West-Havana Cable, plus the accompanying illustrations.

AN outstanding feature of the Trans-Atlantic Cable which, a few years from now, will link the United States to continental Europe will be the "ocean-bottom" repeater which sends the signals speeding on their way.

Unless new research developments replace it in the meantime, the repeater to be used will be the unique array of electron tubes now helping to bridge the hundred-mile gap of water between Cuba and the United States via the Key West-Havana Cable. Three of these repeaters are used in each of two small diameter, one-way cables to provide many more "four-wire" carrier telephone channels than could be obtained without them.

An important requirement of the "ocean-bottom" repeater is that it remain free of trouble or need of replacement of parts over long periods of years. Servicing, even at intervals of several years would be undesirable, not only because of excessive costs but also because of the possibility of damaging a cable.

There were two alternatives: (1) to provide spare elements such as tubes having only moderate life together with switching apparatus to substitute worn out units as necessary, or (2) to provide the simplest possible circuit with inherently long-life elements. The Long Lines Department of AT&T chose the latter.

The repeater circuit is shown in Figure 1. It uses three special heater type electron tubes, with the heaters connected in series with each other and with the central conductor of the cable. (A picture of the tube is shown above.) Direct current for heating is supplied over the central conductor, and the total voltage drop across the heaters provides the necessary screen, plate, and cathode potentials. The net gain of each repeater compensates very closely for the loss-frequency characteristic of 36 nautical miles of submarine cable in the frequency range of 12 to 120 kc. Matching of the repeater gain and cable loss is within a few tenths of a db per repeater section. Net insertion gain of the repeater at 108 kc is 65 db.

Extreme care was used in adjusting the repeater elements so that unusual uniformity of the manufactured product was realized. Measurement on the completed repeaters prior to installing them in the cable showed that they were within 0.02 db of each other at the highest reference frequency, 108 kc. Bell's research men point out that such uniformity is highly desirable for the detection and diagnosis of trouble, after sealing, by means of precise external transmission measurements.

Since it is impractical to isolate and measure an individual repeater after it has reached the ocean bottom, a major problem that had to be solved was how the condition of each repeater could be watched from the terminals. If it had been permissible to add relatively complex elements, a number of ways of obtaining information could be used, but such complication was not practical with this cable.

This problem was solved by adding only one element to the repeater circuit—a quartz crystal that can be relied upon as a stable, trouble-free element. Each repeater has a crystal, of different resonance frequency, shunted across the feedback circuit. The resonant frequency is at some even hundred cycle value within the band between 120.0 and 121.3 kc. This band is above the highest frequency at which the repeaters normally operate. In this way, the stabilizing feedback of the repeater is largely nullified in a narrow band only about 1-cycle wide, in which there is the maximum change in repeater gain with change in tube activity. It is possible to measure transmission over the cable system at one of these frequencies at which the gain of a particular repeater will be unstabilized but all other repeaters in line will be fully stabilized. Change in transmission at this frequency will thus indicate change in the total gain of the three tubes in that repeater alone; thus the tube condition of the individual repeaters can be watched, as a function of time, by periodically checking transmission of these critical frequencies.

One important requirement of the ocean-bottom repeater which Bell was able to fulfill was that there should be no interruption to the smooth and continuous process of laying the cable from a ship, especially in deep water. This meant that the repeater had to be built so that it could be passed overboard like any other length of cable, being flexible enough to pass around the drums and sheaves employed in the conventional laying operation. The repeater assembly, therefore, is a series of small steel rings and plastic units which can be formed almost into a loop.

Data for this article was lifted liberally from two articles in the "Bell Laboratories Record"—"An Electron Tube for Submarine Repeaters" by E. A. Veazie and "Electrical Characteristics of Repeaters and Terminals" by L. M. Ilgenfritz, both of the Bell Laboratories. Our thanks to Hal Martin of AT & T's Washington office and Josephine Doty of Bell's Publication Department.

What kind of tubes are used? . . . How long is their filament life?

Bell developed a tube which has just about all the answers for submarine repeaters. It operates for as long as 20 years without mishap, and it can take the tough treatment of cable-laying operations in stride. Its power comes from direct current over the cable, all tubes being connected in series. If filamentary cathodes were used, the plate voltage would be obtained from the drop across a resistor in series with the filaments. A large part of the available power would be wasted. On the other hand, with indirectly heated cathodes, all of the power could be utilized, provided the total heater voltage drop was equal to the desired plate voltage. This consideration led to the adoption of the indirectly heated cathode.

It was found desirable to use 0.25 ampere at 20 volts for cathode heating.

For the internal structure, emphasis is placed on ruggedness. All three grids are wound on molybdenum supports instead of nickel. Liberal spacings between elements and rigid anchoring of all parts of the tube minimize the hazard of short circuited elements.

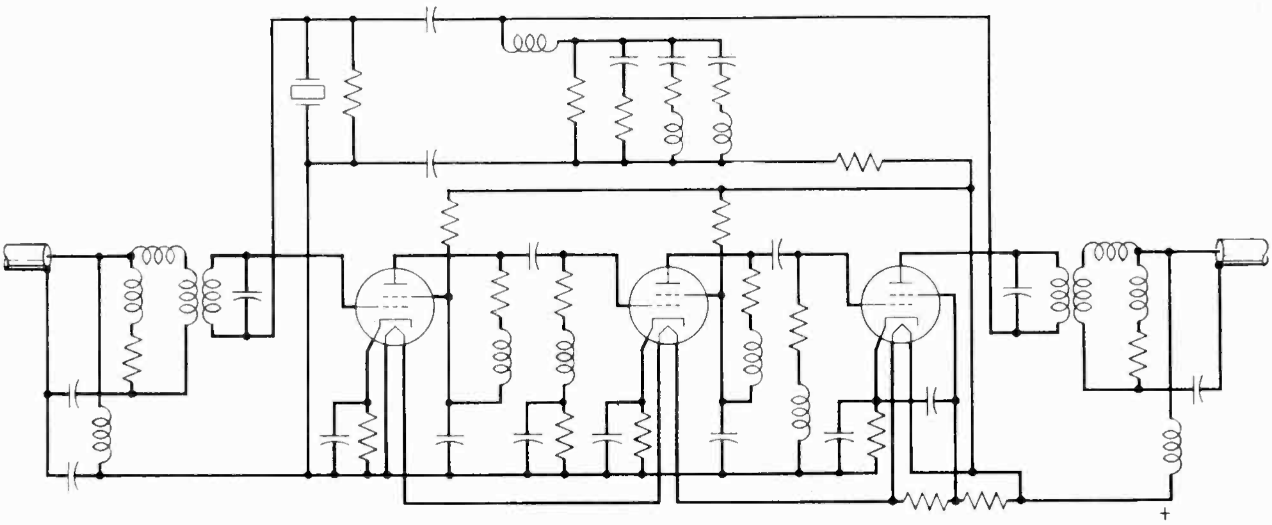
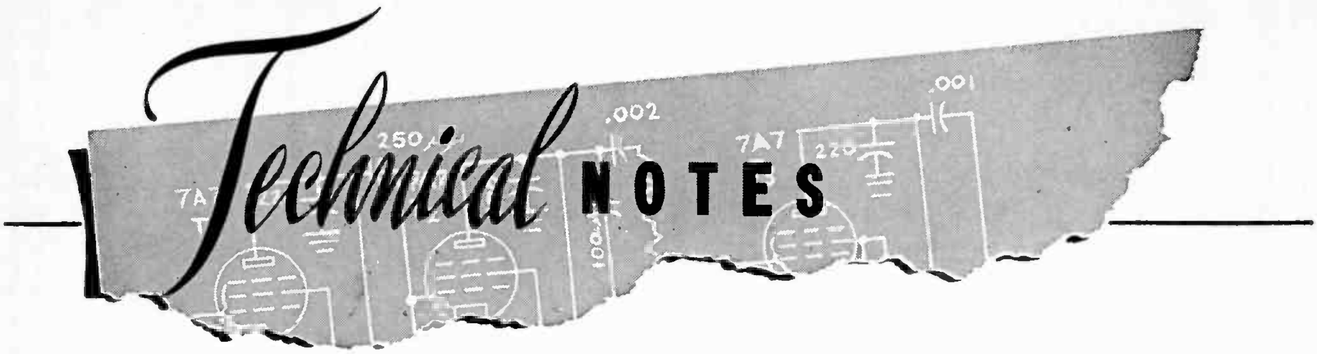


Fig. 1—The repeater circuit.



Technical NOTES

Coreless Power Resistor

General Electric has started production of a new coreless power resistor representing a significant development in the field, according to E. A. Malling, marketing manager of the company's components department.

The new resistor is up to 50 per cent lighter than conventional types and is the first designed to meet characteristic "V" of the MIL R26B specification.

Immediate application for the resistor will be found in military equipment where reduced size and weight is so important. Mr. Malling points out, however, that the new principle of power resistor construction will be followed in types for commercial use.

The new G. E. product, priced competitively, will be marketed under the name "Kor-les Cool Blue Power Resistor" and will be available in standard resistance values within MIL types RW 29, 30, 31, 32, 33, 34 and 35.

The resistors are constructed of a ceramic refractory material completely enclosing the wire windings. This construction permits the use of finer wires when necessary for special applications requiring higher than standard ohmic values and closer resistance tolerances.

The coating of the G. E. resistors is nonorganic, vitreous enamel which will not deteriorate with age and readily withstands the higher operating temperature called for in characteristic "V."

All the materials used in the resistors have a matching co-efficient eliminating the danger of internal stress build-up. Thinner walls permit more rapid heat dissipation and result in cooler operation.

New Trans-Oceanic Receiver

Zenith has marketed a new addition to its line of Trans-Oceanic receivers—one which will function without a lag, though power input is allowed to flop back and forth between 85 and 130 volts.

Features of the new set include a new type of iron-core loop antenna which, in combination with new circuits, affords sensitivity of three times its former value for standard broadcast reception. This loop, called the "Wavemagnet" by Zenith, is removable from the top of the receiver case for attachment to a window, port-hole or any other flat surface, for more effective reception in planes, trains, ships or steel buildings.

Also new to the set is a horizontal slide-rule type tuning dial, keyed to a row of push-button band switches, covering the set's seven receiving bands instantly.

A reel-away take-up on the power cord is also a new feature. Arranged in a recess at the side of the cabinet, the plug and cord can be pulled out to extend to the nearest AC outlet when house current is to be used; the cord snaps back into the set when released. And at all times, self-contained batteries are ready to power the set when access to house current is not available or when the power lines fail.

For short-wave addicts, or for globetrotters, one special new feature will be of great interest. Inside the cover of the set Zenith has located a series of flip charts, including a world-wide time map, wind and weather broadcast schedules for river and lake and ocean navigators, plus listings for all major short-wave stations, the Voice of America, the United Nations radio, and Armed Forces radio. As an incentive for users to dial the short-wave bands, the triple antenna provision is an advantage. Besides the Wave-magnet antenna, the set comes equipped with a pop-up telescoping rod antenna that extends to five feet above the set. For extreme locations, handy internal connections are available for hooking the set to an external radio antenna and ground.

FTC Nixs TV Fix-It Book

A book called "TV Owners' Guide to Operation and Repairs" has been removed from the market by the promoters as a result of Federal Trade Commission findings that claims about the value of the publication were false and misleading.

In consenting to an FTC order forbidding advertising claims that the book enables a television set owner to keep his own set in perfect repair, convert to color TV or obtain discounts on TV sets or services, the mail order house of Huber Hoge and Sons, the Bedford Company and Louis Linetsky stated they had stopped advertising and selling the book.—(LPA)

To Modify Studio Cameras

The General Electric Company announced plans to modify existing black-and-white TV cameras for live color program origination, and predicted the low-cost conversion would hasten the colorcasting of live talent programs by local stations across the nation.

The company estimated factory conversion of any black-and-white camera now in use by TV stations can be made for about $6,000.

The G. E. converted cameras will be used with a device called a Chromacoder, developed by the Columbia Broadcasting System and to be made by G. E. under a patent license agreement reached last week. The Chromacoder translates field sequential color signals from the cameras into compatible NTSC color signals recently adopted by the Federal Communications Commission.

The total cost for one camera conversion, including the Chromacoder, will be about $46,000. This contrasts with the $66,500 cost of a three-tube type camera and associated equipment previously required to produce NTSC color signals.

(General Electric anticipates conversion of a studio to permit live talent color programs will be the final step in a three-phase complete color conversion by a local TV station. The first two phases would cover changes necessary to permit rebroadcast of network color shows, and the origination of local color slide and film shows, at a total cost of about $82,000.)

Because one Chromacoder can be used with any number of field sequential cameras, the capital investment of a station using this new system will be considerably less than would be required for three-tube type cameras.

A station can have two of its present black-and-white cameras converted for color by G. E. for about $52,000, including the Chromacoder. Two three-tube cameras and associated equipment would cost about $133,000.

Savings mount as the number of color cameras increases. A station can have four black-and-white cameras converted, and add a Chromacoder, for about $64,000, compared to the $266,000 cost of four three-tube cameras and associated equipment.

General Electric will build field sequential cameras, as well as the Chromacoder, for present or future stations who desire all new camera equipment. A station could be equipped with two new field sequential color cameras and associated equipment, including a Chromacoder, for about $100,000.

The single-tube field sequential camera also will make possible considerable additional savings to the broadcaster in the form of tube operating and replacement costs.

(For additional news on new color television equipment, see Pages 3-7 of this issue.)

Reading Time

Magnetic Fields of Cylindrical and Annular Coils, *National Bureau of Standards Applied Mathematics Series 38, 29 pages, 25 cents (order from Government Printing Office, Washington 25, D. C.).*

This publication gives the axial and radial components of the magnetic field at any point in space of a cylindrical or an annular coil carrying an electric current. The results are expressed in terms of complete elliptic integrals or of Legendre functions which involve ratios of the significant dimensions of the coils.

In the past many formulas have been published which give the resultant effect of the magnetic field as either the inductance of such a coil or the force between two such coils when a known current exists in them. In contrast with this, the present publication gives a basis for computing in full detail the magnetic field itself, point by point. No formulas for this purpose have been readily available hitherto.

In experimental work it is frequently necessary to produce an accurately known magnetic field, and the use of one or more solenoidal coils of measurable dimensions is usually the most convenient way of accomplishing this. Possible applications range from the laying out of large current-limiting reactors in electric power stations to the design of coils for studying paramagnetic resonance in atomic nuclei.

Producing and Directing for Television *by Charles Adams. Henry Holt and Co., 383 Madison Ave., New York City 17. 282 pp. $3.95*

The author takes beginners in the industry through nearly all the production phases of television. He discusses the areas in which the producer and director must work, the TV station itself, its facilities, personnel, equipment, and special effects. Adams outlines various types of TV programs. He covers the function of the advertising agency, programming for the local station and budget and cost control.

Practical Television Engineering *(Second Edition) by Scott Helt. Rinehart & Co., 232 Madison Avenue, New York 16. 744 pp. $7.50.*

Here's a book that goes from the fundamentals to the most intricate complexities of television. The author is with the Research Division of DuMont, and he is also instructor of television at Columbia University. He gives a detailed engineering treatment of TV, explaining all the components of transmitters and receivers. He tells how they work and how they combine to form the complete television system. Transmitting and broadcasting problems are emphasized.

Station Breaks

CBS Chicago Expansion

The Columbia Broadcasting System has announced its recent purchase of the Chicago Arena for $1,500,000 and that it will shortly begin remodeling the building for television studio use. The building consists of nearly 87,500 square feet of space and plans are being made to convert more than 50,000 square feet to be used by WBBM-TV.

The purchasers expect to begin moving in in April, looking toward program production on a large scale in the early fall of 1954. The station's present facilities in the State-Lake Building have long since proved to be inadequate. The network's radio facility (WBBM) is located in the Wrigley Building and no changes in this operation are presently contemplated.

Win at WENS (TV), Pittsburgh

An NLRB election at WENS on January 25, 1954, resulted in a unanimous 14-0 vote for the IBEW. Officers and members of Local 1481 were instrumental in obtaining this victory and were assisted by International Representative Russell D. Lighty. We extend a hearty welcome to our Pittsburgh members and wish them every success in their joint effort to obtain standard IBEW working conditions. WENS carries ABC and CBS programs and covers the greater Pittsburgh area with a 100-kw signal on Channel 16.

Prefab Metal Framing

Prefabricated metal framing has been used by KMJ-TV, IBEW-contract station at Fresno, Calif., to install studio grids to support lighting and other equipment.

E. A. Nickel, advertising manager of Unistrut Products Co., Chicago, said that the station used the framing for building an adjustable, movable grid to support all lighting, sound, projection, and other equipment. Framings and fittings were quickly assembled by the staff crews of Unistrut, who used only wrenches to construct the framework.

Station KGO-TV of San Francisco has also used the prefab framing to advantage, producing an adjustable scaffolding for studio lighting.

TV Technique for Ike

Television viewers got more of a look at President Eisenhower's face and less of his balding head when he delivered his State of the Union message to Congress January 7.

On the advice of Robert Montgomery, film actor and TV show producer, the lectern holding the pages of the prepared speech was raised three inches, so the President could look more directly at his audience. Montgomery, a strong Eisenhower supporter, has been giving Ike tips regularly on radio and TV technique.—(LPA)

RETMA Meeting

Recent legislative and administrative developments directly affecting the radio-electronics-television industry will be reviewed during a three-day conference of members of the Radio-Electronics-Television Manufacturers' Association, February 16-18, at the Roosevelt Hotel, New York City.

One Moment Please

In Oakland, Calif., union salesmen employed in television and radio stores enjoyed their biggest laugh of the year when a brilliant promotion stunt dreamed up by one store backfired in the owner's face. The store owner, Jack O'Day, announced he would award a new television set to the winner of a contest he was sponsoring; the winner would have to submit the correct four-numbered combination to his store's safe. O'Day overlooked—but a man named Robert Reynolds did not—one of the easiest ways possible of winning the contest. Reynolds sent in 10,000 numbers starting with 0000 and ending with 9999, thus covering all possible combinations. The astounded store owner went storming to the police, demanding to know whether he would have to pay off. He was a sadder and wiser man when he left police headquarters. The authorities told him he had trapped himself, and that the next time he ran a contest he might consider putting a limit on the number of entries. (LPA)

LOCAL UNIONS Having Radio Broadcast Technician Members

This is a newly-revised directory. Please note corrections.

Local and City		*Officer (Business Manager Unless Noted), Address and Telephone*
12	Pueblo, Colo.	G. R. Allenbach, P. O. Box 612. Phone: 1160.
31	Duluth, Minn.	Clyde J. Giles, 203 Labor Temple. Phone: 2-6051.
45	Hollywood, Calif.	Harold Stone, 1584 Cross Roads of the World. Phone: Hollywood 5-3129.
49	Portland, Oreg.	Charles D. Hoffman, 1417 S. W. Third Avenue. Phone: BR. 5479.
65	Butte, Mont.	Albert Coombs, 226 South Dakota Street. Phone: 5926.
77	Seattle, Wash.	Lloyd C. Smith, 1718 Melrose Avenue. Phone: Capitol 4505.
108	Tampa, Fla.	A. W. Schmidt, P. O. Box 905. Phone: 2-6702.
122	Great Falls, Mont.	Ray C. Stanich, P. O. Box 385. Phone: 7449.
135	La Crosse, Wis.	Arthur Schmitt, 423 King Street. Phone: 2-9337.
202	San Francisco, Calif.	John J. Dunn, 450 Harrison Street, Room 210. Phone: Yukon 2-6752.
224	New Bedford, Mass.	James E. Murphy, 384 Acushnet Avenue. Phone: 2-4291.
253	Birmingham, Ala.	Joe S. Harmon, P. O. Box 612.
271	Wichita, Kans.	W. W. Malcolm, 1040 South Broadway. Phone: 5-9324.
292	Minneapolis, Minn.	Joseph F. Krech, 243 Foshay Tower. Phone: Main 0552.
349	Miami, Fla.	Wm. C. Johnson, 1657 N. W. 17th Avenue. Phone: 9-3529.
408	Missoula, Mont.	Charles W. Holden, Pres., 513 South Avenue. Phone: 8617.
417	Coffeyville, Kans.	O. H. Vey, R. R. No. 3. Phone: 3982-W-4.
437	Fall River, Mass.	George H. Cottell, 5 Anawan Street. Phone: 4-2432.
449	Pocatello, Idaho	L. C. Jenkins, 78 Maplewood. Phone: 3593-M.
453	Springfield, Mo.	W. E. Glidewell, 218 West Walnut Street. Phone: 4-7251; Res., 4-4583.
504	Meadville, Pa.	W. C. Kohler, 887½ Water Street. Phone: 4-0475.
530	Sarnia, Ont., Canada	B. Blackwell, 155 South Vidal Street.
575	Portsmouth, Ohio	Glenn Barrett, 1215 Fourth Street. Phone: 3-4381.
624	Panama City, Fla.	William A. Cooper, 105 East Fourth Street. Phone: 4761.
640	Phoenix, Ariz.	Henry Van Ess, 2544 North Seventh Street. Phone: 8-0815.
662	Chattanooga, Tenn.	J. S. Andrews, 803 Underwood. Phone: 873.
676	Pensacola, Fla.	C. J. Kiedinger, 114 East Gregory Street. Phone: 6978.
715	Milwaukee, Wis.	James A. Wilkerson, Pres., 5006 West Burleigh Street. Phone: Hilltop 5-1664.
724	Albany, N. Y.	Joseph A. Koreman, 87 Beaver Street. Phone: 3-2029.
768	Kalispell, Mont.	Charles Byers, 761 Sixth Avenue. Phone: 6255.
995	Baton Rouge, La.	C. H. Sims, Sr., 405 St. Ferdinand Street. Phone: 3-6350.
1077	Bogalusa, La.	Otis Carter, P. O. Box 731. Phone: 674-M.
1139	New Orleans, La.	R. L. Grevemberg, 23 Beverly Garden Drive. Phone: CE. 0801.
1141	Oklahoma City, Okla.	J. J. Caldwell, 1141 N. W. 1st Street. Phone: Regent 6-5449.
1173	Harrisburg, Pa.	Chas. E. Nusbaum, Pres., 1515 Letchworth Road. Phone: 7-9805.
1178	Shreveport, La.	S. A. Contonis, P. O. Box 1053. Phone: 2-9195.
1193	Atlanta, Ga.	David Holt, 221 East Lake Drive.
1212	New York, N. Y.	Charles A. Calame, 11 West 42nd Street, Suite 786. Phone: Pennsylvania 6-8216.
1213	Champaign, Ill.	Wm. Robert Brown, 302 Kirby Avenue. Phone: 6-6314.
1214	Bismarck, N. Dak.	James E. Schlechter, 1030 12th Street. Phone: 3363-W.
1215	Washington, D. C.	North C. Richardson, Pres., 6324 North 31st St. Phone: JE. 3-7966.
1217	St. Louis, Mo.	Denis E. Volas, 4249 Gibson Avenue. Phone: JE. 6718.
1218	Detroit, Mich.	Richard L. McNutt, 24754 Winchester Drive. Phone: LO. 3-4093.
1219	Youngstown, Ohio	Ralph Sherman, Pres., R. D. No. 2. Phone: 3-5924.
1220	Chicago, Ill.	H. Walter Thompson, Pres., 400 N. Mich. Ave., Room 514. Phone: Superior 7-5244.
1221	Omaha, Nebr.	Roy T. Rydberg, Pres., 5544 Pacific Street. Phone: Glendale 9470.
1222	Denver, Colo.	Lucian M. Long, 567 Race Street. Phone: Keystone 1721.
1223	Portland, Me.	T. V. Sale, President, 691 Allen Avenue. Phone: 2-9747.
1224	Cincinnati, Ohio	J. Frank Atwood, Jr., Pres., 3297 Diehl Road. Phone: Humbolt 6197.
1225	Indianapolis, Ind.	William E. Schettler, 3619 W. 32nd Street. Phone: Wabash 3702.
1228	Boston, Mass.	George T. Cairns, 470 Stuart Street, Room 305. Phone: Copley 7-5221.
1229	Charlotte, N. C.	A. B. Leonard, Pres., 225 South Cherry Street. Phone: 4-7350.
1234	Fort Worth, Tex.	Thomas A. Bedford, Pres., 1016 Arch. Phone: La. 3855.
1241	Philadelphia, Pa.	Cecil V. Mullen, Pres., P. O. Box 97, Bala-Cynwyd, Pa. Phone: Madison 3-0172.
1257	Dallas, Tex.	Jones P. Talley, 6622 Petain Avenue.
1258	Des Moines, Iowa	Kenneth Myers, Pres., 88 Gruber Street. Phone: 8-4745.
1259	Kansas City, Mo.	Walter L. Reed, 1017 Washington Street. Phone: Baltimore 5054.
1260	Honolulu, T. H.	Francis J. Kennedy, 708 Ward Avenue, Room 210. Phone: 5-9553.
1264	Mobile, Ala.	H. T. Bailey, 506 Conti Street. Phone: 2-3519.
1266	Dayton, Ohio	Ervin P. Warnick, Jr., R. F. D. No. 1, Farmersville, Ohio.
1272	Quincy, Ill.	Virgil L. Stull, Pres., Route No. 1, Hannibal, Mo. Phone: 6111-W11.
1275	Memphis, Tenn.	Eugene V. Parham, P. O. Box 5613, Crosstown Branch. Phone: 33-8520.
1281	Providence, R. I.	Elmer E. Bergeron, 31 Marmarel Road, Greenville, R. I. Phone: Ho. 1-7233.
1282	Springfield, Mass.	Francois Gouin, Harkness Road, Pelham R. F. D., Amherst, Mass. Phone: 970-M2.
1286	Louisville, Ky.	Bernard Neher, Pres., 302 South 42nd Street. Phone: Ra. 5950.

— Continued on Back Page —

Local and City		Officer (Business Manager Unless Noted), Address and Telephone
1287	Tulsa, Okla.	M. M. Donley, 2226 East Sixth Street. Phone: 6-1939.
1292	Peoria, Ill.	Robert Pratt, 2 Steinmetz Place, Pekin, Ill. Phone: 742-W.
1294	Hartford & Bridgeport, Conn.	Ralph S. Rice, President, 15 Longland Road, W.
1295	Grand Rapids, Mich.	Calvin J. Miller, Pres., 2501 Glenbrook S. W. Phone: Ardmore 6-2485.
1299	Montgomery, Ala.	J. C. Fischesser, Jr., 11 Hubbard Street. Phone: 2-2263.
1300	Columbus, Ohio	Frederick J. Distelzweig, Pres., 1685 South High Street. Phone: Garfield 1543.
1304	Little Rock, Ark.	Cecil Morrow, 1314 Hanger Street. Phone: 5-9226.
1318	Halifax, N. S., Canada	Carl E. Westhaver, Pres., 16 Tobin Street.
1343	Trenton, N. J.	Thompson Durand, President, 27 Ellsworth Avenue. Phone: 8280.
1348	San Antonio, Tex.	James M. Matson, Pres., 420 West Lullwood. Phone: P5-7808.
1349	Rock Island, Ill.	Frank Pierce, 2415 19th Avenue.
1374	Cedar Rapids, Iowa	Merwin Lewis, Pres., 3000 E Avenue, N. E. Phone: 3-3326.
1400	Baltimore, Md.	Robert D. Briele, 6516 Maplewood Road. Phone: Va. 5-1333.
1405	Flin Flon, Man., Canada	M. W. Grant, Pres., 107 Hammell Street.
1481	Pittsburgh, Pa.	Rocco Catalfamo, 1435 Clark Street.
1547	Anchorage, Alaska	Waino Niemi, 4th and Denali Streets.
1564	Gadsden, Ala.	C. C. Williamson, 1407 Jackson Avenue, Route 4.
1622	Washington, Pa.	Bill Bedilion, 30 West Walnut Street, Washington, Pa. Phone: 4506-M.

Revised: January 1, 1954.

INTERNATIONAL REPRESENTATIVES . . . Assignments Radio and Television Broadcasting and Recording Activities

District 2	Walter Reif, 82 Kohary Drive, Devon, Conn. Phone: Milford 2-2124.
District 3	Russell D. Lighty, R. F. D., Lafayette, N. J. Phone: Newton, N. J., 1521.
District 4	Franklin A. George, 734 Pleasant Avenue, Glen Ellyn, Ill. Phone: Glen Ellyn 5.
District 5	O. E. Johnson, 1851 St. Charles Ct., S. W. Birmingham, Ala. Phone: 56-5172.
District 6	Freeman L. Hurd, 135 North Harvey Street, Oak Park, Ill. Phone: Euclid 6-0389.
District 7	Forrest C. Conley, 2625 N. Handley Drive, Fort Worth, Tex. Phone: Lamar 2792.
District 8	George J. Dengel, 617 Belden Street, Lewiston, Mont.
District 9	Marvin L. Larsen, Room 210, 450 Harrison St., San Francisco 5, Calif. YU. 2-6752.
	W. A. Smith, c/o L. U. 77, IBEW, 1718 Melrose Avenue, Seattle 22, Wash.
District 11	Harold J. Becker, 6915 Lake Drive, East St. Louis, Ill.
District 12	Taylor L. Blair, Jr., 3707 LaMar Avenue, Chattanooga, Tenn. Phone: 87-1013.

Are you receiving your TECHNICIAN-ENGINEER *regularly and at the right address? Following the distribution of each issue of the Division magazine, the General Headquarters in Washington receives dozens of returned copies marked "Moved, No Forwarding Address," "Incorrect Address," etc. The office staff is now reviewing the complete mailing list in an effort to bring it completely up to date. If you have a new address, or if you are not already receiving the* TECHNICIAN-ENGINEER, *cut out the coupon below and mail it to us THIS WEEK.*

The TECHNICIAN-ENGINEER
International Brotherhood of Electrical Workers
1200 Fifteenth Street, N. W.
Washington 5, D. C.

ADDRESS CHANGE

NAME: ....

OLD ADDRESS: ....
Street or Box Number

....
City and State

NEW ADDRESS: ....
Street or Box Number

....
City and State

MAILING CODE NUMBER (Indicated in present stenciled address): ....