

NOVEMBER 1951

RADIO — ELECTRONICS

LATEST IN TELEVISION • SERVICING • AUDIO

HUGO GERNSBACH, Editor

NEW ANTENNA COVERS
100 KC TO 4,000 MC!
SEE THEORY AND ENGINEERING



30¢
U.S. and
CANADA

In this issue: Black-and-White Plus Color Receiver •
Revolutionary New Speaker • Filter Facts

it's revolutionary!

The New

du mont

*Selfocus
Teletron*



**actually improves
receiver performance**



**no time wasted
in installation--
focus perfect at
all times--
no circuit changes**



**one type replaces
many --including
electromagnetic- or
electrostatic-focusing
types**

DU MONT

*Teletrons**

*Trade-mark

Be Sure of Your Installations...Next Year

Use *Aptitude-Tested*

MIKE CABLE

Now

● Now, you can be sure of your installations with Belden Microphone Cables. They are *Aptitude-Tested* and rated to give you safe and complete knowledge of their characteristics. Furthermore, Belden Mike Cables are built for maximum service. Put them to work for you now—and be sure... specify Belden.

Belden Manufacturing Co.
4623 W. Van Buren Street
Chicago 44, Illinois



No. 8411
Nominal Capacitance 37 mmf per ft. Use particularly for lapel microphone.

No. 8401
Nominal Capacitance 25 mmf per ft. For crystal, ribbon, carbon microphones.

No. 8422
Nominal Capacitance 32 mmf per ft. Use specially for carbon microphones.

No. 8410
Nominal Capacitance 33 mmf per ft. For crystal, ribbon, carbon microphones.

No. 8412
Nominal Capacitance 68 mmf per ft. Use specially for carbon microphones.

No. 8423
Nominal Capacitance 54 mmf per ft. Use particularly for carbon microphones.

No. 8424
Use for interconnecting power cable for all electronic uses. Also microphone cable.

Belden
Radio **WIRE**

The *Aptitude-Tested* **LINE**

TRAIN

for Security! Good-Paying Jobs!

MAKE THE MONEY YOU'VE ALWAYS DREAMED OF!



LEARN RADIO -TELEVISION

AND ELECTRONICS BY EASY SHOP METHOD TRAINING AT HOME!

**You get
all the parts—even tubes!—**
for this modern Super Heterodyne Receiver. You learn to build it step by step. And you keep it! Get all the facts. Mail coupon now.

Let **NATIONAL SCHOOLS**—a resident-training school for nearly 50 years—train you at home for today's unlimited opportunities in Radio-Television-Electronics. National Schools is one of the largest schools of its kind. It is located in Los Angeles—the center of Radio and TV world! It has four large buildings of modern shops and labs. Its faculty is considered tops in the business.



You learn from lessons prepared by experienced instructors and engineers. Men who are successful Radio and Television technicians. Men who have trained 1000's of men like YOU!



Only National Schools Gives You This Professional Multi-Tester!

You get this amazing, new testing instrument—factory-made and tested—complete—ready to use! Simple to operate. Accurate and dependable. An instrument every Radio-TV man needs. Light enough to carry around—so you can use it at home or on service calls. You'll be proud to own this valuable equipment.

Here are only a Few of the Good-Paying Jobs You Can Choose

Radio Station Engineer, District Service Manager, Aircraft Radio Inspector, Own Your Own Repair Shop, Inspector Technician, Service Specialist, Special Government Jobs, Complete TV Service, Sound Truck Operator. Many more! National Schools graduates have secure, good-paying jobs like these. So don't wait—mail the coupon today. Now—while you're thinking about it!

Attention! Men Going into Service Soon!

National Schools' course quickly prepares you for many important jobs in the Armed Services. With National Schools Training you have an opportunity to get into special service classifications—with higher pay and grade—immediately!

FREE SERVICE FOR GRADUATES

National Schools uses its great influence and prestige to help you find your place in the field of your choice. Don't put it off! Start yourself toward a skilled trade! Get the big pay you've always wanted!

NATIONAL SCHOOLS
LOS ANGELES 37, CALIFORNIA • ESTABLISHED 1905

You Train At Home—In Your Spare Time

National Schools Shop Method Home Training gives you basic and advanced instruction in all phases of Radio-TV-Electronics. And remember—your training is based on resident school training principles. You learn fast from hundreds of diagrams and pictures. All instructions are written by experienced technicians who work in Radio and TV every day. All instructions have been developed and tested in National Schools' own labs and studios, which are equipped with the latest RCA equipment. No wonder this National Schools course is so up-to-date, practical, interesting. And so easy to learn! And no wonder it is held in such high regard by leaders of American industry! Approved for eligible Veterans.

We Teach You How To Make Welcome Extra Money—While You Learn!

Many National Schools students—men like you—make plenty of extra dollars each week in spare time! Fixing neighbors' radios, appliances—and other ways we teach you. You start learning and earning from the day you enroll. From the very first lesson!

WE SEND YOU LOTS OF PARTS LIKE THIS!



With National Schools Shop Method Home Training, you get basic principles and plenty of practical training. You learn by doing. No wonder you learn so fast! We send you many parts—all of professional, modern quality. You do lots of practical experiments. You advance day by day, step by step. Until you can even build the modern Superheterodyne Receiver you see above—plus other important testing units. The free book tells you all about it. The free sample lesson shows how easy the training is. Use the coupon. Send today — without fail!



FREE BOOK TELLS YOU HOW!

Page after page—in color—tells you everything you want to know. Mail the coupon. Get this valuable book today. And if you hurry—YOU GET A FREE SAMPLE LESSON, TOO! Shows how easy National Schools Home Training is. Mail the coupon today.

Today's Shortage of Trained Technicians Creates Chance of a Lifetime For You!

Think of it! With guided missiles, radar, and other electronic devices so important to national defense! With big, new developments in TV. With over 90,000,000 home and auto radios, over 12,000,000 TV sets. With more than 3100 radio stations...over 100 TV stations—and more building every day...yes, imagine the great opportunity you have today! YOU are wanted in Radio-Television-Electronics! America's fastest-growing field. High-pay jobs—the kind you've always wanted—are waiting for YOU!

Job Security! Big Money! For YOU! in Today's Expanding Industries!

Trained Radio and Television technicians really make important money these days. Thousands of National Schools graduates—men just like you—are earning good money all over the country. Why not you? And—National Schools graduates get the personal satisfaction of being highly-skilled technicians. Men people respect. Men who enjoy their work—rather than having to drag along in just any old job.

National Schools Has Trained 1000's of Successful Men! Why Not YOU?

In almost every state—and many foreign countries—National Schools graduates are filling big jobs with famous companies. Or running their own successful businesses. What are YOU waiting for? National Schools training is complete training. So when you graduate you can take advantage of today's big opportunities in Radio-Television-Electronics—fast.

**DON'T PUT IT OFF!
GET THE BIG SALARY YOU HAVE ALWAYS WANTED!**

MAIL THIS COUPON TODAY—WITHOUT FAIL!

NATIONAL SCHOOLS, Dept. GR111
4000 South Figueroa Street
Los Angeles 37, California

Mail in envelope or paste on penny post card.

Mail me FREE the book mentioned in this ad. Also a free sample lesson. I understand no salesman will call on me.

NAME _____ AGE _____

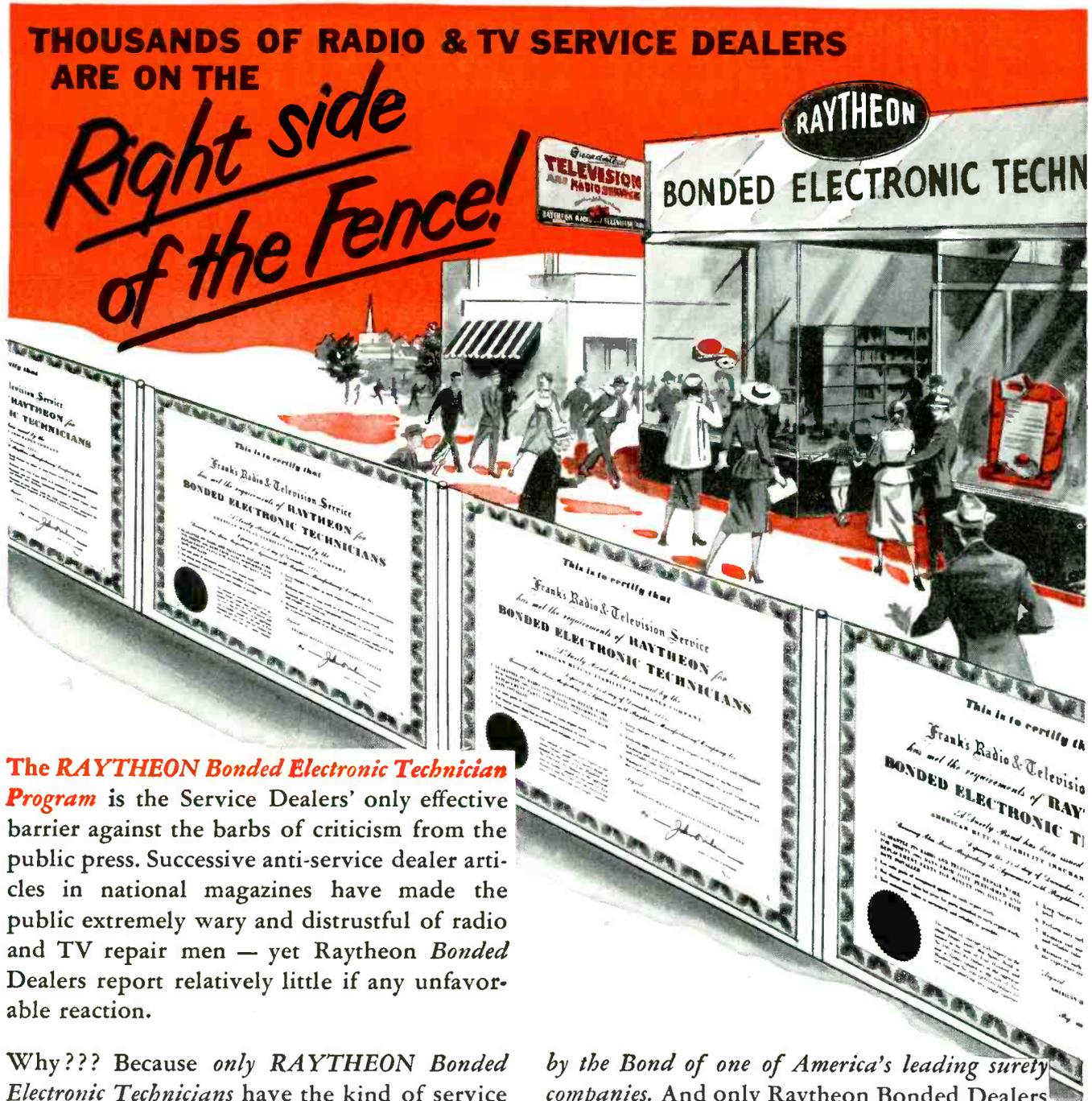
ADDRESS _____

CITY _____ ZONE _____ STATE _____

Check here if you were released from the Service less than 4 years ago.

THOUSANDS OF RADIO & TV SERVICE DEALERS ARE ON THE

Right side of the Fence!



The **RAYTHEON Bonded Electronic Technician Program** is the Service Dealers' only effective barrier against the barbs of criticism from the public press. Successive anti-service dealer articles in national magazines have made the public extremely wary and distrustful of radio and TV repair men — yet Raytheon Bonded Dealers report relatively little if any unfavorable reaction.

Why??? Because *only RAYTHEON Bonded Electronic Technicians* have the kind of service in which the customer can have complete confidence — *cash-protected, guaranteed service backed*

by the Bond of one of America's leading surety companies. And only Raytheon Bonded Dealers operate to a "Raytheon Code of Ethics" which completely satisfies their customers and protects themselves.



This tremendous business asset—The Raytheon Bond—costs service dealers nothing if they can qualify for it. Better ask your Raytheon Tube Distributor if you can join the ever increasing number of Service Dealers who are reaping the benefits of this priceless Bond.

RIGHT...FOR SOUND AND SIGHT®



RAYTHEON MANUFACTURING COMPANY

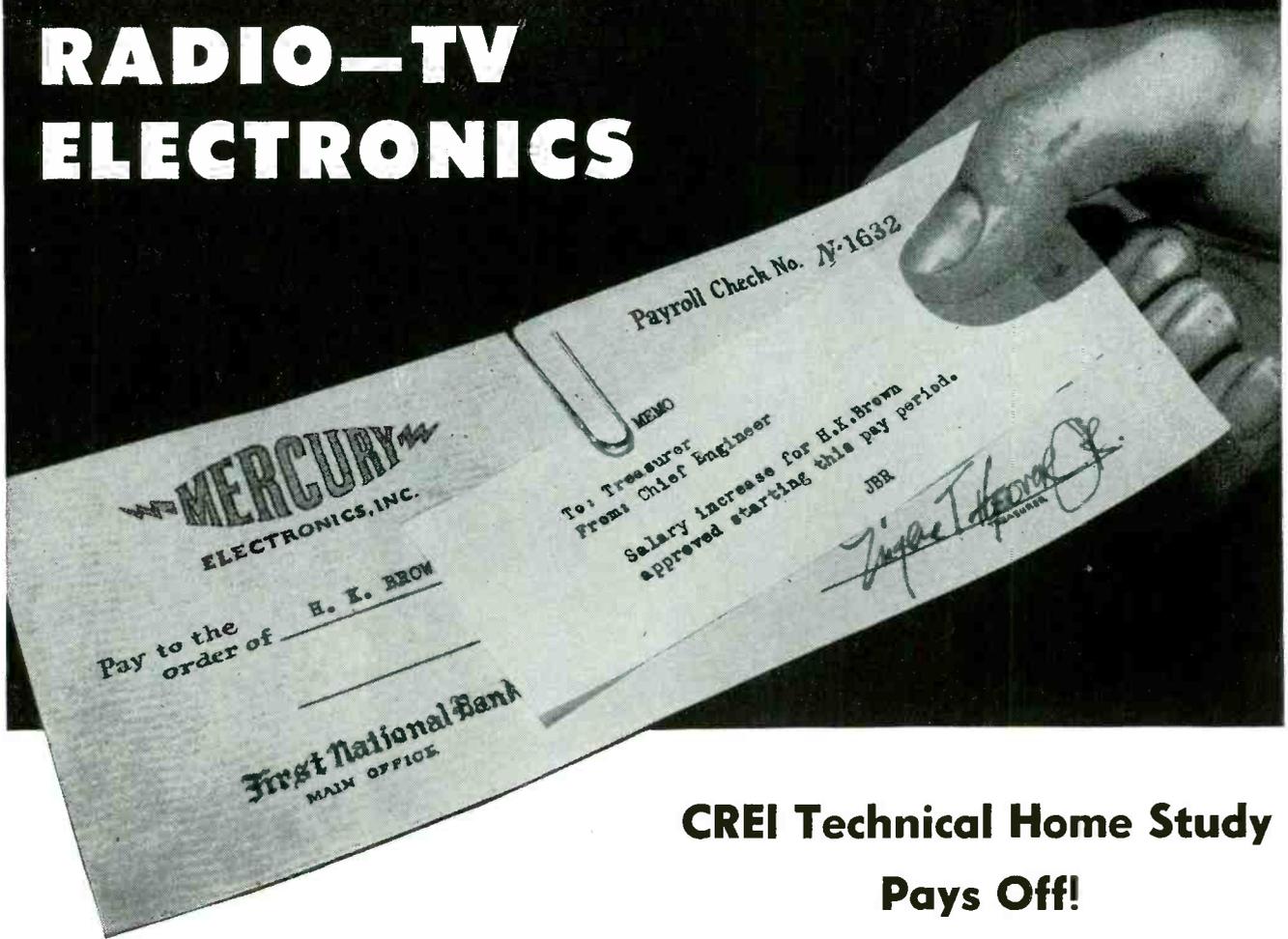
Receiving Tube Division
Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

Excellence in Electronics

RADIO AND TELEVISION RECEIVING TUBES, CATHODE RAY TUBES, SPECIAL PURPOSE TUBES, SUBMINIATURE TUBES, MICROWAVE TUBES

RADIO-ELECTRONICS for

BIGGER PAY CHECKS, INTERESTING JOBS and a SATISFYING CAREER - yours in **RADIO-TV ELECTRONICS**



CREI Technical Home Study Pays Off!

Prepare now to earn your secure, satisfying career in Radio, TV and Electronics—and the bigger jobs and fatter paychecks that come with it! These fields are expanding so rapidly that even the most expert of experts fall far short in their predictions. In the next 5 years, says the Chairman of the FCC, there will be 1,500 TV stations, and 5 years later there will be 2,500. 13,000,000 TV sets and 100,000,000 radios are now in use. (95% of the nation's homes have one or more sets.) Reams of similar statistics indicate thousands of good-paying jobs available now, and many more coming up. Qualified technicians are needed to fill them. One of these jobs can be yours, provided you have the technical training that CREI Home Study offers. CREI helps all levels, from novice to experienced engineer, because its specialized individual instruction brings out the best you have, and takes you as far as your own ability and effort will permit.

CREI is an accredited technical institute founded in 1927. CREI graduates today fill vital jobs throughout the radio, TV and electronics industries. Many leading firms pay CREI to train their own electronics personnel. Examples: RCA-Victor Division, Pan-American Airways, Bendix Products Division and United Air Lines.

Because CREI training is so thorough and so highly regarded, our graduates find a hearty welcome throughout the industry. At the service of our students and graduates is the CREI Placement Bureau, which right now has more requests for personnel than it can fill.

Determine for yourself—now—that you will *get* those higher paychecks, because you will have the training you need. Write today for free booklet, "Your Future in the New World of Electronics."

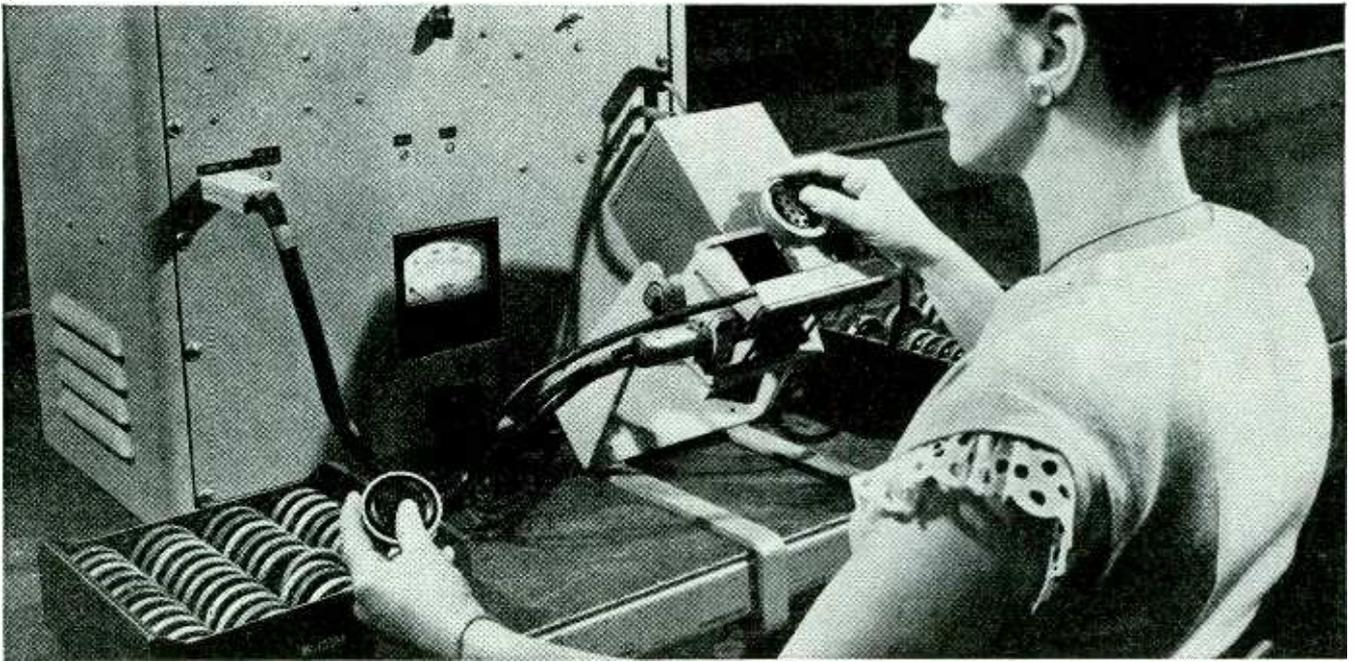
MAIL COUPON FOR FREE BOOKLET

CAPITOL RADIO ENGINEERING INSTITUTE
Dept. 1411C, 16th & Park Road, N. W., Washington 10, D. C.

Gentlemen: Send booklet, "Your Future in the New World of Electronics," together with details of your home study training. I am attaching a brief resume of my experience, education and present position.

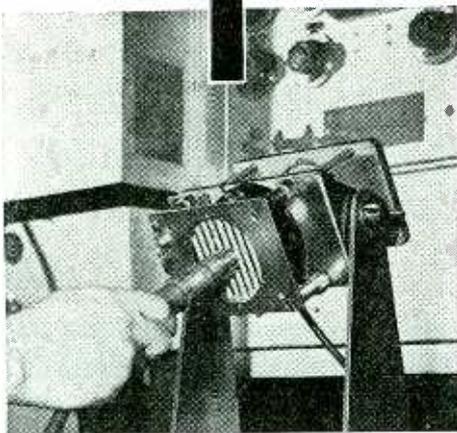
Check the Field of Greatest Interest: Aeronautical Radio Engineering.
 Practical Television Engineering. Broadcast Radio Engineering
 Practical Radio Engineering. (AM, FM, TV).
 TV, FM & Advanced AM Servicing.

NAME.....AGE.....
 ADDRESS.....
 CITY.....ZONE.....STATE.....
If residence School in Wash., D.C. Preferred, Check Here



This Western Electric employee mounts a transmitter in the test fixture which is swung down to face an artificial mouth at 45-degree angle, just as transmitters are held in use. More than a million transmitters are tested each year.

This mouth speaks to millions



At Bell Laboratories a scientist employs a condenser microphone to check the sound level from another type of artificial mouth, used in transmitter research.

To serve the changing needs of telephone subscribers millions of telephone sets have to be moved each year. Before being put back into service most of them are returned to the Western Electric Company's Distributing Houses where they receive a thorough checkup.

Western Electric engineers needed a rapid method of testing transmitters over a range of frequencies. At Bell Telephone Laboratories, scientists had just the thing—a technique they had devised for fundamental research on transmitters. In co-operation with these

scientists, Western Electric engineers developed the practical tester in the illustration.

The transmitter is removed from the handset and put in front of an artificial mouth which emits a tone that swings several times per second over a band of frequencies. A signal lamp tells whether the transmitter is good. Each test takes 5 seconds.

This new tester illustrates how Bell Laboratories research and Western Electric manufacturing skill team up to maintain your telephone service high in quality yet low in cost.



BELL TELEPHONE LABORATORIES

• EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE
RADIO-ELECTRONICS for

NOW... GET EVERYTHING YOU
NEED TO LEARN AND MASTER

TELEVISION

RADIO-ELECTRONICS ...AT HOME!

Use **REAL** commercial-type equipment to get practical experience



Here's the REAL THING!

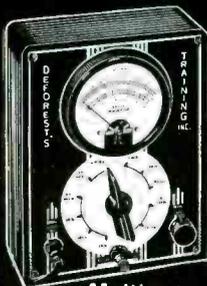
SET UP YOUR OWN HOME LABORATORY



Oscilloscope



R-F Signal Generator



Multimeter



6-Tube Radio



HOME MOVIES

De FOREST'S TRAINING, INC.
CHICAGO 14, ILLINOIS
A De VRY INSTITUTION

ABOVE: Build and keep a real 15 INCH commercial TV receiver. Optional after completing regular training at moderate added cost.

Your future deserves and needs every advantage you can give it! That's why you owe it to yourself to find out about one of the most COMPLETE, practical and effective ways now available to prepare AT HOME for America's billion dollar opportunity field of TELEVISION-RADIO-ELECTRONICS. See how you may get and keep the same type of basic training equipment used in one of the nation's finest training laboratories... how you may get real STARTING HELP toward a good job or your own business in Television-Radio-Electronics. Mail the coupon today for complete facts — including 89 ways to earn money in this thrilling, newer field.

D.T.I., ALONE, INCLUDES BOTH MOVIES and HOME LABORATORY

In addition to easy-to-read lessons, you get the use of HOME MOVIES — an outstanding training advantage — plus 16 big shipments of Electronic parts. Perform over 300 fascinating experiments for practical experience. Build and keep real commercial-type test equipment shown at left.

Get BOTH of these information packed publications FREE!

MODERN LABORATORIES

If you prefer, get all your preparation in our new Chicago Training Laboratories—one of the finest of its kind. Ample instructors, modern equipment. Write for details!

MILITARY SERVICE!

If you're subject to military service, the information we have for you should prove very helpful. Mail coupon today.



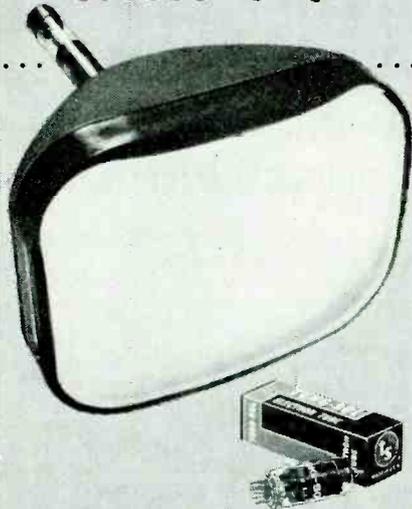
ACT NOW! MAIL COUPON TODAY!

DeFOREST'S TRAINING, INC., Dept. RE-11-H
2533 N. Ashland Ave., Chicago 14, Ill.

Without obligation, I would like your late News-Bulletin showing 89 ways to earn money in Television-Radio-Electronics... and how I may prepare to get started in this thrilling field.

Name..... Age.....
Street..... Apt.....
City..... Zone..... State.....

It's
Tung-Sol
for radio
and tv



Quality

-that keeps pace with the growth of the electronic industry

Quality

-that meets fully the performance requirements of all radio and tv set manufacturers

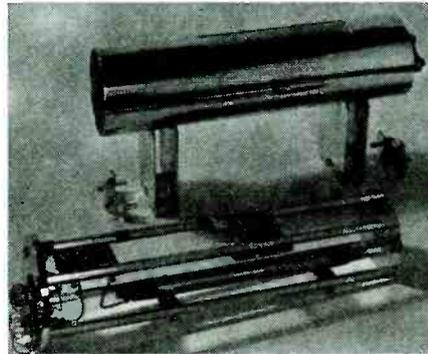
Quality

-that safeguards dealer service work

TUNG-SOL
RADIO, TV TUBES, DIAL LAMPS

TUNG-SOL ELECTRIC INC., Newark 4, N. J.
Sales Offices: Atlanta • Chicago • Dallas • Denver
Detroit • Los Angeles • Newark

FM RADIO SNOW GAUGES, developed by the U.S. Weather Bureau and the Corps of Engineers, are now being used to measure the water content of snow fields on mountain tops and other isolated points. The depth of the snow is measured by burying radioactive isotopes of common metals below the ground surface and using a Geiger-



Courtesy Motorola Inc.

The sensing unit (foreground) with its Geiger tube slips into housing (rear).

Mueller tube to measure the intensity of radiation after passing through the snow. The strength of the radiation is an indication of water content of the snow.

Since the measuring apparatus is located at remote points, battery-operated FM transmitters are used to transmit the data to a central recording station.

PHONE BOOTH TELEVISION came close to being a reality recently in a New York City pay station. Picking up the receiver to make a call, a would-be telephonist heard voices. Thinking he was interrupting a conversation, he hung up and tried again a few minutes later. The voices were still there, and were apparently following the script of some kind of a play. Within a few minutes the program was identified as that of WABD, channel 5.

A call to an official of the telephone company resulted in repair men being rushed to the scene. The company official stated that while such happenings are rare, they can be caused by a crosstalk between the regular phone lines and those used for the TV broadcast.

NEW TV COLOR TUBE, that can be manufactured at a cost comparable to present black-and-white tubes, was demonstrated by Professor Ernest O. Lawrence of the University of California. Dr. Lawrence is the inventor of the cyclotron and a Nobel prize winner for his work in electronic and atomic physics.

The new tube has a screen built up of phosphor strips which glow alternately in blue, green and red. Before reaching this screen, the electrons pass through a multiple-wire grid which acts both as an accelerating electrode and a deflecting lens. By alternately raising and lowering the voltage on this grid a few hundred volts above and below its steady state, the beam is directed to the desired color.

The phosphor color plate can be produced by silk-screen printing methods with sufficient accuracy and at low cost.

According to the inventor, the new tube can be adapted to receive either CBS or RCA color, as well as black-and-white programs. To receive CBS programs only three additional tubes are needed, plus an adapter somewhat similar to those now sold to make standard receivers compatible with CBS 405-line transmissions. Dr. Lawrence worked with Chromatic Television Laboratories, Inc., a Paramount Pictures subsidiary, in the development of the tube.

SHIPBOARD RADIO OPERATORS who have been drafted into the armed services will be discharged and returned to civilian status if recommendations of the Federal Maritime Administration are followed. The recommendation was made at a recent conference of representatives of the FCC, Maritime Administration, radio-operator unions, Coast Guard, and maritime industry at a meeting called to determine means of easing the shortage of qualified marine radio operators which developed when nearly 300 merchant ships were withdrawn from the "moth-ball fleet."

Proposals were made to alter the FCC regulations to permit employment of men not now eligible for the licenses required for shipboard service. The changes would make available men in two new categories. One group includes men who held limited radiotelegrapher's licenses before 1935 and who would be eligible if they could prove previous shipboard service. The second group includes those men who obtained licenses since 1935 and who operated shipboard radio installations under temporary limited licenses during the war. In both instances, the operators would have to pass a code test.

U.H.F. TELEVISION was advocated by FCC chairman Wayne Coy as being a means of bringing about a nation-wide system of competitive television. Speak-in at RCA's one-day u.h.f. seminar in Bridgeport, Conn., Mr. Coy went all out for u.h.f. TV. He said that he is sold on u.h.f. and that he would like to see all TV in the u.h.f. channels.

Mr. Coy pointed out that the "TV freeze" came about when the FCC realized that the existing 12 v.h.f. channels are not sufficient to provide for a competitive TV service in the nation's 168 metropolitan areas with populations of over 50,000. He proposed using the entire band between 480 and 890 mc for u.h.f. TV assignments and asserted that when the freeze is over, two-thirds to three-quarters of all TV station assignments will be in the u.h.f. region. These would make possible the ultimate establishment of nearly 3,000 TV stations in this country.

U.h.f. TV reception was described as excellent. This was based on the fact that the signal from Bridgeport's u.h.f. TV station was as good in New Haven—25 miles away—as that of New Haven's channel 6 station, WNHC-TV.

RADIO-ELECTRONICS for



Where Will You be
in **ELECTRONICS**
6 Months from Today?

ADD TECHNICAL TRAINING TO YOUR PRACTICAL EXPERIENCE

GET YOUR FCC LICENSE IN A HURRY!

THEN—Use Our Amazingly Effective JOB-FINDING Service

Get this Valuable Booklet **FREE**



TELLS HOW —

WE GUARANTEE

TO TRAIN AND COACH YOU AT HOME
IN SPARE TIME UNTIL YOU GET
YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army,
Navy, Radio repair, or experimenting.

TELLS HOW —

Employers make

JOB OFFERS like These
to Our Graduates Every Month

Telegram, August 9, 1950, from Chief Engineer, Broadcast Station, Pennsylvania,
"Have job opening for one transmitter operator to start immediately, contact
me at once."

Letter, August 12, 1950, from Dir. Radio Div. State Highway Patrol. "We have two
vacancies in our Radio Communication Division. Starting pay \$200; \$250 after six
months' satisfactory service. Will you recommend graduates of your school?"

These are just a few examples of the job offers that come to our office periodi-
cally. Some licensed radiomen filled each of these jobs . . . it might have been
you!

**HERE'S PROOF FCC LICENSES ARE OFTEN
SECURED IN A FEW HOURS OF STUDY WITH
OUR Coaching AT HOME in Spare Time.**

Name and Address	License	Lessons
Lee Worthy, 2210 1/2 Wilshire St., Bakersfield, Calif.	2nd Phone	16
Clifford E. Vogt, Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch, 38 Beucler P.L., Bergenfield, N. J.	1st Phone	38
S/Sgt. Ben H. Davis, 317 North Roosevelt, Lebanon, Ill.	1st Phone	28
Albert Schoell, 110 West 11th St., Escondido, Calif.	2nd Phone	23

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RE-35, 4900 Euclid Bldg., Cleveland 3, Ohio

NOVEMBER, 1951

TELLS HOW —

Our Amazingly Effective
JOB-FINDING SERVICE

Helps **CIRE Students Get Better Jobs**
Here are a few recent examples of Job-Finding results:

GETS CIVIL SERVICE JOB

"Thanks to your course I obtained my 2nd phone license, and am now employed by Civil
Service at Great Lakes Naval Training Station as an Equipment Specialist."
Kenneth R. Leiser, Fair Oaks, Mtd. Del., McHenry, Ill.

GETS STATE POLICE JOB

"I have obtained my 1st class ticket (thanks to your school) and since receiving same
I have held good jobs at all times. I am now Chief Radio Operator with the Kentucky
State Police."
Edwin P. Healy, 264 E. 3rd St., London, Ky.

GETS BROADCAST JOB

"I wish to thank your Job-Finding Service for the help in securing for me the position
of transmitter operator here at WCAE, in Pittsburgh."
Walter Koschik, 1442 Ridge Ave., N. Braddock, Pa.

GETS AIRLINE JOB

"Due to your Job-Finding Service, I have been getting many
offers from all over the country, and I have taken a job with
Capital Airlines in Chicago, as a Radio Mechanic."
Harry Clare, 4537 S. Drexel Blvd., Chicago, Ill.

Your FCC Ticket is always recognized in all
radio fields as proof of your technical ability.

OURS IS THE ONLY
HOME STUDY
COURSE WHICH
SUPPLIES FCC-
TYPE EXAMINA-
TIONS WITH ALL
LESSONS AND
FINAL TESTS.



Get All 3 FREE

MAIL COUPON NOW

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RE-35—4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay.)

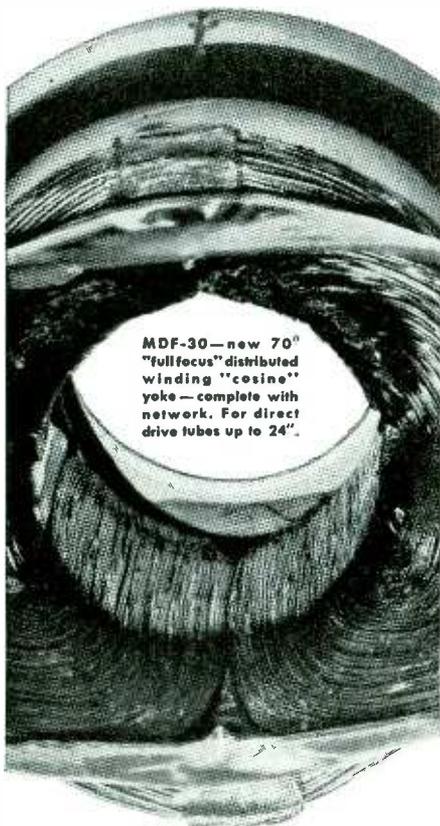
Approved For Veteran Training Under G. I. Bill
I want to know how I can get my FCC ticket in a minimum of time.
Send me your FREE booklet, "How to Pass FCC License Examinations"
(does not cover exams for Amateur License), as well as a
sample FCC-type exam and the valuable new booklet, "Money-Making
FCC License Information."

Name.....
Address.....
City..... Zone..... State.....

Paste on penny postcard or send air mail.

MERIT

Best for Better TV Service



Merit TV full-line* Components For Conversion or Replacement

Merit... HQ for TV Service Aids

Keep ahead of TV conversion and component replacement service problems—write *MERIT, HQ for TV Service Aids.*



FREE
Sept. 1951
Issue #404

These 3 Merit extras help you:

1. Exclusive: Tapemarked © with all specifications and complete hook-up data.
2. Full technical data packed with every item.
3. Listed in Howard Sam's Photofacts.

HVO-8—air core "flyback" for direct drive systems.



*Merit is meeting the TV replacement component and conversion demand with a line as complete as our advance information warrants!

MERIT TRANSFORMER CORPORATION
4425 N. Clark St., Chicago 40, Illinois

ELECTRONIC SCALES are now being used to weigh giant electrical transformers and other equipment too massive and heavy to be weighed by ordinary means. The operation of the new scale is based on the use of a resistance-wire strain gage which changes its resistance in proportion to its length.

The gage is connected to the upper part of a gigantic crane hook which supports the object to be weighed. It is cemented to a member on the crane's structure where the weight of the object develops a compression strain which produces an imperceptible reduction in the length of the member. This compression is transmitted to the strain gage which changes its resistance according to the applied force. Electronic circuits convert the change in resistance directly into pounds or tons on the dial of a portable meter.

RADAR FISH PATROL in use by California's Division of Fish and Game is rapidly driving illegal fishing from the coastal waters of that state. Before radar equipment was installed on the commission's four patrol boats, fog and darkness severely handicapped the seagoing wardens whose duty is to prevent commercial fishing inside the 3-mile limit. Under these conditions, standard operating procedure was to stop the patrol boat and listen for other boat engines and watch for lights aboard boats of careless violators.

Now, with radar, the patrol can always spot violators miles away, at any time of day or night. After a few boats were captured and many warned, the word has gotten around that there can be no escape so there are few attempts at fishing inside closed waters. During 1949 and 1950, 25 boats were caught and 284 crewmen arrested. This year's catch is one boat and nine men.

AUDIO FAIR, the third annual convention of the Audio Engineering Society, will be held on November 1, 2, and 3 in the Hotel New Yorker, in New York City. Audio equipment and accessories will be displayed and demonstrated by manufacturers, distributors, and manufacturers' agents. High lights of the Audio Fair will be a series of technical papers delivered by authorities in the field. The tentative lecture program is as follows:

"Problems of Ultra-Speed Recording Techniques," by C. J. LaBel, of Audio Instrument Co.

"Magnetic Recording Equipment for Motion Picture Production," by Bruce Denny and William L. Thayer, of Paramount Pictures, Inc.

"Modern Recording Installation That Emphasizes Tape," by W. O. Summerlin, of Audio-Video Recording Co.

"An Artificial Reverberation Generator," by Lewis S. Goodfriend, of Audio Facilities Corp.

"Magnetic Tape Recording for Instrumentation and Data Storage," by Kenneth B. Boothe, of Audio and Video Products Corp.

"Loudspeaker Enclosures," by Daniel J. Plach and Philip B. Williams, of Jensen Mfg. Co.

"Multiple-Speaker Systems," by Harry F. Olson, of RCA Laboratories.

"Design Principles as Applied to Radio and Loudspeaker Cabinets," by Jeff Markell, New Horizons Furniture.

"New Amplifier Design," by Herbert I. Keroes, of Acro Products Co.

"Industrial Sound Systems," by H. S. Morris, of Altec Lansing.

"Transistors in Audio Use." Speaker from Bell Telephone Laboratories.

"Magnetic Amplifiers for Audio Applications." Speaker from Bureau of Ships, U. S. Navy.

—end—



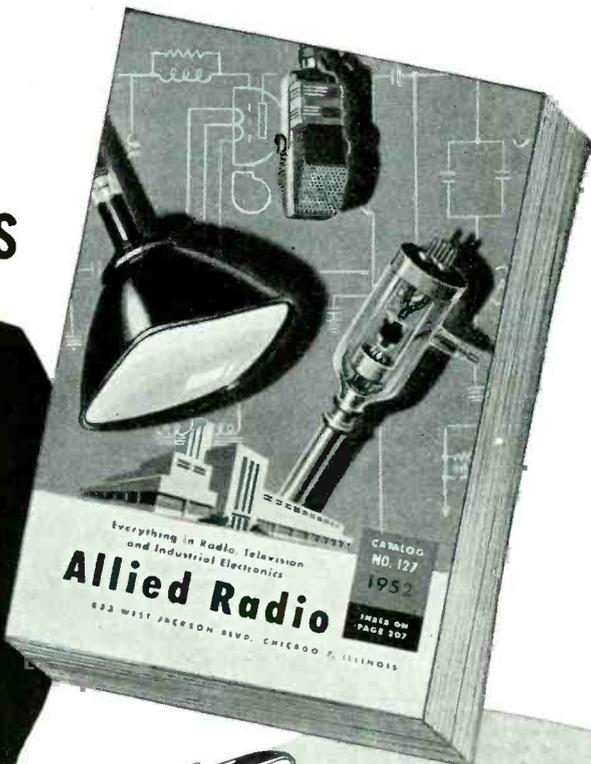
Captain Hooker scans the radar screen aboard the 63-foot patrol boat Bonito. Seagoing game and fish warden uses radar to spot violators off California coast.

Courtesy General Electric Co.

RADIO-ELECTRONICS for

the only complete catalog
for everything in Radio,
TV & Industrial Electronics

your 1952 **free!**
ALLIED 212-page
value-packed catalog



Send for it today!

Here's the *one* authoritative, complete, up-to-date Buying Guide to TV, Radio and Industrial Electronics. Make your selections from the world's largest stocks of quality equipment at lowest, money-saving prices. See the latest and most complete presentation of electronic apparatus: new TV, AM and FM receivers; High-Fidelity Custom Sound components; latest P.A. Systems and accessories; recorders; fullest selections of Amateur receivers and station gear; specialized industrial electronic equipment; test instruments; builders' kits; huge listings of parts, tubes, tools, books—the world's *most complete stocks* of quality equipment.

ALLIED gives you *every* buying advantage: speedy delivery, expert personal help, lowest prices, liberal time payment terms, assured satisfaction. Get the latest 1952 ALLIED Catalog. Keep it handy—and save time and money. Send for your **FREE** copy today!

**the world's
largest stocks**



- Radio Parts Unlimited
- Test Instruments
- Television & Home Radios
- P.A. and Hi-Fi Equipment
- Amateur Station Gear
- Builders' Supplies
- Equipment for Industry

quick, expert service

ALLIED IS YOUR TV and HI-FI HEADQUARTERS

TV Count on ALLIED for the latest in TV! If it's made—we have it for quick delivery. We specialize, too, in High-Fidelity sound components—everything in amplifiers, speakers, tuners, phono gear and accessories. For TV or Hi-Fi—think of ALLIED!

HI-FI



free SEND TODAY FOR RADIO'S LEADING BUYING GUIDE

ALLIED RADIO
the World's Largest Radio Supply House
EVERYTHING IN ELECTRONICS

ALLIED RADIO CORP., Dept. 2-L-1
833 W. Jackson Blvd., Chicago 7, Illinois

Send FREE 212-page 1952 ALLIED Catalog No. 127.

Name _____

Address _____

City _____ Zone _____ State _____

INDISPENSABLE!**PHOTOFACT BOOKS**

Photofact Television Course. Covers TV principles, operation and practice, 216 pages; profusely illustrated; 8½ x 11". Order **TV-1**.....Only \$3.00

Television Antenna. New 2nd edition. Describes all TV antenna types; tells how to select, install, solve troubles. Saves time; helps you earn more. 200 pages; illustrated. Order **TAG-1**.....Only \$2.00

Television Tube Location Guide. Volume 2. Accurate diagrams show position and function of all tubes in hundreds of TV sets; helps you diagnose trouble without removing chassis. 224 pages; pocket-size. Order **TGL-2**. Only \$2.00

Television Tube Location Guide. Vol. 1. Over 200 pages of TV receiver tube position diagrams on hundreds of models. Order **TGL-1**.....Only \$1.50

1949-1950 Record Changer Manual. Vol. 3. Covers 44 models made in 1949, including multi-speed changers and wire and tape recorders. Original data based on actual analysis of equipment. 286 pages; 8½ x 11"; paper-bound. Order **CM-3**.....Only \$3.00

1948-1949 Changer Manual. Vol. 2. Covers 45 models made in 1948-49. Paper bound. Order **CM-2**. Only \$4.95

1947-1948 Changer Manual. Vol. 1. Covers 40 post-war models up to 1948. Order **CM-1**.....Only \$3.95

Recording & Reproduction of Sound. A complete authoritative treatment of all phases of recording and amplification. 6 x 9". Order **RR-1**.....Only \$5.00



Audio Amplifiers. Vol. 3. Clear, uniform, accurate data on 50 important audio amplifiers, plus full coverage of 22 FM and AM tuners, produced during 1950. 362 pages, 8½ x 11". Order **AA-3**.....Only \$3.95

Audio Amplifiers. Vol. 2. A complete analysis of 104 well-known audio amplifiers and 12 tuners made 1949-50. 368 pages, 8½ x 11". Order **AA-2**.....Only \$3.95

Audio Amplifiers. Vol. 1. Covers 102 amplifiers and FM tuners made through 1948. 352 pages. Order **AA-1**.....Only \$3.95

Auto Radio Manual. Complete service data on more than 100 post-war auto radio models. Covers over 24 mfrs. 350 pages, 8½ x 11". Order **AR-1**.....Only \$4.95

Communications Receiver Manual. Complete analysis of 50 popular communications models. 246 pages, 8½ x 11". Order **CR-1**.....Only \$3.00

Radio Receiver Tube Placement Guide. Accurate diagrams show where to replace each tube in 5500 radio models, covering 1938-1947 receivers. 192 pages, pocket-size. Order **TP-1**.....Only \$1.25

Dial Cord Stringing Guide. Vol. 2. Covers receivers made from 1947 through 1949. Shows you the one right way to string a dial cord in thousands of models. Pocket-size. Order **DC-2**.....Only \$1.00

Dial Cord Guide. Vol. 1. Covers sets produced 1938 through 1946. Order **DC-1**.....Only \$1.00

Making Money in TV Servicing. Tested proved methods of operating a profitable TV service business. Covers all important phases. Authoritative, valuable guide to success. Over 130 pages. Order **MM-1**.....Only \$1.25

Order from your Parts Jobber or write direct to
HOWARD W. SAMS & CO., INC., 2201 E. 46th St., Indianapolis 5, Indiana

HOWARD W. SAMS & CO., INC.

Merchandising and Promotion

Merit Transformer Corp., Chicago, has published a new "TV Replacement Guide and Catalog" which lists all makes and models of TV sets with manufacturers' numbers and Merit replacements. The catalog is available through the company or its distributors. The company also introduced a new conversion and replacement kit for distributors' sales departments, featuring a "Day-Glo" card.

Astatic Corp., Conneaut, Ohio, has issued two new phonograph cartridge

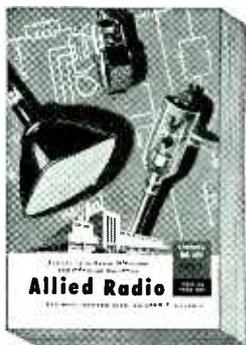


replacement guides. One lists the proper Astatic replacements for Columbia phonographs and record changers, and the other gives similar data on Philco models. Recommended Astatic cartridges and needle types are illustrated and a numerical designation given.

Allen B. Du Mont Laboratories' Cathode-Ray Tube Division advertising manager, Jake Ruiters, outlined the largest and most comprehensive advertising campaign the division has yet undertaken. The campaign will include advertisements in leading trade and service publications as well as extensive use of point-of-sale material for distributors, dealers, and service technicians.

The Division also issued a new pocket-size TV Picture Tube Replacement Selector which indicates the correct replacement type for worn-out Du Mont picture tubes. The circular cardboard indicator is available free through the company and its Teletron distributors.

Allied Radio Corp., Chicago, has published its 1952 catalog. The new 212-page book lists radio, television and



electronic parts, test equipment, P.A. systems and many other items to meet the requirements of the radio-television-electronics field.

Brach Manufacturing Corp., Newark, N. J., is sponsoring a joint advertising campaign with Dynamic Stores over New York's WOR-TV. Built around the theme, "Two Sets for Every Happy Home," the campaign features the Brach two-set coupler.

South River Metal Products, Inc., South River, N. J., has prepared a new catalog on its antenna mounting accessories.

Edwin I. Guthman Co., Inc., Chicago, has published a new booklet illustrating its production facilities. The company is a fabricator of electrical and TV components.

Columbia Wire & Supply Co., Chicago, published a new booklet describing its facilities and products which it manufactures, including all types of electrical insulating wire, cords, cable, wire kits, etc. Columbia is also a national warehouse and distributor for Anaconda Densheath television and radio wire and cable.

Sangamo Electric Co., Springfield, Ill., released its first TV capacitor replacement catalog. The 28-page booklet lists not only Sangamo capacitors but types comparable to them made by other manufacturers. The booklet may be had from the company or its distributors.

Servicing Business

The RCA Service Co., Camden, N. J., added two new protection plans to its full-coverage service contracts. One plan provides protection for the picture tube only; guarantees the tube for one year from the date of purchase by the user. Cost of the plan varies according to the size of the tube. The second plan features complete installation, instructions to the customer and a one-year parts and tube warranty plus one service call during the year. Additional calls are charged at the rate of \$3.95 if the set is brought to the RCA Service Company, and \$5.95 if it is a home call.

Production and Sales

The RTMA announced that sales of receiving tubes by manufacturers during the month of July dropped to 13,185,567, almost 50% less than the June figure. An analysis of sales showed that 7,117,435 were for new equipment, 4,625,314 were for replacements, and the balance for export and Government agencies.

The RTMA also announced that 89,144 cathode-ray tubes were sold to TV receiver manufacturers during July as compared with 221,759 during June. Of the July total, 99% were rectangular and 16 inches or larger in size.

The NBC-TV Sales Planning and Research Bureau announced that there were 13,271,700 TV sets installed in the United States as of August 1. There were 2,455,000 in New York City, 1,003,000 in Los Angeles, 942,000 in Chicago, 874,000 in Philadelphia, 754,000 in Boston, 526,000 in Detroit, 486,000 in Cleveland, 312,000 in Pittsburgh, and 308,000 in Baltimore.

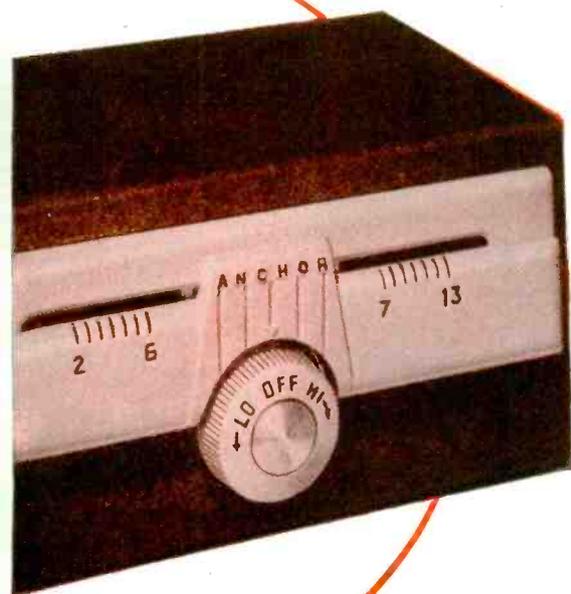
Show Notes

The Radio Parts & Electronic Equipment Shows, Inc., Board of Directors

RADIO-ELECTRONICS for

ANCHOR Boosters

**First in Preference!
First in Fringe
Reception!**



REACHING NEW

horizons

*Anchor engineering
always a year ahead!*

ANCHOR RADIO CORP.

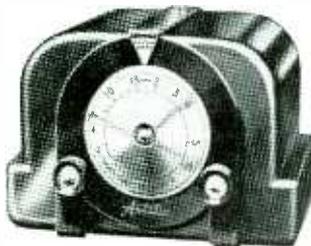
2215 SOUTH ST. LOUIS AVENUE
CHICAGO 23, ILLINOIS

For a
BETTER PICTURE
 on the TV Screen
 .. And Atop the TV
 Receiver Cabinet
ASTATIC TV and FM BOOSTERS



Model BT-1
 List Price
 \$32.50

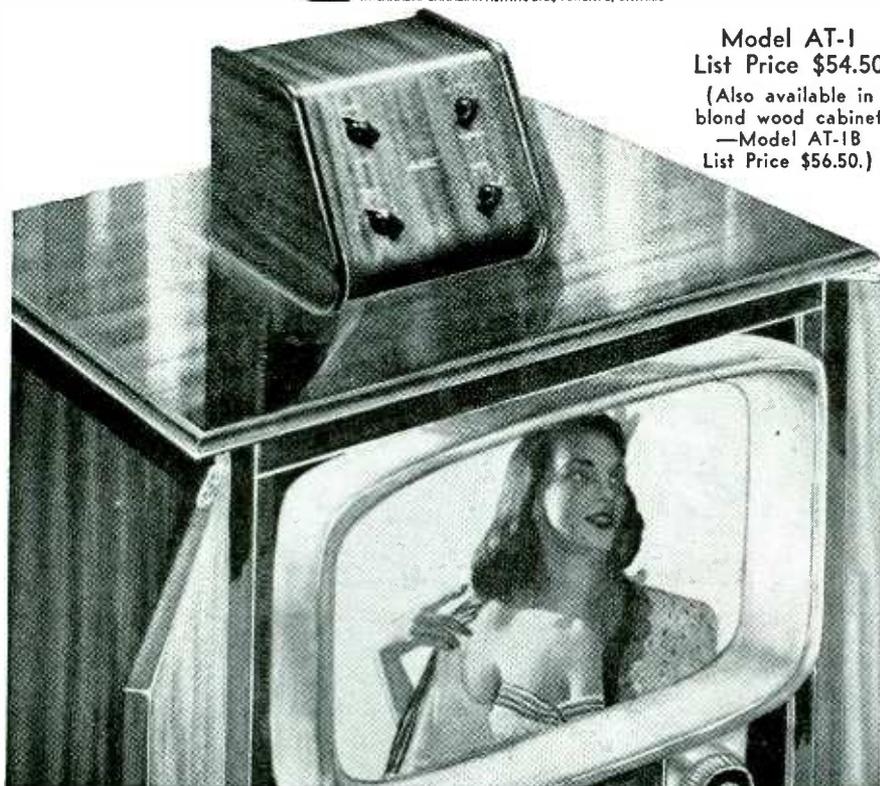
IT'S better viewing all around, with one of the four Astatic TV and FM Booster models. Advanced engineering principles and famous Astatic manufacturing quality assure better performance . . . brighter, clearer pictures . . . crisp, clear sound. Handsome, luxurious cabinets—in a variety of styles and finishes—permit selection to suit the style of the TV receiver. No matter how you look at it, the better booster is an Astatic. Write for full details.



Model BT-2
 List Price
 \$34.95

THE
Astatic
 CORPORATION
 CONNEAUT, OHIO
IN CANADA, CANADIAN ASTATIC LTD., TORONTO, ONTARIO

Model AT-1
 List Price \$54.50
 (Also available in
 blond wood cabinet
 —Model AT-1B
 List Price \$56.50.)



approved a three-point program for basic changes in the future conduct of the show. The board was increased from nine to fourteen members to include seven NEDA members and seven members of cosponsoring manufacturers' associations, including the RTMA, Association of Electronic Parts & Equipment Mfrs., Sales Managers Club, Eastern Division, and West Coast Electronic Mfrs. Association. Other changes in the bylaws provided that at least the first two days of shows be exclusive distributor days and that no individual may serve and no company may be represented on the board for more than two consecutive years. As a result of these changes, the NEDA Board of Directors decided that beginning in 1952, and every year thereafter, there would be an Annual NEDA Convention and Manufacturers' Conference without a trade exhibit.

The Eighth Annual Pacific Electronic Exhibit Show Committee increased its membership to eight. This increase of three members was made to include representatives of the I.R.E. who will cosponsor the show with the West Coast Electronic Manufacturers' Association in 1952.

New Plants and Expansions

The American Phenolic Corp. is erecting its fourth plant on Chicago's west side to permit a greater expansion of AN and RF connector assembly production at the main plant. The new 65,000-square-foot plant will house all synthetic operations.

General Electric Company's Tube Department leased the Garden State Lines bus terminal in Clifton, N. J., for use as its electronic tube warehouse and as headquarters for the department's eastern commercial service operations.

Haydu Brothers, Plainfield, N. J., manufacturer of TV tubes and other electronic products, is adding a new wing to its plant.

Helipot Corp. added a second plant to its facilities in Pasadena, Cal. It comprises 15,000 square feet of floor space with facilities for over 150 employees.

The Hi-Lo TV Antenna Corp. constructed an additional plant immediately adjacent to its present plant in Chicago.

Veri-Best Electronics Co. is now in full production in its new plant at Westbury, N. Y. The company plans a new series of electronic products in addition to its current line of TV antennas.

North American Philips Co., Inc., New York City, purchased the capital stock of the A. W. Haydon Co., Waterbury, Conn.

Collins Radio Co., Cedar Rapids, Iowa, has established a Procurement Division which will be headed by Max W. Burrell, former general sales manager.

Electronic Devices, Inc., Brooklyn, N. Y., purchased the Precision Rectifier Corp., which will now operate as the Precision Rectifier Division of Electronic Devices. The division will manufacture selenium rectifiers.

—end—

RADIO-ELECTRONICS for

By any standard of comparison,
whether it be

**PRICE—
QUALITY—
PERFORMANCE...**



**You can't beat
The TARZIAN TUBE**

There just isn't any better picture tube than the TARZIAN Tube. "The Fine Beam Means Fine Screen." Yes, the smaller dot makes for a better picture. And, the rigid quality control assures complete customer satisfaction.

Want to know how greater profits await you in the replacement field? Write—Wire—Call

SARKES TARZIAN, Inc., Sales Division, Bloomington, Indiana



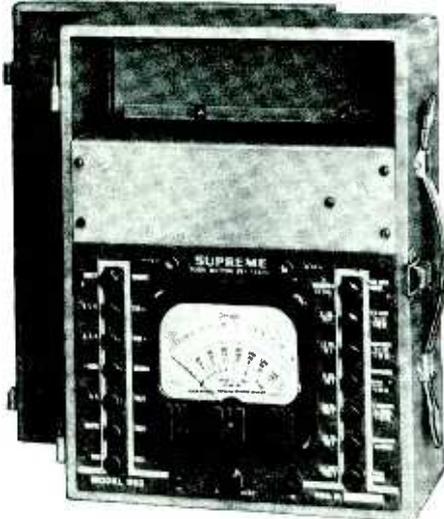
TARZIAN MADE PRODUCTS



STATIONS WTTS (5000 WATTS) AND WTTV (CHANNEL 10)
OWNED AND OPERATED BY SARKES TARZIAN IN BLOOMINGTON

SUPREME TEST EQUIPMENT AT SPECIAL SAVINGS

THAT FAMOUS QUALITY RECOGNIZED AND PRAISED BY ELECTRONIC TECHNICIANS FOR OVER 24 YEARS
 ● NO REDUCTION OF COMPONENTS ● NO REDUCTION IN QUALITY ● ONLY A REDUCTION IN PRICE TO YOU



AM - FM - TV MULTI-METER

MEASURES DC VOLTAGE TO 35,000 VOLTS AT 25,000 OHMS PER VOLT! The popular Supreme Model 592 has been extended for television. It now measures up to 35,000 volts DC with input resistance of the high range being 875 megohms. Many VTVMs are below this. Once you have used the Supreme 592, you would not trade it for all the rest. It's simple to operate and gives the user speed he never dreamed of. After test leads are inserted in the two pin jacks, it is not necessary to move them again (except on the 14 ampere and 35,000 volt ranges).

Fifteen DC VOLTAGE ranges—two sensitivities—8 ranges at 25,000 ohms/volt and 7 ranges at 1000 ohms/volt—0/3.5/7/35/140/350/700/1400 volts DC. External extension unit included for 35,000 volt range at 25,000 ohms/volt. Six OHMMETER ranges—0/500/5000/50,000/500,000/5 meg./50 meg. No ranges omitted to confuse operator. All readings are made on easy-to-read single scale by simply adding zeros. Ohmmeter uses standard type batteries—simple, economical replacement. No external power required, even for the 50 megohm range! Six AC VOLTAGE ranges—0/7/35/140/350/700/1400 volts. Temperature compensated double bridge rectifier circuit provides maximum accuracy and protection. Seven DIRECT CURRENT ranges—0/70 microamperes, 0/7/35/140/350 milliamperes, 0/1.4/14 amperes. Six OUTPUT VOLTAGE ranges—0/7/35/140/350/700/1400. No external blocking condenser required when used as output meter in alignment. Four DECIBEL ranges—0 to plus 16, plus 10 to plus 26, plus 26 to plus 36, plus 36 to plus 46 db. All decibel ranges calibrated for direct reading on 500 ohm line. Full-vision, Supreme built, four inch meter with 40 microampere movement and sturdy pointer. Instrument housed in attractive, sturdy, metallic carrying case with leather handle, test lead compartment, and detachable lid. Shipped complete with instruction manual, test leads, batteries, and high voltage extension unit. Approx. dimensions 8½ x 12 x 5 inches. Shipping Weight 13 pounds.

Regular Value \$69⁹⁰

YOUR COST DURING THIS SPECIAL OFFER \$36⁹⁵

ALL SUPREME INSTRUMENTS ARE COMPLETELY WIRED, TESTED AND CALIBRATED AGAINST RELIABLE STANDARDS BY SKILLED INSTRUMENT TECHNICIANS. THEY ARE NOT KITS. EACH SUPREME INSTRUMENT IS BRAND NEW FRESH EQUIPMENT—NOT SURPLUS OR REBUILT.

TUBE AND BATTERY TESTER

CHECKS AM—FM—TV RECEIVING TUBES AND PORTABLE RADIO BATTERIES. The SUPREME Model 616 cannot be beat for efficient bench or counter tube testing. Incorporating that famous tube test circuit and patented regulated neon leakage test, both pioneered and developed by Supreme. Have set tube rejection standards for years. Minimized obsolescence by use of Supreme patented element selector system. Thousands of testers using this circuit have been in use over ten years. Socket facilities for all AM, FM and TV receiving tubes. ILLUMINATED ROLL CHART with hundreds of types listed. TUBE SETTING DATA on future tubes supplied by Supreme as they come into use. Quality test readings for both tubes and batteries on "Replace-Good" scales of beautiful BIG SEVEN INCH FULL VISION METER designed and built by SUPREME. Non-breakable window. Most people can read this meter ten feet away. Also checks portable radio batteries UNDER PROPER LOAD. Tests batteries with rated voltages of 1½, 4½, 6, 45, 67½, 90 volts. Hammerloid finished metallic case with detachable cover. Approx. dimensions 11 x 15 x 6½ inches. Shipping weight 20 pounds.



Regular Value \$87⁵⁰

YOUR COST DURING THIS SPECIAL OFFER \$54⁹⁵

SUPREME MODEL 600 is also being made available during this special sale offer. Similar in appearance to Model 616, with all the features listed above plus 31 multi-meter ranges (1000 ohms/volt).

Regular Value \$117⁵⁰

Your Cost during this Special Offer \$74⁹⁵

ORDER TODAY—THIS OFFER IS SUBJECT TO WITHDRAWAL IN 60 DAYS, OR BEFORE IF ANY MODEL IS SOLD OUT AND NOT AVAILABLE FOR IMMEDIATE DELIVERY. PRICES APPLY ONLY TO ORDERS FROM INSIDE THE CONTINENTAL U. S. A.



A DEPENDABLE SIGNAL GENERATOR

RF TO 82 MC—400 CYCLE AF—COVERS TV IF MARKERS

Supreme pioneered in the development of all wave signal generators and the Model 661 is the result of many years of development and research to find the most stable circuits and provide the most simple operation. Many circuits were explored and the one used in the 661 was declared the best of all. Many dial arrangements were investigated; many calibration methods checked; many attenuators and modulation methods carefully analyzed. There is no better service oscillator on the market than the Model 661. Only 2 dial scales but 5 bands. All ranges are read simply on two basic scales that are accurately calibrated—even at both ends. Impregnated iron core tuned inductors and air dielectric trimmers provide the maximum frequency stability. Guards against shift due to line voltage fluctuation, aging, temperature and humidity. Continuously variable output in a 4 step ladder attenuator. Double shielding to minimize leakage. Shielded line cord, illuminated hair line dial. RF ranges from 65kc to 82 megacycles (65kc to 20.5 Mc on fundamentals). Audio frequency output, continuously variable from minimum to maximum. Internal modulation of RF signal approximately 50%. Jack provided for external amplitude modulation. Housed in heavy steel case, attractive finish. Complete with instruction manual and shielded connector. Approx. dimensions 9½ x 8½ x 7½ inches. Shipping weight 15 pounds.

Regular Value \$72⁵⁰

YOUR COST DURING THIS SPECIAL OFFER \$34⁷⁵

EVERY SUPREME INSTRUMENT IS BACKED BY OUR COURTEOUS AND EFFICIENT SERVICE ORGANIZATION. NO "ORPHAN" INSTRUMENTS. FULL ONE YEAR GUARANTEE, BACKED BY THE FACTORY. ANY SUPREME INSTRUMENTS SHIPPED DIRECTLY FROM THE FACTORY ARE SOLD STRICTLY ON A "MONEY-BACK-IF-NOT-SATISFIED" BASIS. TRY ANY OF THEM FOR 10 DAYS. IF NOT COMPLETELY SATISFIED, RETURN FOR FULL REFUND OF PURCHASE PRICE.

MAIL YOUR ORDER TO SUPREME, INC., BOX A552, GREENWOOD, MISSISSIPPI—ORDER TODAY

I WANT TO TAKE ADVANTAGE OF THIS SPECIAL SUPREME SAVINGS OFFER—PLEASE RUSH THE MODELS CHECKED—

_____ Model 592 @ \$36.95 \$ _____ Ship to _____
 _____ Model 616 @ \$54.95 \$ _____ Address _____
 _____ Model 600 @ \$74.95 \$ _____ City _____ State _____
 _____ Model 661 @ \$34.75 \$ _____ \$ _____ Deposit ship balance C.O.D. \$ _____ Payment in full

Enclose full payment with order or send 20% deposit with C.O.D. orders. (Full payment orders are the quickest to handle and save you C.O.D. fees). NOTE: If you do not want to cut this page, copy above on separate sheet of paper and mail. It will receive same prompt handling.

RADIO-ELECTRONICS for

Golden Opportunity

to prepare for better pay jobs in

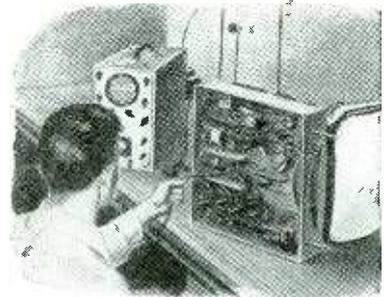
Television Servicing

for men in
radio-electronics



YOU STUDY AT HOME

In your spare time, you learn pre-tested "How-to-do-it" techniques with "How-it-works" information in easy-to-study lessons. The course is based on the experience of the RCA Service Company in servicing thousands of home television receivers.



YOU KEEP WORKING ON YOUR JOB

Because you work in the radio-television-electronics industry, your job provides the laboratory work of the course. There are no kits, parts or equipment to buy. Self-employed independent radio and television servicemen are eligible for enrollment.

No vocational field offers more opportunities for "career" jobs and good pay than television—America's fastest growing industry. The demand for TRAINED and EXPERIENCED TV SERVICEMEN is growing. There is a big shortage of such men now and will be for several years to come.

PLENTY OF GOOD JOBS OPEN TODAY

Radio-Television jobbers, dealers and service companies offer lifelong opportunities with excellent salaries for qualified service technicians. Manufacturers of television receivers are looking for men with good service training as inspectors, testers and troubleshooters. Many experienced servicemen go into business for themselves. Others hold their regular jobs and earn extra money servicing TV receivers in their spare time.

Radio-electronics manufacturers busy with defense equipment contracts offer excellent job opportunities for men with a television technician background. Servicemen called into military service are further reducing the supply of skilled TV servicemen available for civilian activities. Think what television servicing offers *you* in terms of a lifetime career and financial security.

**RCA INSTITUTES Home Study Course
in TELEVISION SERVICING—**

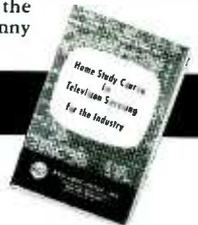
A Service to the Industry

Because of the critical shortage of TRAINED and EXPERIENCED TV SERVICEMEN, RCA Institutes is offering this highly specialized and practical home study course as a service to the working members of the radio-television-electronics industry. Its object is to train more *good* servicemen and to help make good servicemen *better*.

Never before has this course been available to anyone outside of RCA. It is now offered to *you*, through RCA Institutes, one of America's oldest and most respected technical training schools. The course covers most major makes and types of TV receivers. Available exclusively to men in the radio-television-electronics field. Not offered to the general public, or under G.I. Bill.

The cost is low . . . only \$9 a unit for 10 units or \$90 total, on an easy pay-as-you-learn plan. At successful completion of the course you earn an RCA Institutes certificate that can lead straight to a better job at higher pay.

SEND FOR FREE BOOKLET. Find out complete details of the RCA INSTITUTES Home Study Course in TELEVISION SERVICING. Don't pass up this opportunity to prepare yourself for a money-making career in the television industry. Illustrated booklet explains all the features of the course. Mail coupon in an envelope or paste on a penny postcard—NOW!



MAIL COUPON NOW!

RCA INSTITUTES, INC.
Home Study Department, RE-1151
350 West Fourth Street, New York 14, N.Y.

Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in TELEVISION SERVICING." (No salesman will call.)

Name _____
(Please Print)

Address _____

City _____ Zone _____ State _____

RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. Write for free catalog on resident courses.



RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.

NOVEMBER, 1951

EICO
TEST INSTRUMENTS

Guard

CBS-Columbia Inc.
COLOR TELEVISION PRODUCTION QUALITY



In the CBS-Columbia design laboratories, Al Goldberg takes some important readings with the EICO Model 221 Vacuum Tube Voltmeter and Model 555 Multimeter, as Harry R. Ashley looks on.



Mr. Al Goldberg, Assistant Chief Engineer of CBS-Columbia, and Harry R. Ashley, President of EICO, inspecting the use of the EICO Model 221 Vacuum Tube Voltmeter and Model HVP-1 High Voltage Probe at the Sweep Frequency Troubleshooting Position on the CBS-Columbia Color Television production lines.



NEW
221K VTVM KIT \$25.95
WIRED \$49.95



HIGH VOLTAGE
PROBE \$6.95



NEW
425K 5" PUSH-PULL
SCOPE KIT \$44.95. WIRED \$79.95

KITS
WIRED INSTRUMENTS



NEW 555K MULTIMETER
KIT \$29.95. WIRED \$34.95
20,000 ohms/volt



320K SIG.
GEN. KIT \$19.95. WIRED \$29.95

NEW 322K SIG. GEN
KIT \$23.95. WIRED \$34.95



NEW 950K R-C BRIDGE &
R-C COMP. KIT \$19.95
WIRED \$29.95



NEW 1040K BATTERY ELIM.
KIT \$25.95. WIRED \$34.95



511K VOM
KIT \$14.95
WIRED
\$17.95



NEW 526K MULTI-
METER KIT \$13.90
WIRED \$16.90
1000 ohms/volt



NEW 1171K RES.
DECADE BOX KIT
\$19.95
WIRED \$24.95



NEW 315K DELUXE SIG.
GEN. KIT \$39.95
WIRED \$59.95



145K SIG.
TRACER KIT
\$19.95
WIRED
\$28.95



NEW 625K
TUBE TESTER KIT \$34.95
WIRED \$49.95



360K SWEEP GEN. KIT \$34.95
WIRED \$49.95

*For Laboratory Precision at Lowest Cost—
the Leaders Look to EICO!*

WHY does CBS-Columbia, Inc., today's headline-maker in Color Television set production, use EICO Test Instruments on its new Color Television production lines and in its design laboratories?

BECAUSE — like Emerson, Tele-King, Teletone, and many another famous TV manufacturer coast to coast, CBS-Columbia knows that . . .

*Only EICO Test Equipment delivers
All 10 EICO nomical Features!*

1. Laboratory Precision
2. Lowest Cost
3. Lifetime Dependability
4. Speedy Operation
5. Rugged Construction
6. Quality Components
7. Latest Engineering
8. Super-Simplified Assembly and Use Instructions
9. Laboratory-Styled Appearance
10. Exclusive EICO Make-Good Guarantee

Before You buy any higher-priced equipment, be sure You look at the EICO line—in *Wired*—as well as *Kit form!* Each EICO product is jam-packed with unbelievable value. YOU be the judge—compare, see EICO instruments today — in stock at your local jobber — and SAVE! Write NOW for FREE newest Catalog 11-C.

FOLLOW THE LEADERS . . . INSIST ON EICO!

EICO

ELECTRONIC INSTRUMENT CO., Inc.
276 NEWPORT STREET, BROOKLYN 12, NEW YORK

©1951, Electronic Instrument Co., Inc.
Prices 5% higher on West Coast. Due to unstable conditions, prices and specifications are subject to change without notice.

Radio-Electronic Giant

... The radio-electronic industry will soon be one of the top three ...

By HUGO GERNSBACK

Sometimes the members of our industry do not realize the giant strides that it has made in recent years. Dr. Allen B. Du Mont last month stated that more than \$7,600,000,000 will have been awarded for radio-electronic contracts by the end of 1951, ranking the industry next to steel and aircraft in importance during the present military buildup.

Military contracts are, however, only a single facet in the new giant industry. At the moment, no accurate statistics as to the total volume of radio-electronic dollar volume can be compiled. The industry is too young and is growing so fast that no sooner have the first set of figures been computed than they are already obsolete. The industry is so huge and goes into so many ramifications—at times overlapping other industries—that it is often difficult to formulate a true overall picture. Take for instance, two of the largest radio-electronic manufacturers in the country, General Electric and Westinghouse, who do not report their radio-electronic sales separately. These concerns manufacture many other items of electrical or other nature, (not radio or electronic) which makes it impossible to get accurate figures. While the radio-electronics industry is now some thirty years old, even the U. S. Department of Commerce still lumps its radio-electronic figures under a heading: "Manufacturing, electrical machinery."

If we estimate that radio and electronic items represent only 15% of the total production of such huge firms as General Electric and Westinghouse in 1950, we can obtain an approximate figure of their radio-electronic dollar volume. If then we add the twenty topmost radio-electronic firms manufacturing radios, television sets, and various electronic items, we find that the income of these firms during 1950 came to around \$3,000,000,000. (Three billion dollars.)

This isn't, however, the whole story and does still not give us a correct perspective. The point is that there are hundreds of lesser firms who manufacture all sorts of radio-electronic devices, both for peace and military purposes. Many of these firms are young and have as yet to make their way. New firms spring up in the industry every week and while many manufacture radio-electronic devices exclusively, there are equally as many firms who manufacture other products as well.

The war effort has also blurred the picture somewhat, because it is difficult to disentangle war orders from others throughout the industry. One thing is quite certain: even with no war orders it seems likely that annual non-military sales of the entire radio-electronic industry by 1960 should reach no less than \$10,000,000,000.

So much for the dollars and cents aspect of the giant industry. People on the outside sometimes find it difficult to understand that our industry has made such tremendous strides, particularly during the past ten years.

The answer is simple. In nearly every endeavor that one can think of radio-electronics has a part nowadays. There is hardly any household, office, or factory today which is untouched by the magic wand of radio-electronics. This tendency is certain to increase and will keep on increasing during the next few decades.

Indeed, radio-electronics has created a new industrial revolution far greater than any of us realize today. It keeps on eliminating many jobs throughout this country and, indeed, the world at an astonishing rate. Unlike other

industrial revolutions, few people get hurt in the process. The workers are simply released for other and more important jobs, which usually pay better. Surprisingly enough, radio-electronics has been a huge factor in not only increasing the prosperity of the country but in a large measure is responsible for higher wages. In our own industry, when radio-electronic workers are eliminated in one branch these same workers, practically without exception, command higher wages on their next jobs. This is true in many of the allied industries as well.

The machine age has now been replaced by the radio-electronic age. Heretofore, men tended the machines. Soon the machines will tend themselves, purely due to the magic of radio-electronics. Modern plants have already begun robotizing. Some plants where formerly hundreds of employees were needed, today require only a handful of engineers to supervise a series of complex procedures. This tendency is now on the march and will continue to expand during the next few decades at an ever-accelerating rate. It would seem that there are few manufactured items which cannot be made successfully in a practically manless plant.

These tendencies will make man freer than he ever was before. The drift toward shorter hours which has been going on for the past 30 years is still in evidence and will continue at an increasing rate, due primarily to radio-electronics and its labor-saving devices.

The new uses for radio-electronics are so astonishing that even men within the industry are hard put to keep track of them. Every day brings new applications which in turn increase the power of the industry. One of the newest huge additions is the electronic computer—the robot mathematician. The manufacture of computers in itself is becoming quite an industry and these computers will be one of the big factors in the automatic factories of the future.

Radio-electronics has successfully invaded other industries such as plastics. Some solid plastics are now made from liquids. Cathode rays, similar to those we use in television, convert liquid raw materials into solid plastics.

Another unsung radio-electronic achievement is the assorting machine, which nowadays is doing almost magical jobs. It would seem impossible that a machine could accurately sort thousands of different unlabeled cans, containing dozens of different foods; nevertheless, this has been done recently in a very striking manner. There is no visible identification on the cans, but then radio-electronics doesn't need any. Before the cans are packed with the various foods they are magnetized in certain spots in a special code. The radio-electronic sorter segregates the various cans using the magnetic code on their rims. Then the machine selects the correct label, affixes it and sends it down the conveyor.

Wonders such as these are becoming commonplace in our blasé world—which expects them. Nothing seems impossible today for radio-electronics. It improves our health, it gives us more and purer foods, it gives us more leisure and far greater wealth. It is the key to interplanetary travel—impossible without it. Radio-electronics to future ages will be known as the *Ultimate Emancipator*, for it, and it alone holds the key to man's peace on earth—the final elimination of war.

—end—

CBS-Columbia — First Commercial Color Plus Black-and-White Set

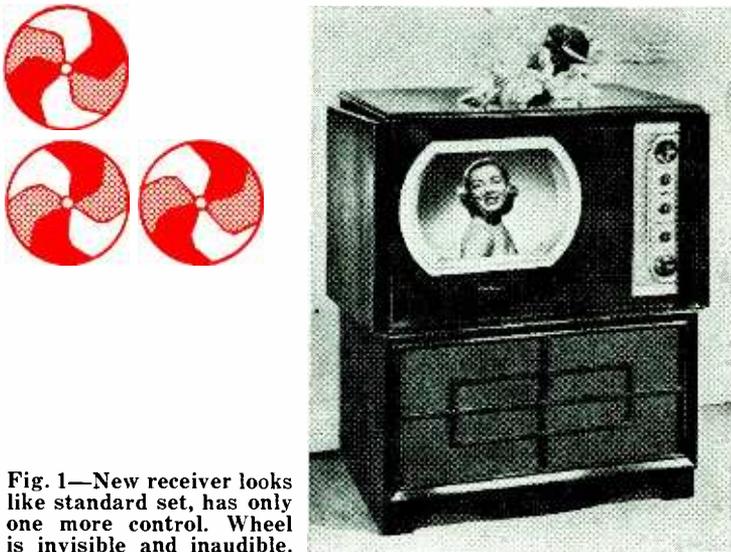


Fig. 1—New receiver looks like standard set, has only one more control. Wheel is invisible and inaudible.

By

I. J. MELMAN,*

E. S. WHITE,*

S. CUKER*

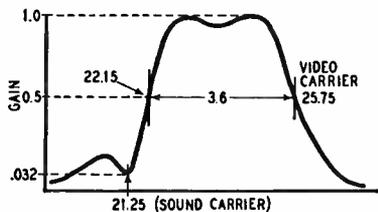


Fig. 2—Video detector output response. Sound carrier is maintained at a level approximately 30 db below video carrier.

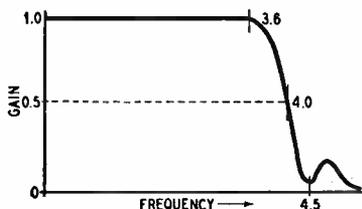


Fig. 3—Response of the combined outputs of video detector and amplifier. Half-power points are near 4 mc on the highs and 30 cycles at the lower end.

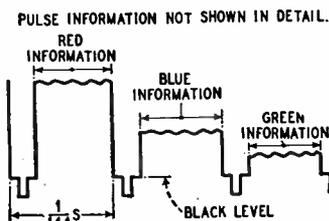


Fig. 4—Signal at video amplifier grid. The amplification of each color must be equal regardless of frequency or level.

A COMPLETELY self-contained television receiver which can receive both black-and-white transmission and CBS color transmission is an important advance in the television field. The console unit shown in Fig. 1 contains—within an exterior no larger than most current black-and-white television models—what the viewing public looks at as a somewhat magical device which reproduces either color or monochrome pictures with the flick of one simple switch.

The dealer and service technician may

fear its supposed complexity and wonder about its reliability and serviceability. It should be made quite clear, therefore, that with the exception of the scanning mechanism and its associated 3-tube disc control circuit, the fundamental circuitry in every section of this receiver is already well known to the television industry. Unlike rival color television systems, the CBS color-monochrome receiver uses circuits which have been production- and field-tested for many years. Special consideration has been given in the design of the various sections to bring out the full potentialities of the CBS color system; however, these special considerations represent only refinements of currently "known art."

It might be suspected that the quality of the monochrome picture produced by this dual-type receiver would be neglected in concentrating upon reproducing a good color picture. As will be shown later in this article, design requirements for a good color picture are more stringent than for a good monochrome picture. Since the same basic circuits are used for both color and monochrome, however, the natural consequence is not only good color, but also very good black-and-white reproduction.

The design and operation of the complete color-monochrome receiver will be discussed under the following headings:

1. Tuner and i.f. amplifier.
2. Video amplifier, d.c. restorer, and intercarrier sound system.
3. Synchronization, sweep, and high-voltage circuits.
4. Disc-control circuit.
5. Scanning disc and motor assembly.

*CBS-Columbia, Inc., Advanced Development Laboratory

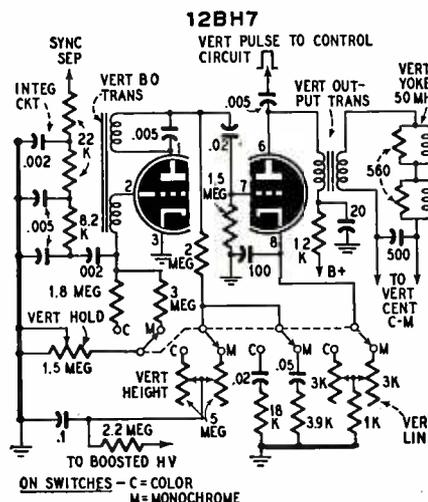


Fig. 5—The vertical sweep circuit, including color-monochrome switching.

Receives black-and-white at 525 lines or full color at 405 lines. at the flick of a switch, and is completely self-contained. Its design features are described in the article below.



Items 1 and 2 are the same in both the color and monochrome positions; switching of circuit elements between color and monochrome operation is necessary only in 3; 4, and 5 operate only during color reception.

Tuner and i.f. amplifier

Since the r.f. tuner or "front end" is not called upon to perform any unusual function in the color-monochrome receiver, almost any well-designed tuner is suitable. The usual considerations of noise factor, gain, oscillator radiation, spurious responses, etc., are applicable.

In the CBS color system, both the vertical and horizontal scanning frequencies are increased over current standard monochrome scanning frequencies. To retain as much picture information as possible in the color position, a minimum over-all r.f. and i.f. 6-db bandwidth of 3.6 mc is employed. A high-Q accompanying sound trap is capacitively-coupled to the first i.f. amplifier tube grid, so that at the output of the video detector, the sound carrier is attenuated 30 db relative to the pass-band. The over-all relative response at the

video-detector output is shown in Fig. 2. Two staggered pairs, with CCB6 amplifier tubes, are used because of simplicity and cost considerations. Almost any i.f. amplifier interstage coupling arrangement may be used as long as the response obtained is as shown. Overloading and departures from linearity must be avoided.

Video amplifier

A combined video amplifier and video detector response flat out to 3.6 mc is used to retain picture information. The response is shown in Fig. 3. A good low-frequency response, down to 30 cycles, is also desirable.

Although high-frequency peaking often is employed in monochrome television receivers to "crispen up" the picture, its desirability is questionable in color reception. To obtain the proper color balance, as transmitted, the detailed color information in the red, blue, and green fields should be amplified equally regardless of frequency.

The output linearity of the video amplifier is particularly important. Consider the highly simplified signal,

shown in Fig. 4, arriving at the input grid of the final video-amplifier tube. The scene depicted is a solid color consisting mainly of red, with some blue and less green components. If the tube characteristics are not linear, the relative amplification of the three fields may be considerably different, resulting in poor color reproduction. Furthermore, this color distortion will be a function of over-all signal level. To avoid this difficulty, an output swing of approximately 100 volts with a maximum of 10% departure from linearity has been designed into the receiver.

D.c. restorer

The theoretically desirable type of d.c. restorer, from the point of view of color fidelity, is highly efficient and has a speed of response of the order of a few lines. The instantaneous position of the video amplitude on the kinescope amplification characteristic will, of course, determine the degree of faithfulness of reproduction of the color. Since this position is determined, in great part, by the value of d.c. component present at that instant, one can ap-

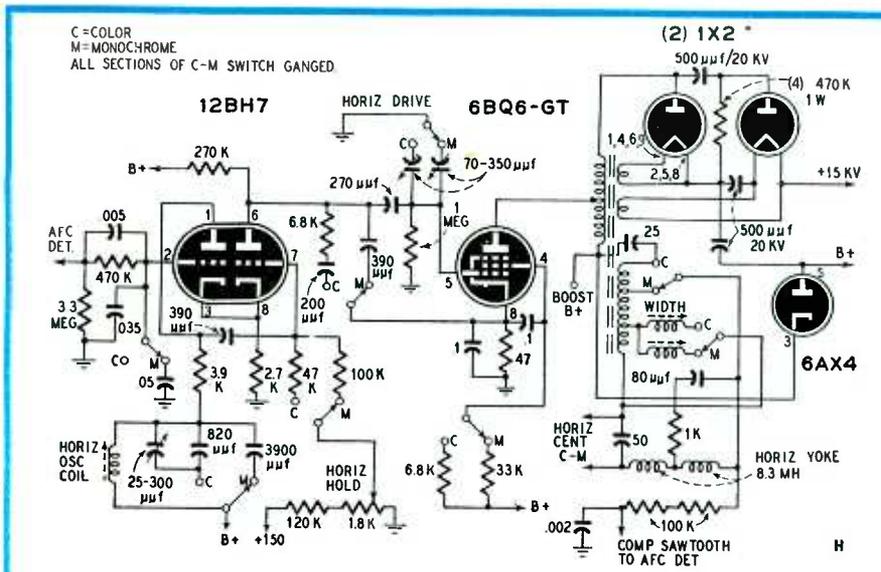


Fig. 6—The receiver's horizontal sweep circuits, with switching for color and monochrome. Note that component values change in the same ratio as sweep rates.

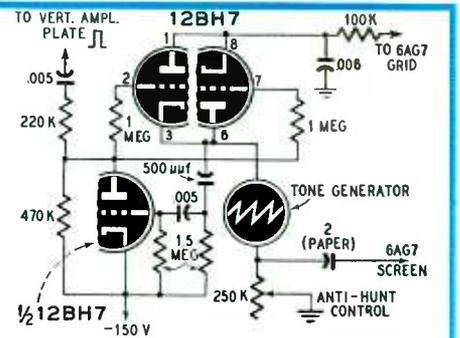


Fig. 9—Source of the control voltage.

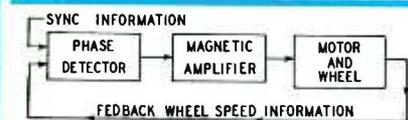


Fig. 7—Disc control circuit diagram. Phase detector and magnetic amplifier schematics appear in Figs. 8 and 9, and the motor photograph in Fig. 13.

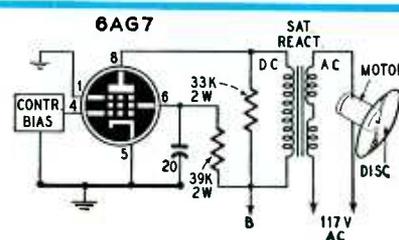


Fig. 8—The magnetic control amplifier.

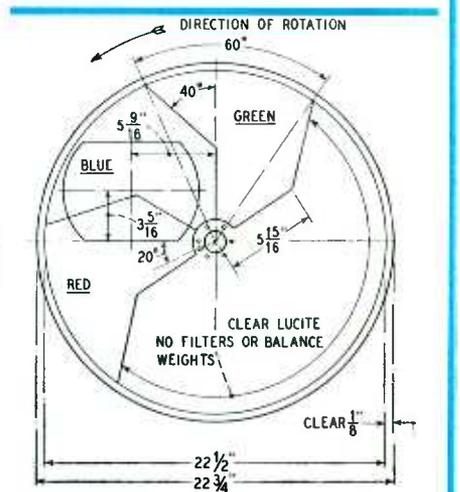


Fig. 10—The two-section color disc.

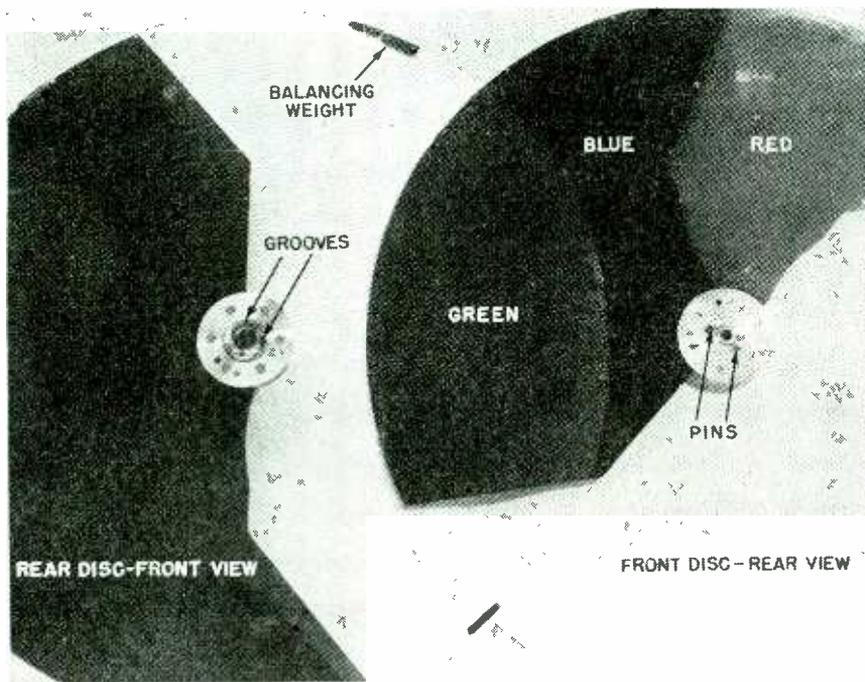


Fig. 11—Some details of the discs and hubs, showing the pins and grooves which reproduce color while in motion but permit black-and-white reception when still.

preciate the reasons for the d.c. restorer requirements stated above.

To meet these requirements at the present time would involve complex and costly circuitry (the simple direct-coupling arrangements employed in current monochrome receivers do not meet these requirements), and so a simple diode d.c. restorer circuit has been used, pending further developments.

Intercarrier sound system

The intercarrier sound system, although not critical, requires more care in its design. In the color position, 144-cycle sync buzz is more readily amplified by the audio system and more accurately reproduced by the loudspeaker than is 60-cycle sync buzz in monochrome reception. Application of well-known principles, however, is sufficient to eliminate any audible buzz.

Most important of these are:

1. The sound carrier should be attenuated at least 26 db relative to the pass-band at the video detector.
2. The video detector should operate with as high a signal level as possible without overloading the last i.f. amplifier stage.
3. Operation of the video amplifier with the composite video signal sync tips close to the cutoff region must be avoided.
4. Picture i.f. amplifier overloading must be prevented.
5. Adequate amplitude modulation rejection must be provided by the ratio detector or by whatever other FM detector and limiting device is used.

Sync, sweep, and high-voltage

The synchronizing circuits require no basic changes to accommodate the vertical sweep at 144 cycles and the horizontal sweep at 29,160 cycles. However, a

noteworthy improvement, the double time constant input, is incorporated in the sync circuit of this receiver. This addition to the conventional sync circuit improves the noise immunity of the sync by providing a fast discharge path for the undesirable noise energy stored up in the grid-coupling capacitor, thus preventing the effects of impulse noise bursts from "hanging on."

The problems of converting to color sweep frequencies have been brought to the attention of the public and the industry² and still remain a point of interest. To produce the color sweep frequencies of 144 and 29,160 cycles per second, the time constants of the vertical blocking oscillator and the horizontal multivibrator must be switched. The ratios by which the time constants must be decreased are:

$$\text{Vertical: } \frac{144}{60} = 2.4$$

$$\text{Horizontal: } \frac{29,160}{15,750} = 1.85$$

If the reader checks the circuits shown in Figs. 5 and 6, he will see that the values which are switched are approximately in the ratios of these numbers. It is interesting to note that the higher vertical sweep frequency requires a retrace time of about 40% of that for monochrome, hence the large peaking resistor.

No changes are required in the vertical amplifier stage. Since the vertical output transformer is designed for 60-cycle sweep, it will operate at least as well at 144 cycles. The vertical winding of the yoke will likewise perform well.

The horizontal output and high-voltage circuits merit some special attention in connection with color. Because of the

light reduction, it is necessary to raise the high voltage and average beam current. The energy storage in the 53° deflection yoke for the 10RP4 picture tube is insufficient to produce over 10 kv with a single rectifier without excessive retrace time or excessive 6BG6 cathode current. Therefore, a voltage doubler is used to meet the 14 kv, 250 μ a requirements. The high voltage could have been obtained with a single rectifier only at the cost of excessive retrace time, or with a high-current horizontal deflection amplifier.

Obviously, the design of the horizontal output transformer would be a function of the sweep frequency. Nevertheless, the same transformer, in conjunction with a single yoke, is called upon to operate satisfactorily in both color and monochrome performance. This is accomplished by a simple autotransformer design with an extra tap for switching the horizontal yoke.

Since the losses go up as frequency squared, a ferrite yoke must be used. Ferrite yokes give increased width and high voltage at 15,750 cycles, and at



Fig. 12—The black-and-white window.

29,160 cycles the advantages gained by using a ferrite yoke are even more significant.

Disc control circuit

In the CBS field-sequential system the color information is transmitted in the order red-blue-green. To reproduce the color information on the viewer's screen, the color disc must be in exact synchronism with the transmitter. Furthermore, the red field and the red filter on the disc must coincide. The circuit which keeps the disc in step with the transmitter is dubbed the "disc-control circuit."

For the purpose of analysis, the circuit will be divided into several simple circuits whose individual functions are more readily apparent. A block diagram is shown in Fig. 7.

The magnetic amplifier consists of a high-gain pentode whose plate current flows through the d.c. winding of a saturable reactor. The a.c. winding of this reactor is in series with the motor which drives the disc. See Fig. 8. Operation is as follows:

If the control bias becomes less negative, the plate current increases. The increased plate current in the d.c. winding drives the reactor into saturation and hence decreases the a.c. voltage drop across the reactor a.c. winding,

thus making a larger share of the line voltage available for the motor. Therefore, a reduction in negative bias at the control tube grid speeds up the motor, and an increase in the negative bias slows down the motor. However, we are *not* interested in varying the speed of the disc; we *are* interested in *keeping its speed constant* at 1,440 r.p.m. This implies that the control bias must be furnished by a circuit which will insure that at every instant the proper control bias is present to keep the motor speed absolutely constant regardless of line voltage or of any line frequency fluctuations.

The phase detector is just such a circuit. Two signals are furnished to the phase detector, one from the vertical output of the receiver which is in sync with the transmitter, and the other one from the disc tone generator. After the two signals are compared by the phase detector, a d.c. output whose magnitude is a function of the relative phase results. A schematic diagram is given in Fig. 9.

By obtaining the proper polarity from the sawtooth tone generator, the phase detector can be made to produce a d.c. correction bias which will keep the color disc exactly in step with the vertical amplifier pulse. Thus the color disc is held in dynamic synchronism by a straightforward electronic control circuit.

Scanning disc and motor

One of the advantages of the field-sequential system for color transmission and reception is that the frequency of color switching is low enough to render it practical to use either electronic, electromechanical, or comparatively simple mechanical devices. The simplest technique thus far used is that of the rotating color disc. The disc is used in the present production receiver. (Other methods have been used or are now in the laboratory stage). The color drum is a mechanical means for obtaining a larger color picture. The tricolor tube is being investigated as a possibility for an electronic field-sequential system. Other mechanical means for converting present 17- and 20-inch black-and-white sets to receive color are under investigation.

To date, the most faithful color reproduction has been obtained with the disc. The discs used in the current receiver are shown in Figs. 10, 11, and 12. The shape of the color segments is determined by:

1. The requirement that the color segment follow the scanning lines vertically down the raster.
2. The position of the center of the disc relative to the raster.

The color-monochrome receiver uses two discs. Each of the discs have three color segments and a 50% clear section. When the selector switch is in *color* position, the color segments of the rotating discs are 180° opposite each other, and the effect is that of a conventional 6-segment disc. When the switch is in *monochrome* position, the discs are in-

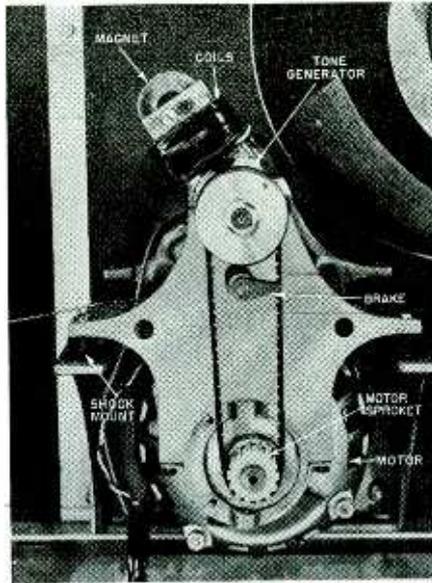


Fig. 13—The motor and motor control.

dexed (as explained later) so that the clear area of each disc is stationary in front of the raster (Fig. 12).

The filters used in these discs may be the red, green, and blue Monsanto "E" filters or the following Eastman Kodak television filters:

Blue—# 451, Green—# 610, Red—# 260

To avoid flicker, the two discs are paired so that the comparative filters for similar color segment areas do not vary more than $\pm 1\%$ for green, $\pm 2.5\%$ for red, and $\pm 3.5\%$ for blue in their color transmission. The discs are statically balanced to within 0.1 inch-ounce.

The rotating disc and motor are generally not discernible by the viewing audience. It has been the experience of the writers, while demonstrating the receiver to various groups, that invariably the question is raised, "Is there a disc in the cabinet?" The audience (including engineers and service technicians) could neither see nor hear the disc about which they had been hearing and reading.

With the proper motor and shock mounting (Figs. 13 and 14), the operation is essentially noiseless. The motor used in this receiver is a split-phase capacitor type which has a torque of 21 inch-ounces. Its speed is 1,748 r.p.m. and it is geared down with belt and sprockets (Fig. 13) to 1,440 r.p.m. The operating voltage of the motor is approximately 85.

The disc shaft is rigidly connected to the front disc. When this disc rotates it pulls the other, or free, disc along with the indexing pins (Fig. 11) which are engaged in the grooves of the "free" disc hub. It takes the discs approximately 20 seconds to reach the operating speed from the off position.

Mounted on the rear of the disc shaft (Fig. 13) is a tone-generator disc. As each pair of arms of this disc passes under the ends of the horseshoe magnet, a sawtooth voltage is generated in the coils. The spacing, the shape of the

arms, and the ends of the horseshoe magnet determine the generated wave-shape. The sawtooth voltage is then applied to the disc control circuit for comparison with the vertical sweep pulses as explained previously in the section on disc control.

When the selector switch is thrown to *monochrome* position, a mechanical brake (Fig. 13) is applied. This slows down the forward motion of the discs. At the same time, the current through one of the motor windings is reversed. As the driven disc slows down with respect to the free disc, its relative position with respect to the free disc is allowed to change by 120°, where the free disc is again held in position by the indexing pins which ride in the grooves of the free disc hub (Fig. 11). In this position there is 120° of clear area (Fig. 12). When the reverse current in one of the motor windings re-

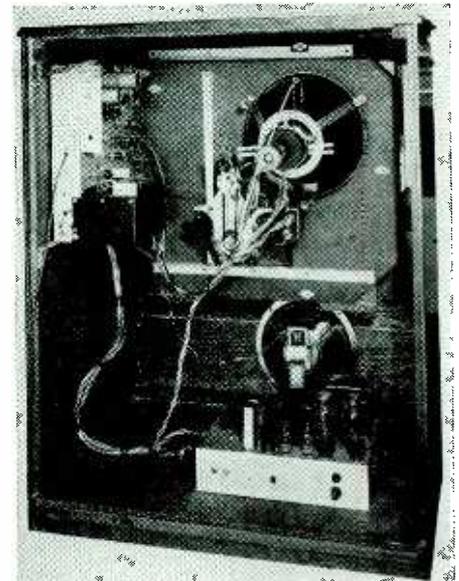


Fig. 14—Rear view, complete receiver.

verses the direction of rotation of the disc, a stop latch on the hub of the free disc moves up against a stop on the mounting assembly and both discs are stopped in the correct position (clear sections in front of raster). When the discs are in the correct position, a micro-switch behind the stop latch turns the motor current off. This changeover from color to monochrome takes less than 8 seconds.

A magnifying lens enlarges the 10-inch tube image to the equivalent of a 12½-inch tube.

Acknowledgment is gratefully given to the CBS Engineering Staff, and particularly to Dr. Peter Goldmark, John Christianson, and Al Goldberg who worked closely with the authors in the development of this receiver.

REFERENCES

- 1 "Vacuum Tube Amplifiers," Valley and Wallman; Chapter 4.
- 2 "Field Sequential Color Companion," Cohen and Easton; *Electronics*, May 1951.

—end—

Remote Controls For TV Promote Viewer Comfort

electromechanical and electronic systems are used

By **ROBERT F. SCOTT**

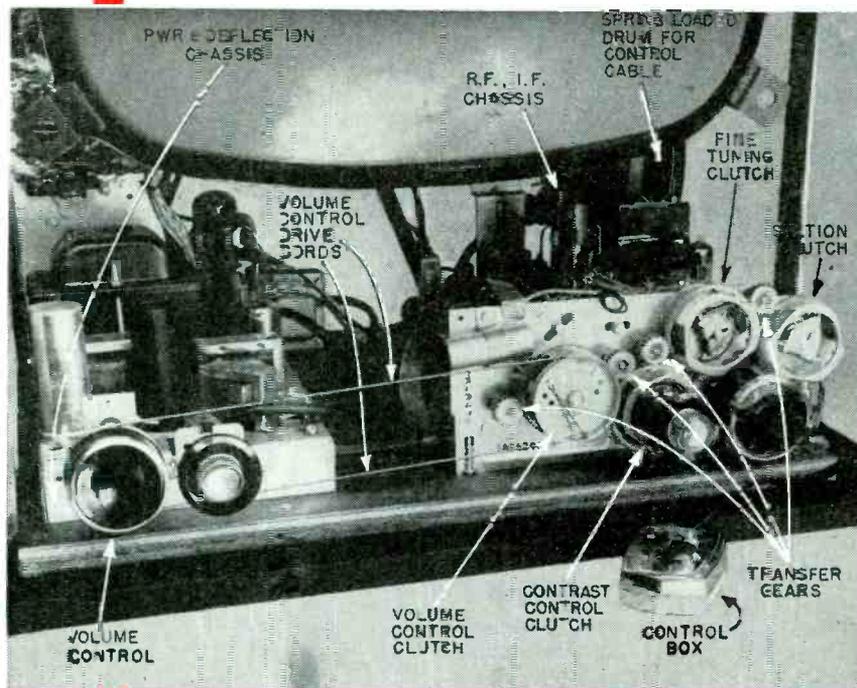


Photo A—Remote control unit on Philco dual-chassis receiver.

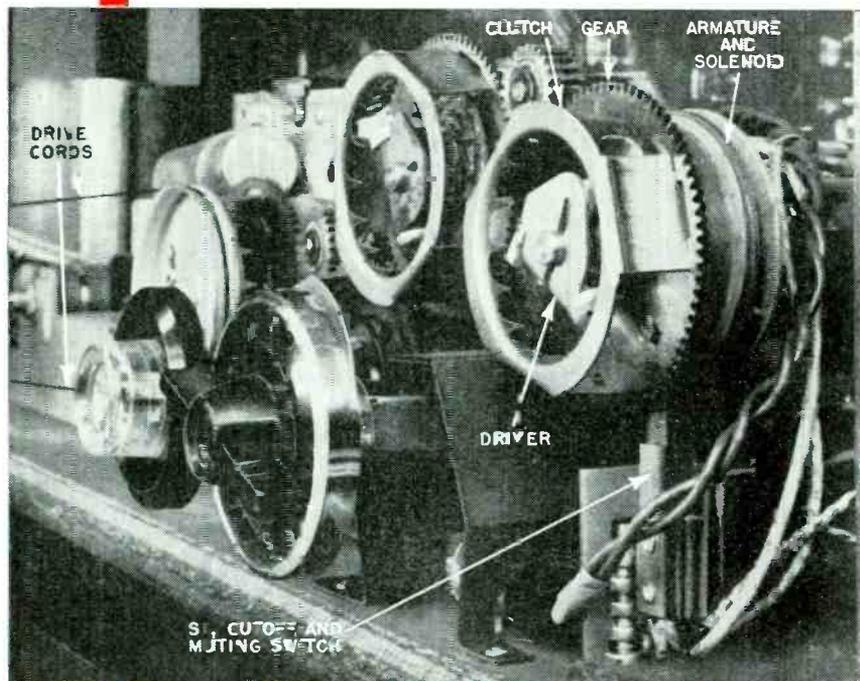


Photo B—Close-up of drive unit of Philco's remote control.

BUILT-IN and large-screen television installations are usually placed where the screen can be seen clearly by a maximum number of viewers, who may be seated 10 or 15 feet away. If the host sits among his guests, he blocks their view each time he gets up to adjust the volume, tuning, or contrast. If he sits beside the set where he won't block the view of others, he will probably go to bed with a neck cramp from trying to see the screen and with a headache from watching it from too near. One TV owner even sits beside the set and watches the screen in a mirror on the opposite wall.

Some TV set manufacturers have produced remote viewers and remote-control systems which permit control of the set from a convenient viewing spot. Some of the following systems are electronic, others are electromechanical.

Zenith "Lazy Bones"

The Zenith remote-control system, called "Lazy Bones," is optional on the 1951 series H chassis. It consists of a motor-driven tuning mechanism bolted to the rear of the tuner and controlled by two push switches on the end of a 17-foot 3-conductor cable. A schematic of this system is shown in Fig. 1 and a drawing of two views of the mechanical arrangement is shown in Fig. 2.

The essential parts of the system are a low-voltage a.c. motor, step-down transformer, a high-ratio reduction gear, an electromagnetic clutch, and a small control box on the end of the 17-foot cable. The drawings in Fig. 2 show the drive mechanism in the unenergized position. Gear G1 has a D-shaped hole which fits the shaft extension on the rear of the tuner turret. The worm gear G2, mounted in bearings on the armature of the electromagnet EM, is coupled to the motor shaft through a flexible coupling made of rubber tubing or similar material.

Pressure on S1 or S2 applies power to the motor and the electromagnet which is in series with it. When the motor starts, the magnet attracts the armature holding G2 and pulls in until G1 and G2 are meshed. Because of the gear ratio, G1 turns slowly. This slow

RADIO-ELECTRONICS for

motion and a heavy detent causes the stations to click in one after the other as long as S1 or S2 is closed. All the operator need do to change channels is press either switch until the detent drops into the right channel. S1 causes the turret to turn clockwise and S2 turns it counterclockwise. No provisions are made for operating any controls other than the channel selector.

Philco control

The Philco RC-1 remote control turns the set on or off, selects any channel, and adjusts volume, contrast, and fine-tuning controls from any distance up to 30 feet from the receiver. The control cable fits on a spring roller reel-up drum. Proper length is pulled out.

Shown schematically in Fig. 3, it consists of four self-centering d.p.d.t. switches on the end of a 30-foot 8-conductor cable, a 24-volt reversible a.c. motor and step-down transformer, and a clutch-gear assembly which turns the shafts of the volume, contrast, station-selector, and fine-tuning controls. Photo A shows the front of one of the recent Philco models with the gear assembly and motor in place. Photo B is a close-up of the gear mechanism.

The major portion of the remote-control mechanism—the clutch-gear-solenoid assembly—is mounted on the r.f.-i.f. chassis. The volume control—on the power and deflection chassis—is coupled to its drive mechanism through a pulley and drive cords (see Photo A). All controls on the set have concentric shafts. Only those controls on the outer shafts are operated by the remote-control system. One gear in the train is driven by a belt from the motor. This belt-driven gear is coupled to the others through small transfer gears. See Photo A.

There are four solenoid-clutch-driver assemblies. The clutch-gear assembly is a one-piece unit which revolves continuously as long as the motor is turning. When the solenoid is excited, the clutch moves back approximately 1/8 inch so one of its cogs engages the toggle on the driver and the shaft starts to turn. A spring returns the armature and clutch to their resting position when the solenoid circuit is opened.

A safety device on all controls except the channel selector is a spring toggle which maintains sufficient pressure to turn the control throughout its range and slips with an audible clicking when the control reaches the end of its range. The channel selector can be rotated continuously so it does not have such a slip-type clutch.

Referring to Fig. 3, we see that throwing any switch on the control box starts the motor and excites the solenoid which transfers the rotary motion to the shaft corresponding to the switch. The switches have a dead center position with a spring return. The rotation can be reversed by sliding the switch in the opposite direction.

The channel-selector mechanism is coupled directly to a normally open cut-off and muting switch S1 placed across

the speaker voice coil and the cycling switch S2. Photo C shows the exploded view of the cycling switch and detent assembly and Photo D is the detent and roller assembly which fits over a shaft

on the back of the turret tuner.

Operation

When the STATION SELECTOR switch is pressed, the motor and corresponding

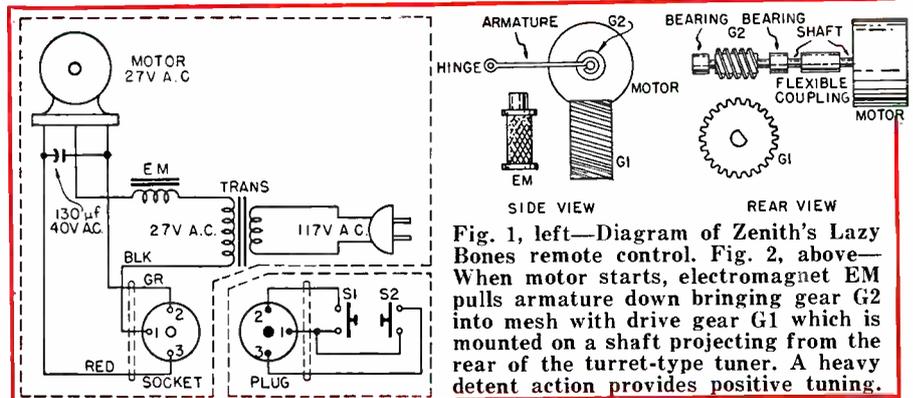


Fig. 1, left—Diagram of Zenith's Lazy Bones remote control. Fig. 2, above—When motor starts, electromagnet EM pulls armature down bringing gear G2 into mesh with drive gear G1 which is mounted on a shaft projecting from the rear of the turret-type tuner. A heavy detent action provides positive tuning.

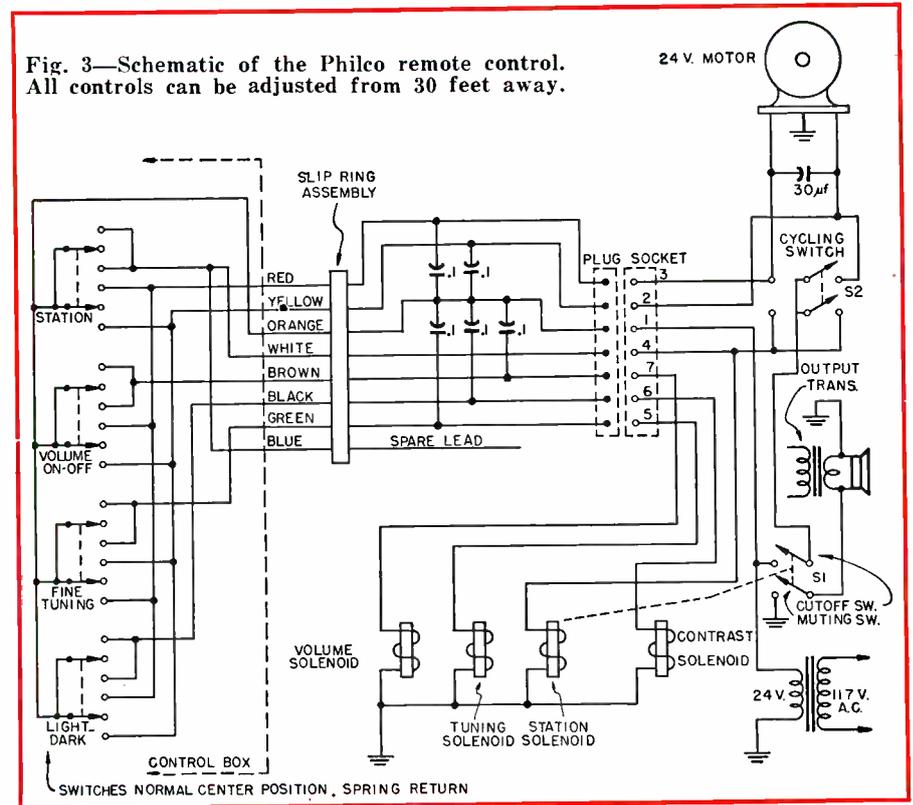


Fig. 3—Schematic of the Philco remote control. All controls can be adjusted from 30 feet away.

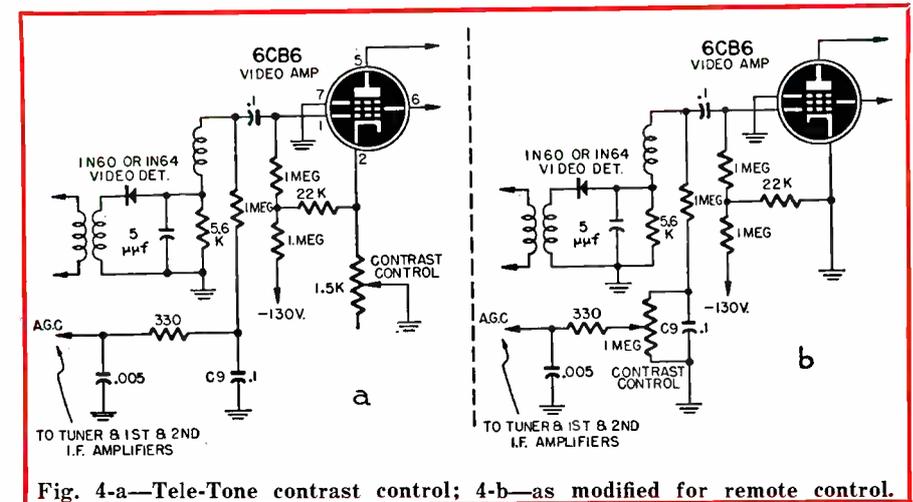


Fig. 4-a—Tele-Tone contrast control; 4-b—as modified for remote control.

solenoid are energized and the turret shaft starts to rotate. The detent rollers (see Photos C and D) are subjected to sideways and upward thrusts by the star wheel on the detent-plate assembly. The centering lever moves sideways to

close the cycling switch S2. This switch is in series with the cutoff section of S1 which was closed earlier by the clutch gear as it moved backward to conduct the driver.

These two series-connected switches

parallel the STATION SELECTOR in the control box. Therefore, during the time that the detent roller is riding up on the star wheel, the centering lever holds S2 closed.

The cycling switch S2 closes, even on one sharp pulse from the station selector switch. Thus the station selector switch does not have to be held down once the tuner starts to rotate. S2 has two positions; as shown, because the motor rotates in one of two directions, and proper phasing must be maintained. The detent cam throws S2 in one of the two positions, depending on the initial direction of rotation.

The tuner continues to revolve until the detent roller (see Photo D) dips down to the next depression in the star wheel. The centering lever returns to its normal position and opens S2 so all voltage is removed from the motor and solenoid. The armature returns to its resting position and opens S1 which removes the short from across the speaker voice coil.

During manual operation, S2 is closed by rotation of the tuner shaft but the motor and solenoid are not excited because S1—in series with the hot lead from the transformer—is open.

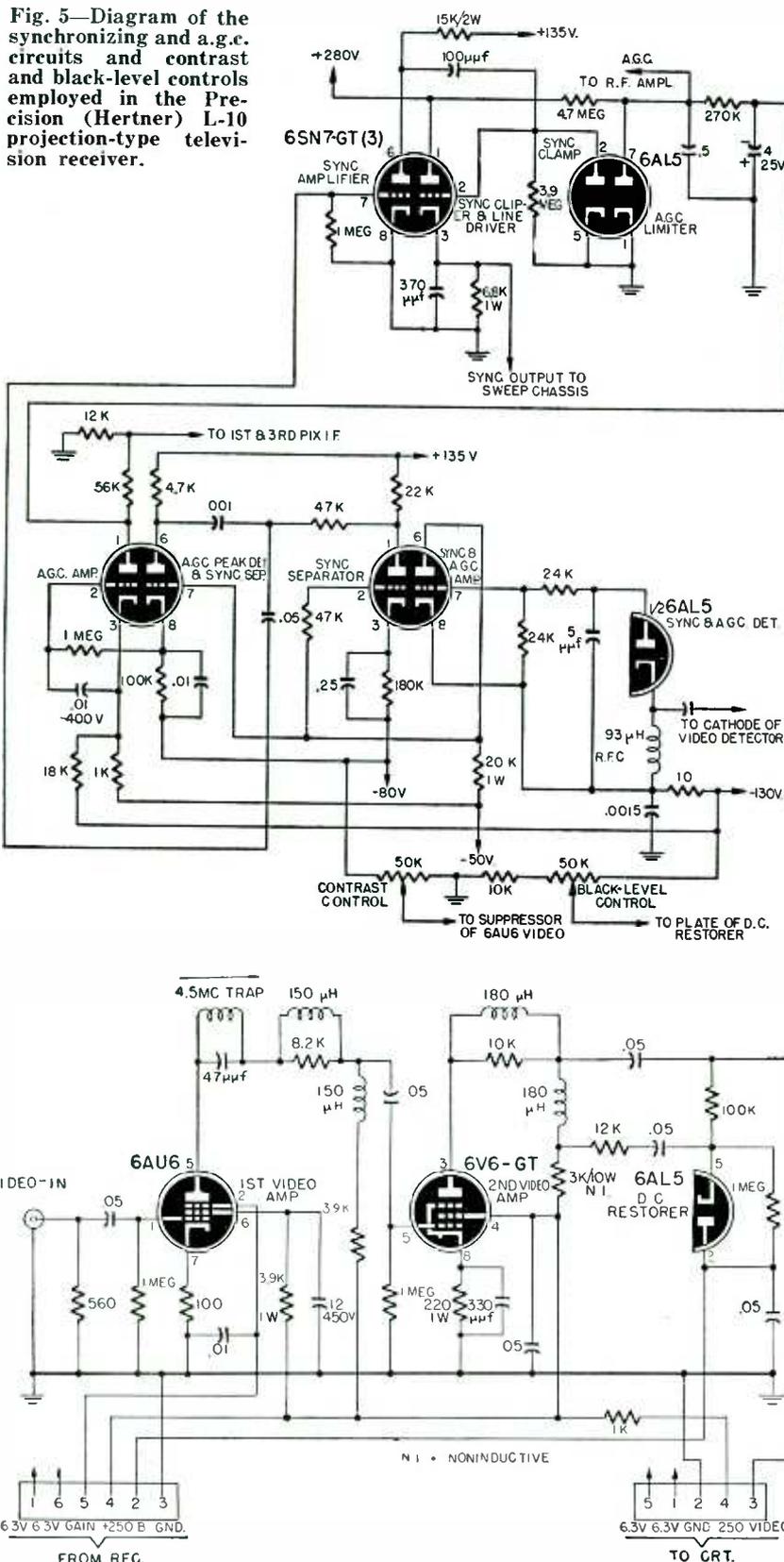


Fig. 6—Video circuit of the L-10. Lead B from the d.c. restorer plate goes to the brightness control. The contrast control varies suppressor bias on the 6AU6.

Tele-tone control

Tele-Tone type TAP chassis are used in some remote installations. The tuner is removed from the set and installed in a small control box. The converter and first i.f. transformers have low-impedance secondaries and primaries, respectively, which are link-coupled with 72-ohm coax. The volume-control circuit is brought to the control box through standard 2-conductor shielded cable.

When the TAP chassis is used in a straight console or table model, the contrast control is a 1,500-ohm potentiometer in the cathode return of the 6CB6 video-amplifier stage shown in Fig. 4-a. Since the control is in a signal circuit, it is not practical to extend to the control box for remote-control installations. Therefore, the control is removed from the circuit and the cathode of the video amplifier is returned directly to ground. The modified circuit is Fig. 4-b. The video amplifier operates at full gain as it does with the original contrast control at minimum resistance.

The a.g.c. lead is disconnected from the junction of R14 and C9 and connected to the arm of a 1-megohm potentiometer shunted across C9. Placing the contrast control in a d.c. circuit makes it possible to extend its leads to the control box without disturbing the operation of the circuit.

The Hertner system

An electronic remote-control system is used in the Precision (Hertner) L-10, a projection model which has the tuner, i.f. strips, sync circuits, and audio amplifier on the remote-control or receiver chassis. The 30-kv r.f. power supply, sweep circuits, and video amplifier are all on separate chassis. The tuner and audio amplifier are on subchassis which can be taken off the receiver chassis

Television Service Clinic

Conducted by **MATTHEW MANDL**

A NUMBER of television receivers make use of a sound i.f. of 21.25 megacycles and a picture i.f. of 25.75 megacycles. These sets normally give good service in most signal areas, but use of these i.f.'s sometimes can cause considerable trouble.

A reader in Tucson, Arizona, reports fringe-area reception of channel 5 resulted in finely-spaced horizontal lines which look like thickened horizontal trace lines. Fine tuning adjustment caused such lines to rotate from their horizontal position to vertical. They disappear when the station signal strength increases. A booster or 4.5-mc trap adjustment did not help.

In these receivers the source of trouble is the third harmonic of the video i.f. falling on channel 5 picture carrier frequency:

Channel 5 picture carrier77.25
Receiver picture i.f.

25.75 X 377.25

With the slightest deviation of oscillator frequency (such as 25.72 i.f. resultant) heterodyning action can take place between channel 5 picture carrier and the third harmonic of the i.f. which is present because of low-Q circuits and non-linear mixing systems. The resultant frequencies, if slightly below the 15,750 sweep, will produce the effect shown in the photo.



Horizontal lines are due to video i.f.

Varying the fine tuning may change the difference frequency enough to produce a resultant above the 15,750 sweep. The interfering lines will then be vertical. If the incoming signal is strong, the visible line structure will be less noticeable.

The 25.75-mc picture i.f. can also produce interference in localities with different station allocations. For instance, a fairly strong channel 10 carrier can ride in on channel 6.

To tune channel 6, the local oscillator in sets using an i.f. of 25.75 will have to generate a frequency of 109 mc. Similarly, to tune channel 10 it would have to generate a frequency of 219 mc.

However, the oscillator for channel 6 produces harmonics as well as the fundamental 109 mc. The second harmonic is 218 mc, which is so close to the channel 10 oscillator frequency (219 mc) that channel 10 will ride into the i.f. system and cause interference on channel 6.

Other such interference problems have arisen and manufacturers have subsequently used 25.5 mc for the picture i.f. and 21 mc for the sound i.f. in their later receivers. Many technicians have realigned such receivers slightly to rid them of this type interference. When this is done the tuner must be tracked to produce the new i.f. frequencies and the i.f. stages must be aligned for proper acceptance of the new resultant. This was done by our Tucson reader. It resulted in complete absence of the interfering lines.

Adjacent channel interference

What can be done to reduce adjacent channel interference in this area? Local stations are strong and spill over when the more distant ones are tuned in. A. D., West Orange, N. J.

When local stations are extremely high in signal strength, not much can be done to reduce adjacent channel interference. Adjacent channel traps can be installed in receivers which do not have them, or additional ones can be put into receivers which have single ones. Poor i.f. alignment will cause adjacent channel spill-over and so will a poorly tracked tuner. A good booster, with its added selectivity, will also help. Also check antenna orientation and use multielement reflectors for better screening from the rear.

Reversed picture

After conversion of an RCA receiver from a 10-inch tube to a 14-inch, the picture appeared reversed in a horizontal direction. Would this be caused by the newly installed yoke? C. H., Cleveland, Ohio.

If you get a reversed picture along the horizontal plane it indicates that you have the two leads to the horizontal coils of the yoke reversed.

Interchange these leads. When the leads are reversed on the horizontal coils, sweep starts from the right and goes to the left instead of vice versa. If you had reversed the vertical-coil leads your picture would have appeared upside-down.

Transformer sing

After conversion of an Admiral to a 14-inch screen everything worked all right except for the presence of a very

high-pitched squeal. Evidently the 15-750 sweep is now very audible and I would appreciate suggestions for its reduction. F. S., South Attleboro, Mass.

Your new horizontal output transformer is the offender. Some transformers produce more singing than others. If the transformer windings are vibrating, little can be done except boiling the core in a sealing compound. A reduction in the drive-control setting sometimes is helpful; excessive drive aggravates singing. Reduce drive as much as possible, but check horizontal linearity to prevent picture distortion. Also check to see that width is proper.

Reduced picture size

On a G-E model 806 the picture does not fill the screen. There is about 1/2 inch border all around the picture and I have been unable to fill the mask. G. L., New Brunswick, N. J.

If both height and width controls are unable to bring the picture to full size, one of several things may be wrong, as listed:

1. Defective low-voltage supply. Replace the low-voltage rectifier and check filter capacitors to see that leakage resistance is not draining too much current.
2. Excessive high voltage. This could be caused by a gassy horizontal output tube or high-voltage rectifier. Replace each to see if picture expands.
3. Improper placement of yoke on neck of tube. If yoke is too far back from the flare of the picture tube, the beam cannot sweep fully.

Picture stretch

I have a receiver with excessive stretching of the picture at the left. The outer circle of the test pattern is almost pointed.

I have tried to remedy this condition by replacing the damping tube and adjusting controls, without success. R. S., New York, N. Y.

Normally this condition is caused by an incorrectly adjusted "drive" control which, in conjunction with the horizontal linearity and width controls, must be properly set for a perfectly rounded circle. If adjustment of these controls fails to reduce left-side stretch, the discharge tube should be replaced and a check made of the associated circuit. An incorrect value voltage-boost capacitor in the cathode circuit of the damper tube may also cause this condition.

Defective picture tube

I have a receiver using a 12LP4 tube. When the set is turned on, sound is all right but the picture takes about 15 minutes to come up to proper bright-

ness. During this time the screen has no brilliancy, and as the picture appears it is badly out of focus and double images appear. Eventually focus and brilliancy reach normal levels. I have tried receiver-tube changes but this didn't help. The trap in this receiver is a single-magnet type—could this cause such symptoms? H. P., Birmingham, Ala.

All indications point to a defective picture tube in this receiver. The 12LP4 tube requires a double-magnet type of ion trap, and if this receiver has been in use for any appreciable time with a single-magnet ion trap, damage to the gun structure of the tube has probably occurred. Try a double-magnet ion trap and carefully position it for brightest raster. This may make some difference in performance, though if the damage is extensive, the tube will have to be replaced before you will regain normal operation.

No picture or sound

In an Air-King model A-1000 both sound and picture are missing, but the raster is present. Inasmuch as this is not an intercarrier receiver I suspected the tuner. I replaced all the tubes in the tuner with new ones without result and finally changed the entire tuner but to no avail. Where else could the trouble lie? M. G., Cementon, Pa.

This model receiver has the same circuit as the RCA 630 and the sound take-off is right between the mixer tube and the first i.f. stage. Absence of both picture and sound usually indicates tuner trouble. Since you replaced the front end, it is quite possible that you have a bad tube or defective part in both the video and the sound section. There is also a bare possibility that there was some defect in the new tuner that you installed.

If the tubes check all right in both these stages, localize the defective stage in the sound i.f., detector, and audio amplifier by signal-tracing methods. Repeat for the video section from the tuner to the picture tube.

Conversion to 20-inch tube

I have a Radio Craftsman receiver, model RC-100-A, using a 16AP4A picture tube. Am I right in assuming that my present high-voltage system would be suitable for the 20CP4 conversion I have in mind? Is changing the yoke the only major conversion item? O. M., Moosup, Conn.

You would need more high voltage for the 20CP4 than your present supply furnishes to get best results. Besides a new yoke, the horizontal output transformer also should be changed for a proper impedance match. The focus coil also will have to be replaced. The 16AP4-A is a 53° deflection tube using a double-magnet ion trap and metal-cone lip, high-voltage connection.

The 20CP4 is a glass tube (70° deflection) and the high-voltage connection is of the cavity type. A single-magnet ion trap is needed.

—end—

Television dx Forecast for November

The between-seasons character of November is reflected in the nature of TV dx conditions that may be expected during the month. Just as in weather, November provides samplings of both summer and winter in its v.h.f. propagation conditions.

Sporadic-E skip is not uncommon at this season, but the openings are usually of short duration and reception is likely to be highly erratic in character. TV dx of this sort will be more prevalent in the lower latitudes. Viewers 500 to 1200 miles from either Mexico City or Havana will be getting occasional looks at the Channel 4 transmissions from these two cities. Stations in the southern parts of this country will be received at similar distances several times in November, with the more northerly stations affected less often. Little dx will be observed on TV channels above 4.

Tropospheric propagation will run the gamut from very good to near the winter minimum, and these variations will follow the weather pattern closely. Parts of the country where November's days are still warm and the nights only

moderately cool will be getting good extended-range reception on the lower channels in fair calm weather. High-band tropospheric DX occasionally observed in early fall will be rare after the latter part of October.

Average signal strengths on all channels will deteriorate somewhat, increasing "fringe-area jitters" on the part of TV service technicians. Viewers who have had their first TV experience in the favorable conditions of summer and early fall will be needing their technicians to fix up their snowy reception, and educational as well as technical methods will be required to pacify them. This may be a little trying to a busy man's patience, but it can be good for the booster and high-gain antenna business.

The aurora borealis is likely to provide a show or two for residents of that portion of the U.S.A. above Latitude 40 (approximately Washington to Reno), and we again request that propagation effects observed on the TV frequencies during auroral disturbances be reported in detail for study.

—end—

WOR'S "Television Square" Opens Next Month

Television Square, WOR-TV's new block-square studio, is scheduled to be opened for occupancy about December 1, a month ahead of schedule. The two-story structure—New York's first to be erected solely as a TV studio—runs from Broadway to Columbus Avenue and occupies practically the entire block between 67th and 68th Streets.

The building, which will contain approximately 50,000 square feet of floor space, will enable WOR-TV to place nearly all their production facilities under one roof. Incorporated in the studios are many new design features suggested by competitive engineers from Du Mont, ABC, CBS, and NBC. The live-production facilities consist of two 4,000- and one 6,000-square-foot studios on the first floor. Each is entirely self-contained with its own control room, sponsor's and announcer's booths, and a 400-square-foot rehearsal room. The largest studio has a spectator's balcony seating nearly 250 persons. The studios are adjacent to four dressing rooms for stars and two others which

accommodate about twelve performers each. Each studio has access to 5,000-square-foot storage area used for scenery and properties.

The second floor is equipped for filmed productions. There are editing, cutting, and projection rooms, master control, and a small studio for forum and news telecasts.

The roof of the building has clear range to WOR-TV's transmitting tower in North Bergen, N. J., thus making it possible to use microwave relay between studios and transmitter. The entire building is acoustically treated, air-conditioned, and protected against fire.

An ingenious system is devised to discourage gate-crashing and trespassing and to prevent unauthorized persons from entering or leaving except through the main entrance. An indicator board is located at the receptionist's desk. If any door, except the main one—is opened, a light flashes and a buzzer sounds until the door has been closed and locked.

—end—

Underwater TV Spots Submarine's Remains

Underwater television was used by the British Navy to locate and positively identify the wreck of the submarine *Affray* lost with 75 men aboard during a practice dive last April.

The equipment consisted of a portable TV camera equipped with remote controls and sealed in a watertight container. The camera assembly was fitted with powerful lights designed for underwater photography. It was installed

on the salvage ship *Reclaim*.

Underwater soundings taken over many square miles of sea located many wrecks which were investigated with the undersea TV equipment. After several weeks of intensive investigation, the search was climaxed when viewers aboard the *Reclaim* were able to read the name *Affray* on the wreckage 250 feet below the English Channel surface.

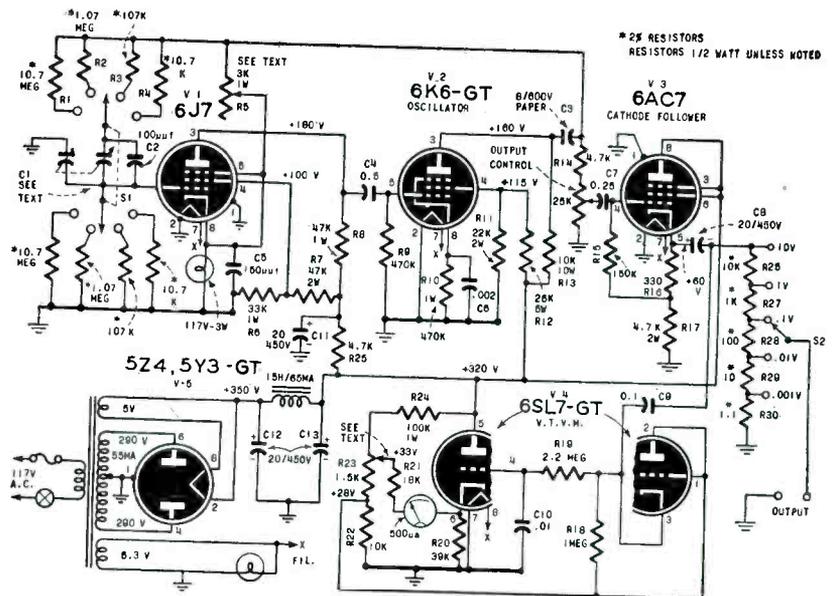
—end—

AUDIO SIGNAL GENERATOR WITH CALIBRATED OUTPUT

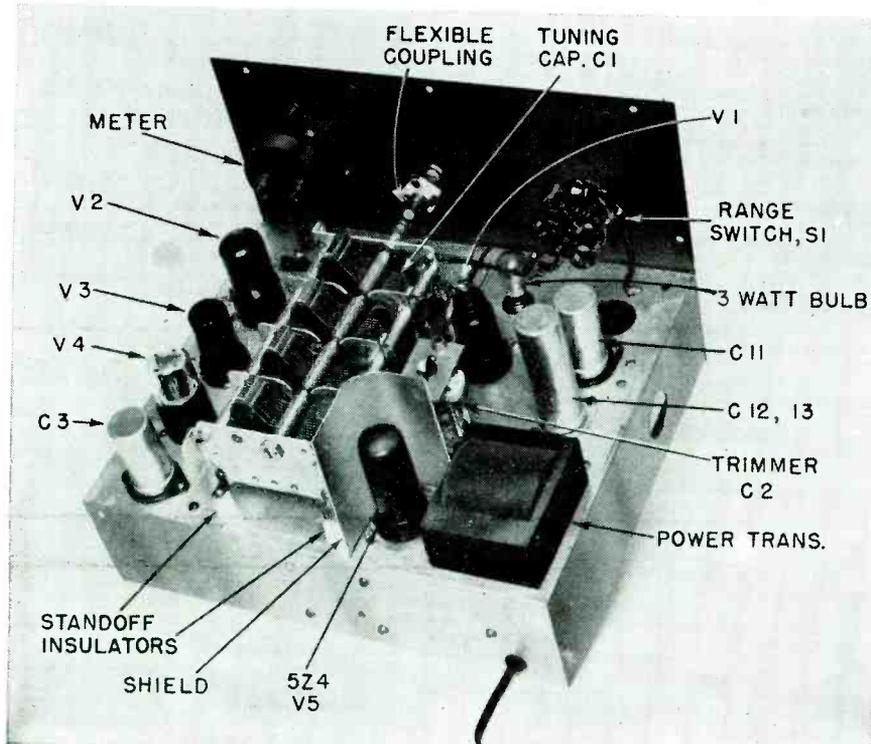
By
LAWRENCE FLEMING

ALL audio measurements and testing require a calibrated signal source. Very few audio oscillators are equipped to tell just how many volts or millivolts they are delivering to their terminals, and without knowing this we are in no position to measure, for instance, the gain of an amplifier.

If we want to feed the input of an experimental amplifier, say 10 millivolts at 2,500 cycles, we usually need a regular oscillator plus an auxiliary output meter and a calibrated attenuator. Most amateur, PA, and allied work doesn't require 1% laboratory precision. This instrument does the job with 5 to 10% accuracy, is easy to build, uses stand-



Oscillator is a Wien bridge with wide-range amplifier and calibrated attenuator.



Layout of the generator. Variable capacitor must be insulated from chassis.

ard parts throughout and is completely self-contained. An output meter and attenuator are built into the same case with a conventional resistance-tuned audio oscillator. The output is isolated from the oscillator proper by a cathode-follower stage.

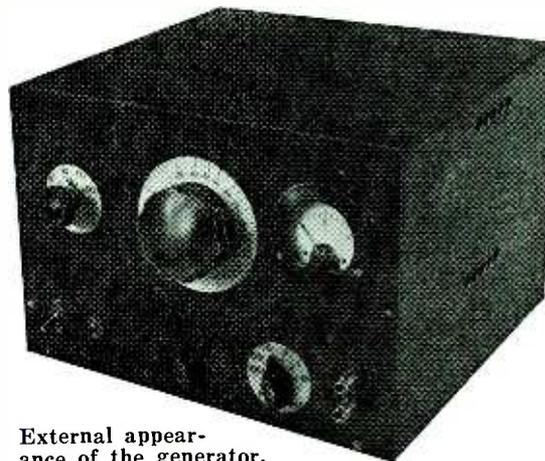
The frequency range is 20 cycles to 200 kc, covered in 4 ranges. The same dial calibration serves for all ranges. The output voltage is variable from 100 microvolts to 10 volts. The output impedance varies with the setting of the attenuator switch, but is always lower than 900 ohms.

General layout

The instrument is built on a standard 10 x 12 x 3-inch chassis, which fits into an 11 x 12 x 8-inch utility box. As shown in the photo, the main tuning capacitor, C₁, is mounted down the middle of the chassis. It is a 4-gang, 365- μ f-per-section unit. The sections are paralleled in pairs, giving in effect a two-gang capacitor having 730 μ f per section. The range selection switch S₁ and its associated resistors, as well as the 6J7 tube V₁, are mounted to the left of the tuning capacitor.

The power supply occupies the back

An instrument with calibrated output variable from 100 microvolts to 10 volts and frequency range from 20 cycles to 200 kc in four bands.



External appearance of the generator.

left-hand corner of the chassis (filter choke L_1 is under the chassis), and the remaining tubes and the output meter are mounted to the right of the tuning capacitor. V_2 is nearest the panel, and next to V_1 . The cathode-follower output stage V_3 is next in line, and the v.t.v.m. tube V_4 , for output metering, the rearmost.

Circuit operation

The oscillator is the Wien bridge type and its principal components are the bridge itself, C_1 , R_1 - R_4 and the two stage amplifier V_1 , V_2 . With resistors R_1 switched in, the frequency range is 20-200 cycles; with R_2 , 200-2,000 cycles; with R_3 , 2,000-20,000 cycles; with R_4 , 20,000-200,000 cycles. This last range is easy to include and is useful in getting the bugs out of feedback amplifiers, which often oscillate up above 30 or 40 kc.

The amplifier part of the oscillator system has to have wide-range response and low phase-shift, which is the reason for not using screen bypass capacitors. The 6J7 and 6K6 tubes get their screen voltage from voltage dividers R_6 , R_7 , R_{11} , R_{12} instead. This is the reason too for the large 0.5 μ f interstage coupling capacitor C_2 and the very large capacitor C_3 for coupling the output back to the positive and negative feedback networks. C_5 and C_6 are for high-frequency equalization, such as is used in oscilloscope amplifiers.

The negative feedback loop extends from the plate of V_2 through C_3 , through feedback potentiometer R_5 to the cathode of the first stage V_1 . The 3-watt lamp, which acts as a cathode resistor for V_1 serves also as the automatic amplitude control. If the output voltage rises, the signal voltage fed back across the lamp will rise and the lamp filament will consume some energy. When the filament gets hotter, its average resistance increases, so that the negative feedback factor increases too and the gain drops.

The positive feedback extends from the plate of V_2 through C_3 , the Wien bridge, and back to the grid of the tube V_1 .

The rotor of the main tuning capacitor C_1 is hot and precautions have to be taken also for stray capacitances and hum pickup. The variable tuning

capacitor is mounted on small ceramic standoffs and the dial is connected to it through an insulating coupling. The frame-to-ground capacitance is across the lower section of C_1 . The purpose of the 100- μ f air trimmer C_2 is to balance this capacitance, and its normal setting should be about 60% of maximum.

To prevent electrostatic hum pickup in the grid circuit of the 6J7, shielding is necessary. The metal cabinet is sufficient shielding from 60-cycle electrostatic fields originating outside the chassis. In the chassis the only offender is the rectifier tube V_5 . If a glass tube, such as a 5Y3-GT, is employed, a tin baffle shield will be required between the tube and C_1 . Use of the metal 5Z4 makes the baffle shield less necessary, but still advisable. A shield was added to the present unit after the photo was taken. All a.c. wiring should be below the chassis, and the 6J7 grid lead, range switch S_1 and its resistors R_1 - R_4 all should be above the chassis to assure elimination of hum.

Hum pickup shows up as beats between the oscillator frequency and 60 cycles and its harmonics. Thus when the dial of C_1 is set within a few cycles of 60 or 120 cycles the beats will appear as an oscillation of the output amplitude at the difference frequency. The effect is very noticeable when the instrument is operated with the cabinet removed. Normally the effect is hardly perceptible.

Cathode-follower stage

The normal amplitude of oscillation at the plate of V_2 is about 15 volts. To isolate the oscillator section and provide a lower output impedance, a cathode-follower is used for the output stage. A 6AC7 tube, V_3 , operates at about 12 milliamperes plate current and about 60 volts drop across its load resistor R_{17} . Our maximum useable output is about 10 volts. This is fully adequate for all applications of supplying input to an amplifier. For testing speakers, cutting heads, etc., a power amplifier is needed anyway, external to the signal generator.

Potentiometer R_{21} gives continuous control of the signal level to the grid of the output stage, and the step atten-

uator S_2 , R_{20} - R_{30} mounted below the chassis, knocks the output level down in successive steps of 10. This attenuation at the output insures a good signal/hum ratio at low output levels. The step attenuator is a simple voltage divider. The impedance looking back into the output terminals accordingly varies with the attenuator setting, but this disadvantage is outweighed by the gain in simplicity for nearly all practical work.

The choice of the over-all resistance of the divider is controlled by the following considerations: If it is too high, the output impedance on those taps near (but not at) the top will be excessive; if too low, it will load the output stage too much.

Leakage in the electrolytic capacitor C_3 used for output coupling sometimes causes a fraction of a volt of d.c. to appear across the output terminals. This is a difficulty common to most commercial resistance-tuned oscillators, too. Hence it is not advisable to connect the output directly to a grid without an intervening capacitor, since it might upset the bias.

Output metering

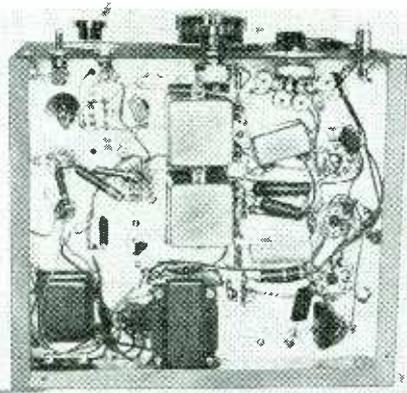
The output meter circuit consists of a double triode V_4 with one half used as a half-wave diode rectifier and the other half as a d.c. vacuum-tube voltmeter. It is stable, low in cost and does not load the output circuit enough to cause any distortion due to clipping. No zero adjustment is needed other than the mechanical zero on the 500-microampere d.c. meter.

The diode rectifier works into a 1-megohm load R_{16} . The positive d.c. voltage developed across it is fed through a filter R_{10} , C_{10} to the grid of the other triode section, which operates as a cathode-follower type voltmeter. The full-scale voltage is 10 volts r.m.s. The sensitivity is adjusted by the multiplier resistor R_{21} , and the zero is governed by the ohmage of the voltage divider resistor R_{23} .

An indicating meter of higher sensitivity than 500 microamperes full-scale can be used at M merely by in-

creasing the series multiplier R_{21} , but a less sensitive movement such as 0-1 milliamperes will not work without redesigning the whole circuit. Once calibrated, this v.t.v.m. is quite accurate and stable, because the over-all sensitivity depends only very slightly on tube characteristics. With 10 volts r.m.s. a.c. input to the diode, the rectified d.c. applied to the grid of the triode section is 14.14 volts. This voltage is applied to the meter through an effective resistance made up of multiplier R_{21} , voltage divider resistors R_{22} and R_{23} , and the output impedance of the triode which appears across cathode resistor R_{20} . This last is only a few hundred ohms, whereas the fixed resistors total 28,000 ohms.

The output voltages appearing across the attenuator switch S_2 are 10, 1, 0.1, .01, and .001 volts. The photo showing



An underchassis view of the generator

the front of the panel shows an additional .0001-volt section on S_2 . This was added by the author, but in most cases is not necessary. If desired, an additional resistor, 0.11 ohms in value, can be used to give this scale reading. However, great accuracy at this level should not be expected. If used, the resistor is inserted between R_{30} and ground, and an additional switch section is necessary for S_2 .

Calibration and adjustment

When construction is completed, the first thing to check is the d.c. potentials at the various plates, screens, and cathodes, and they should be within about 20% of the values marked on the schematic.

The amplitude of oscillation is controlled by the 110-volt 3-watt lamp bulb and by the negative feedback potentiometer R_5 . An oscilloscope is necessary, and the first thing to do is to increase R_5 until flat-tops just become noticeable on the sinusoidal output of the oscillator. Then decrease R_5 until the amplitude has dropped to about two-thirds of its former value. If R_5 is too high, overloading and distortion will result; if too low, oscillation will tend to die out. Individual selection or padding of R_5 is necessary because the lamp bulbs vary quite a bit in characteristics.

Incidentally, the interstage coupling capacitor C_4 should be a good one. Leakage here is about the commonest cause of trouble in commercial instruments.

Calibration of the output meter merely consists of connecting a 1,000 ohm-per-volt a.c. meter to the output, setting output control and S_2 for 10 volts, and selecting or padding multiplier R_{21} until meter M reads full scale. The frequency should be low, say 100 cycles. If the meter does not zero properly, adjust the 1,500-ohm divider resistor R_{23} until the electrical zero and mechanical zero coincide. The meter scale is linear.

Trimmer C_2 is best adjusted with the chassis in the cabinet, through a hole in the top of the box. The procedure is merely to adjust C_2 until the output voltage of the oscillator is most nearly the same at both ends of the dial. This obtains on the three lower frequency ranges only. On the 20–200-kilocycle range it is normal for the output voltage to rise 20% or so at the high-frequency end. On the high end of this range, too, the frequency calibration is somewhat dependent on the value of the small capacitor C_5 across the lamp bulb. Ordinarily not much accuracy is required up there, but if it is desired C_5 can be adjusted by beating the output against a signal generator at 200 kc.

Frequency calibration

Barring a serious inaccuracy in the Wein bridge resistors, there is no reason why the dial calibration for one range will not hold precisely for the other ranges. The 200–2,000-cycle range is the most convenient for calibration. The following methods may be used, the easiest requiring the most apparatus and vice versa. The easiest way is to use another audio oscillator which you trust, as a standard. Apply the

output of the standard to the horizontal input of an oscilloscope, and the newly-built unit to the vertical plates. Identity of the two frequencies is shown by a circle or ellipse on the screen.

The instrument can be calibrated with Lissajous figures on an oscilloscope screen, using the 60-cycle power frequency as a standard. Frequencies such as 20, 30, 60, 90, 120, and 180 cycles are easy to spot, but frequencies with more complicated ratios to 60 cycles (such as 50 and 200) are more difficult to identify.

A piano that is reasonably well in tune might be used as a standard, but the frequencies are all rather odd values. The lining-up of the oscillator frequency with the piano notes is best done by ear, even if a microphone and a scope are available, because the piano tones have very high harmonic content. Middle C is 261.6, A one octave above middle C is 440, and 2 octaves below it is 110 c.p.s.

Materials for generator:

Resistors: 2—10.7, 2—1.07, 2—0.107 megohms, 2—10,700 ohms, 1—10,000, 1—1,000, 1—1,000, 1—100, 1—10, 1—1.1 ohms, 1/2 watt, 2% accuracy; 1—300, 2—5,000, 1—10,000, 1—18,000 (see text), 1—39,000, 1—150,000, 1—500,000 ohms, 1—1, 1—2 megohm, 1/2 watt, 10% accuracy; 1—500, 1—30,000, 1—50,000, 1—100,000 ohms, 1 watt; 1—5,000, 1—22,000, 1—50,000 ohms, 2 watts; 1—25,000 ohms, 5 watts; 1—10,000 ohms, noninductive, 10 watts; Potentiometers; 1—3,000, 1—1,500, 1—25,000 ohms.

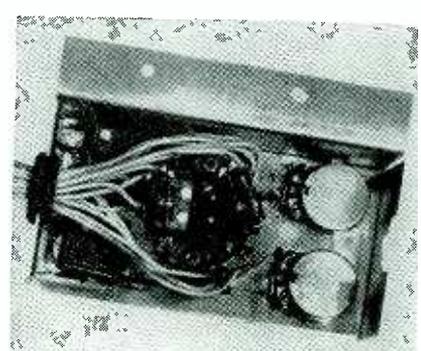
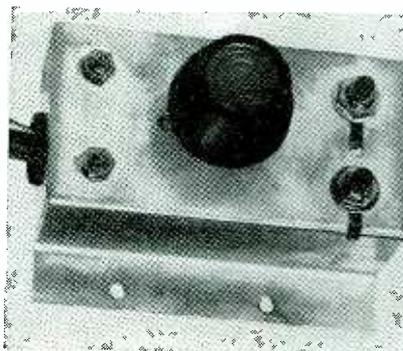
Capacitors (Electrolytic) 2—20 μ f, 1—20 μ f, 450 volts. (Mica) 1—150 μ f, 1—0.002 μ f. (Paper) 1—0.1, 1—1, 1—25 μ f, 400 volts. 1—5, 1—8 μ f, 600 volts. (Variable) 1—4-gang, 365 μ f per section, 1—100 μ f.

Inductors: 1—15 h, 65 ma choke, (approx. 500 ohms d.c. resistance. 1—power transformer, 600 volts, c.t., 55 ma.

Miscellaneous: Tubes: 1—6J7, 1—6K6-GT, 1—6AC7, 1—6SL7-GT, 1—5Z4 or 5Y3-GT (see text), 1—S1, 2-circuit, 4-position rotary switch, shorting type, 1—S2, 1-circuit, 5-position rotary switch, shorting type, 1—s.p.s.t. toggle switch, 1—6-volt pilot lamp and socket, 1—3-watt, 117-volt lamp, 1—1 ampere fuse and fuse holder, 1—0-500 microampere d.c. meter, 2 1/2-inch diameter, Tube sockets, Chassis. Hardware. Solder. Wire.

—end—

DU MONT MAKES 405-LINE ADAPTER



A number of "color adapters" which make possible black-and-white reception of CBS color broadcasts have been put on the market recently. Du Mont is possibly the first large television manufacturer to produce such an adapter. It is intended for use with standard Du Mont receivers to receive 405-line programs. The front and rear appearance of the unit is well shown by the two photographs. It is attached to a convenient place on the rear of the receiver, and is said to take only one hour for installation.

This adapter will make possible reception of CBS color programs in black-and-white. Adding a color wheel would permit reception in full color.

V-R systems are important in many new developments

FUNDAMENTALS OF VOLTAGE REGULATION

By ALLAN LYTEL



VOLTAGE-REGULATION systems are used to maintain a constant voltage output over a range of varying load requirements. There are two fundamental circuit types: one uses gas-filled tubes and is based upon the ionization of the gas particles; the second utilizes vacuum tubes and is based upon the changing plate resistance.

Gas regulator tubes can maintain a fixed voltage output over a range between 5 and 40 milliamperes. Fig. 1 illustrates the OD3 (VR-150) gas-filled voltage-regulator tube. A d.c. potential of 180 volts is necessary to ionize the inert gas and start the tube in operation. The tube has a voltage of 150 between plate and cathode after ionization; operating current is 5–40 ma. Fig. 2 shows the operating characteristics of the OD3. The table shows how this tube compares with two other gas tubes.

How gas tube regulates

A typical gas diode voltage regulator circuit may be seen in Fig. 3. Assume that the d.c. output voltage from the power supply filter tends to rise; this may be because the line voltage increases. As the line voltage increases, the d.c. output from the rectifier will increase and the output voltage across the load would also have a tendency to rise. But the voltage regulator tube will now draw more current which increases the voltage drop across the series resistor R1. This increased voltage drop *decreases* the voltage output to the load.

If the line voltage should drop and the d.c. output from the rectifier circuit tends to decrease, the voltage-regulator tube will draw less current. This decreases the current flow and the voltage drop across resistor R1. This action tends to keep the output voltage constant. The same regulatory action occurs as the current drawn by the load changes. If the output voltage from the regulator circuit tends to decrease

resistor R1 also prevents excessive current flow to the regulator tube which would shorten its life. Tubes must operate within their proper range to regulate properly. Less than 5 ma., their regulation action is poor. With more than 40 ma. their life span is shortened.

Several of these tubes may be operated in series to obtain a higher voltage output. Two 0C3's will give a d.c. operating voltage of 210 for instance. Parallel operation is impossible, since one tube will ionize first and reduce the voltage across the second below the ionization potential.

If the regulator tube is removed from its socket, the voltage output from the power supply rises to a higher value than normal, due to the current taken by the operating voltage-regulator tube. In some of these tubes, a jumper is used as an additional safety device, Fig. 4. This jumper is connected in series with the voltage output to the load. If the tube is removed no voltage output can be obtained.



Fig. 1—Cold-cathode gas tube OD3. The small tube beside it is an OA2.

because of increased load, the regulator tube draws less current and keeps the output voltage constant.

V-R tubes must have an applied voltage greater than their operating voltage before they will ionize. This voltage occurs during the initial surge when the power supply is turned on. The series

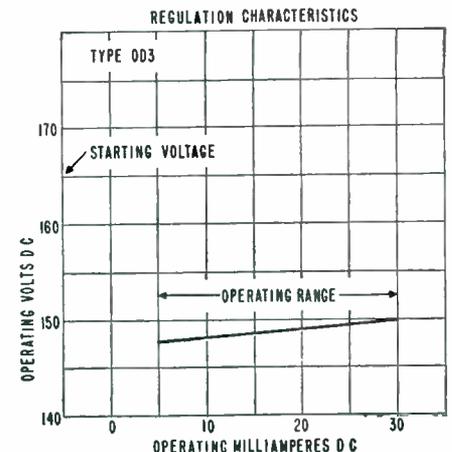


Fig. 2—OD3/VR-150 operating characteristics. Note the operating range.

	0A3/VR-75	0B3/VR-90	0C3/VR-105	0D3/VR-150
D.c. starting supply voltage (min.)	105v	125v	133v	180v
D.c. operating voltage (approx.)	75v	90v	105v	150v
D.c. operating current (min.)	5ma	5ma	5ma	5ma
D.c. operating current (max.)	40ma	40ma	40ma	40ma

Vacuum tube regulators

Where only small currents (up to 40 ma.) need to be regulated, it is possible to use a gas tube. For higher

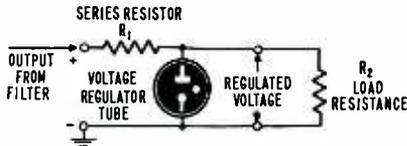


Fig. 3—Gas diode regulator circuit.

currents and better regulation, vacuum tubes are used. Fig. 5 is a simplified circuit demonstrating vacuum tube voltage regulator action.

R2 is the resistance which represents the load; the regulated output voltage appears across it. A voltmeter, V, is placed across the regulated voltage output. The regulation occurs in the element marked R1, a vacuum tube in practice, but here shown as a variable series resistor: A small series resistor

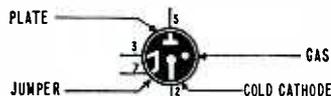


Fig. 4—Base connections for 0A3, 0B3, 0C3 and 0D3. See text for jumper use.

means a small voltage drop, a high series resistor a high voltage drop. An actual variable resistor is not used in the circuit; by means of vacuum tubes' plate resistance the same effect is obtained. The value of this variable resistance changes as the d.c. supply voltage

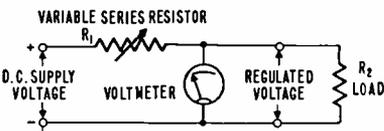


Fig. 5—Simplified vacuum tube regulator circuit where R1 is the tube resistance.

changes. This same variable resistor also changes value when the current drawn by the load changes. This circuit effectively keeps the output voltage constant in spite of changes in the line voltage and changes in the load current.

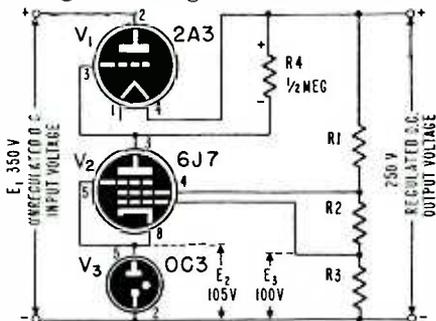


Fig. 6—A simple voltage regulator.

A vacuum tube voltage-regulator circuit shown in Fig. 6 uses two vacuum tubes and one gas tube. V1, a 2A3 power amplifier triode, acts as the series resistance R1 of Fig. 5. The plate resistance of a triode tube can be said to vary as the grid bias varies if other voltages are constant. If the grid voltage is positive, and approximately equal

to the plate voltage, the tube conducts heavily and acts like a very low series resistance. A negative grid voltage (less current flow with the same applied voltage), will make the tube act as a higher resistance. If we apply a negative voltage great enough to prevent current flow entirely, the 2A3 acts as a very high resistance.

A 6J7 is used as the voltage amplifier tube V2; it supplies the control voltage for the grid of V1. V3 (0C3) supplies a fixed reference voltage. The output load resistors in series are R1, R2, and R3. R3 is variable.

Tube regulator action (6J7)

The cathode of V2 (6J7) is fixed at a definite value above ground by V3. V2 acts as an amplifier, feeding back the changes in output voltage to the variable resistor, V1. As this resistance changes, the output is held constant.

Assume that the circuit is turned on. The complete path for the current flow for V3 is through V2, R4, and V1 to the positive side of the input voltage. As the 0C3 ionizes, it will have 105 volts from cathode to plate. This is shown as E2 in Fig. 6. The plate voltage of the regulator tube is exactly the same as the cathode voltage of V2.

The grid of V2 is connected to the junction of R2 and R3. Its grid voltage is 100 volts d.c. Since grid bias is the voltage difference between grid and cathode, if the V2 cathode has 105 volts and its grid 100, the bias is -5 volts d.c. This is not enough to cut the tube off but acts as a control voltage.

The suppressor grid of V2 is tied to its cathode; the screen is attached to the bleeder network at the junction of R1 and R2, with between 100 and 250 volts d.c. on it.

The plate voltage of V2 is also the grid voltage of V1. Current for the 6J7 flows through R4 and the 2A3. The current flow through this resistor establishes a potential so that the grid of the 2A3 is more negative than the cathode.

Regulator action (2A3)

The circuit is placed in operation by connecting it to a power supply with an output of 350 volts. Conduction is established through the 3 tubes in the circuit, and current flows through the

resistor string R1, R2, and R3. Since the 2A3 is conducting, it appears as a fixed resistance in the circuit and there is a voltage drop from cathode to plate of this tube. This is the reason the output voltage is 250 rather than 350 volts.

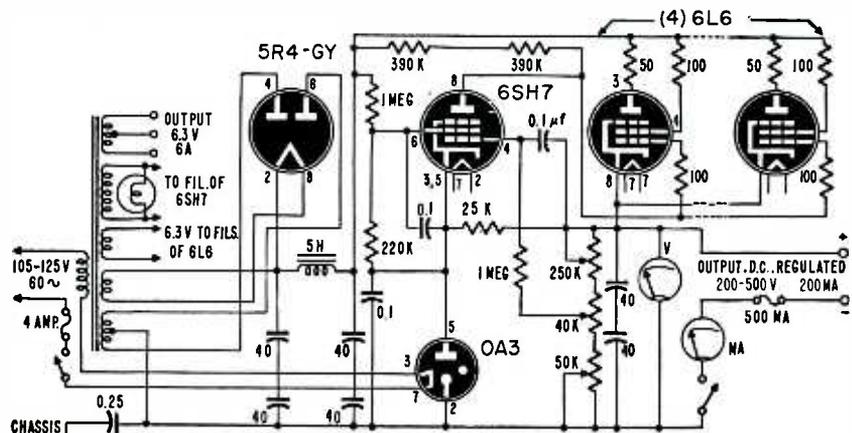
Assume now that the input voltage to this circuit increases, (this may be caused by an increase in the applied line voltage). As the output voltage tends to increase, the voltage on the control grid of the 6J7 will also increase. This will decrease the bias on this tube and decrease the voltage difference between E2 and E3. The 6J7 now conducts more heavily, and more current flows through R4. The larger voltage now developed across this resistor increases the bias on the 2A3 tube; this tube conducts less and becomes a higher resistance. More voltage is now dropped across this higher resistance and the output voltage tends to drop.

Assume the input voltage decreases. Less voltage appears across R1, R2, and R3. There will be a decrease in voltage on the grid of the 6J7 which will increase the negative grid bias on this tube (because its cathode is held at a constant potential by V3). Less current flows through R4. A smaller bias voltage is applied to the 2A3 which conducts more readily, becoming a lower resistance. A smaller voltage drop appears across this lower resistance and the output voltage rises. Thus constant voltage output is maintained.

A 6J7 is used for the control tube since it has high gain and small changes in output voltage give close regulation.

V1 must be a tube able to carry large currents since all of the current used in the load flows through this tube. A type 2A3 is used in regulators which supply up to approximately 50 milliamperes. Power amplifier triodes of this type are often used; by means of parallel connections, several tubes may be used and this multiplies the effective current by the number of tubes being used. One control tube of the 6J7 variety can be used with several 2A3 tubes in parallel. A 6Y6-G tube is used in parallel to obtain load currents of up to 250 milliamperes. Other types of control tubes are the 6SF5 triode or the 6AC7 pentode.

—end—



The Kepco model 245 supply uses series regulator like that shown in Fig. 6.

DISCONE — BROADBAND ANTENNA

This antenna, using discones in two of its three switching positions, goes from 100 kilocycles to 4,000 megacycles in only three tuning ranges

By FRED SHUNAMAN

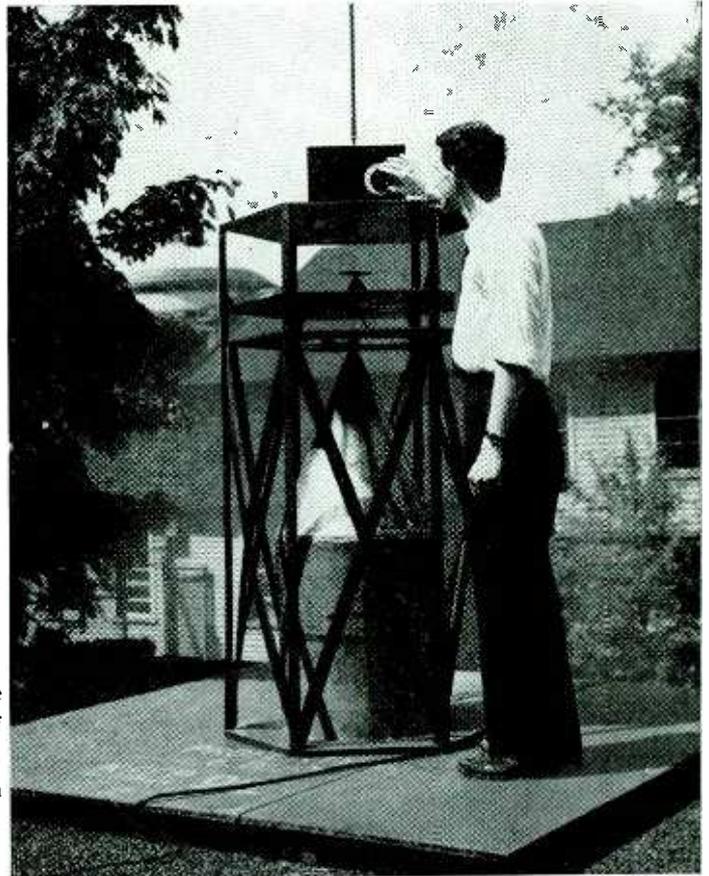
THE antenna on our cover is possibly unique among its kind both in the size of the job it is able to do and in the special design features that permit it to do that work. It resulted from the need of the Air Force's Air Development Center for an antenna that would cover the almost unbelievable bandwidth of 100 kc to 4000 mc. A research project with the objective of designing such an antenna was let to Camburn, Inc., who sublet it to the College of Engineering of New York University. The resulting antenna is largely the work of two students in that college, Lester Saporta and Paul Chirlian.

Even this antenna does not cover the band in one continuous sweep without switching. But only three switch positions are necessary to work across the whole spectrum. The lower band, from 100 kc to 12 mc, is handled prosaically with a 22-foot whip antenna and tunable loading coil. It is in the upper reaches of its spectrum that the antenna departs from tradition. To cover the extended frequency range, it was necessary to use the peculiar qualities of the *discone*.

The discone antenna is not new. Developed by Armig G. Kandoian of Federal Telephone and Radio Corporation, it was first described by him to the Institute of Radio Engineers in 1945. Its inventor says that it "may be visualized as a radiator intermediate between a conventional dipole and an electromagnetic horn." The radio technician studying it for the first time may also see it as a combination of transmission line, matching section, and radiator.

It may be difficult to conceive of how an antenna can combine all these features, but the actual operation of the discone is rather easy to understand. Starting with it as a piece of standard

Lester Saporta, one of the designers of the antenna, tunes up the whip section



Courtesy New York University

coaxial transmission line (for convenience placed at right angles to a vertical feeder, Fig. 1-c) we check the radiation. It is negligible. Now, if we flare the outer conductor out into a sort of horn (Fig. 1-b), it begins to radiate efficiently at frequencies above a certain cutoff point. Our flared coaxial line becomes a radiator with a wide frequency range, but good in one direction only.

Four such "coaxial horns" would make an omnidirectional antenna, though the field pattern would be irregular, because radiation naturally would be best directly ahead of each horn. But there is a simpler and better way to get a perfect omnidirectional pattern. Imagine rotating our "coaxial horn" around the end of its feeder through a complete circle (360 degrees). The inner conductor would, as they say in geometry, "generate" a disc, and the top and bottom of the horn would each "generate" a cone. This would be equivalent to an infinite number of these "horns" or at least such a large number that the central conductors would be close enough together to become a disc. See Fig. 2.

The top half of this antenna merely duplicates the lower half, and can be abandoned, and we have a discone—a horn that presents a mouth in all directions.

Frequency range

The frequency range of the discone is phenomenal. Antenna bandwidth is

often rated in terms of the percentage of center frequency at which response is 3 decibels down. The bandwidth of the discone is so great that its useful frequency range is usually stated in terms of octaves rather than percentages. The smaller (upper) antenna in the photograph is used over the region between 600 and 4000 mc, while the big one works over the enormous frequency range of 12 to 600 mc.

A vertically polarized wave is transmitted (or received best) and the bulk of the signal is radiated almost parallel with the earth at the lower end of each antenna's spectrum, the angle tipping slightly upward as the frequency is raised. For greater flattening of the signal area, two or more discones may be stacked one above the other, compressing the radiation pattern into a thin disc which puts most of the power near the earth's surface where it is needed.

At frequencies near cutoff, the inventor states, we can think of the antenna as a dipole. Of course, since we are dealing with the space between two surfaces instead of a conductor, we will have to think in terms of electric fields instead of currents. As the waves move out from the center of the discone, the electrostatic lines of force extend between disc and cone as in Fig. 3. For any given frequency, there is a point where the wave finds it easy to "take off" into space. Our imaginary dipole,

then, can be taken as a ring around the cone and one around the disc, on which the ends of the electrostatic lines of force rest at the point where they are being radiated out into space. Cutoff comes at the point where the lines extend from the disc to the extreme lower edge of the cone.

Automatic impedance match

Here is where the matching section feature of this antenna comes in. The discone acts not only as a radiator for

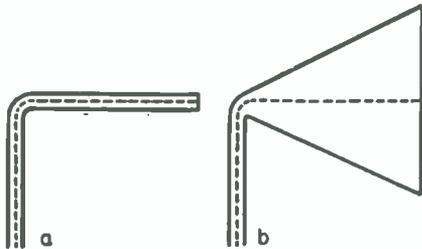


Fig. 1—Evolution of a coaxial horn.

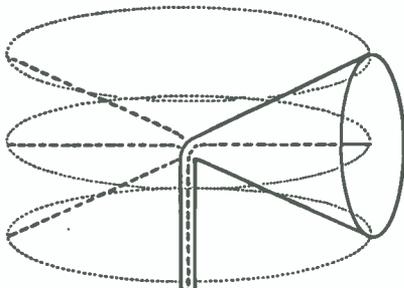


Fig. 2—Discone is derived from horn.

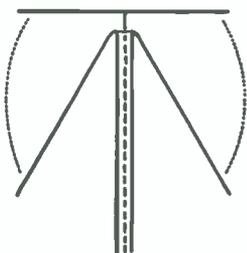


Fig. 3—Electrostatic field on discone.

a given frequency, but as a matching transformer between the transmission line and that point on the antenna at which that frequency finds conditions suitable for transfer between antenna and space.

As a matching transformer, it resembles closely the old delta- or V-match section of the lead-in of a doublet—that section which is fanned out to match line to flat-top. The V-section matches a lower to a higher impedance because of the gradualness with which its impedance increases as it opens. If a 52-ohm line were connected to the terminals of a 300-ohm antenna, waves would be reflected back along the line, and the match would be bad. But if the 52-ohm line opens into a very short section of 53-ohm line, and that into an equally short section of 54-ohm line, and so on out to the 300-ohm points on the antenna, the mismatch at any one point is slight, reflection is minimized, and the match is considered good.

The gradually increasing distance between upper and lower plate of the discone acts as just such a transmission line matching section, increasing gradually in impedance as the space between them increases, down to the point where the wave takes off into space. That again can be considered a matter of matching impedances. At the critical point, the impedance of the antenna for the given frequency is similar to that of space. The impedance just before that (toward the center of the antenna) is lower, and toward the edge is higher. Therefore the wave finds it easier just to depart into space than to stay on the cone.

The critical point moves outward as frequency is lowered, making it necessary to build a bigger antenna for lower frequencies. Kandoian gives the following dimensions for 90 mc (see Fig. 4): A, 9 inches; B, 24 inches; C, 10 inches. For 200 mc, the figures are: A, 4½ inches; B, 12½ inches; and C, 7 inches. Amateurs² have found it safe to consider the cutoff frequency that at which the slant height of the cone (D in Fig. 4) is a quarter wavelength.

The larger antenna in the photograph may not seem to be a true discone. The difference is one of detail. The designers found that by making a cylinder out of the lower part of the cone, they could retain most of the advantages of the conical shape while saving a great deal of the space that would otherwise be occupied by the flaring lower edge.

The discone has not come into as common use as its qualities would seem to justify. Possibly its peculiar and novel

appearance has prevented is more general acceptance. Search through the standard antenna handbooks turns up very little about it, and that little usually buried in the section on ground-plane antennas. Its vertical polariza-

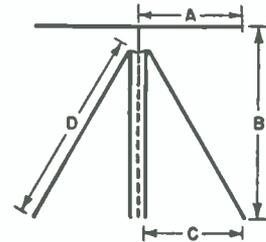


Fig. 4—Discone dimension references.

tion—in the position most convenient for mounting—may keep it out of the television field. Yet it might be the solution to the problem of perfect matching at both high and low frequencies, which might compensate for the difficulties of horizontal mounting. In size, such an antenna could be kept within about 4 feet in height and diameter and it could be built of copper screen on a metal (or insulating) framework, to keep down wind resistance.

The amateurs, as already noted, are beginning to use the discone for v.h.f. and u.h.f. work. As frequencies continue to rise, we may expect to see these antennas more and more often.

¹ Proceedings I.R.E., Waves and Electrons Section, Vol. 1, No. 2, February, 1946.

² Discone—40 to 500 Mc Skywire, Joseph M. Boyer, W6UYH, CQ, July, 1949.

—end—

An Interesting Mixer Circuit

Needing a mixer having special characteristics, we thought of a combination of two cathode followers, tying the cathodes together to deliver the modulated output voltage. The circuit shown was tried and worked nicely at on e. A 6J6 tube was used, but equally good results were obtained with 6SN7-GT and 6F8-G tubes. The scheme is extremely simple and involves no critical parts.

A scope was used to see how this works. The F1 input posts were tied to an oscillator working on 200 kc, and the F2 ones to an audio oscillator. Fig. 1 shows the output wave modulated at 60%; the modulation is rather good.

A radio-frequency choke RFC is required to provide a low impedance path for the audio component. When RFC was omitted, the pattern of Fig. 2 was obtained, showing the audio wave with

superposed r.f. This is no modulated wave. The choke must be chosen in accordance with the r.f. range of the mixer.

Fig. 1

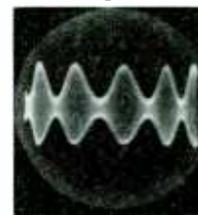
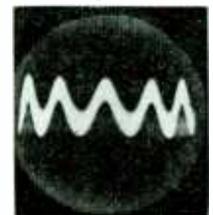


Fig. 2

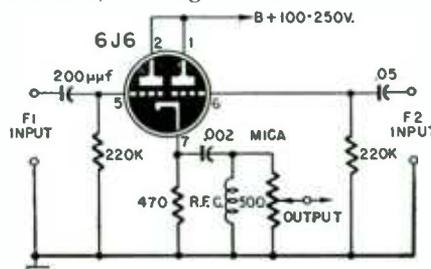


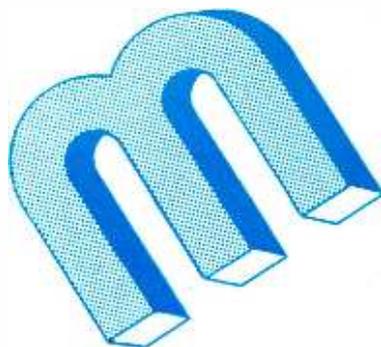
This circuit features several outstanding advantages:

- 1—Very low input capacity. As a cathode follower, the amplification of the tube is less than unity, and there is no Miller effect.
- 2—High input impedance. The grid resistors are of 0.2 to 2 megohms.
- 3—Low output impedance. A good characteristic for signal generators.
- 4—High stability. The B-voltage can vary widely without any change in modulation quality. Resistors and capacitors are in no way critical.
- 5—Economy. Minimum of components.

Alfred Haas

—end—





m a g n e t i c P H E N O M E N O N

Strange action of bismuth in a magnetic field opens up new range of possibilities in future electronic discoveries and applications

By ALVIN B. KAUFMAN

ONE of the most unusual of all magnetic phenomena now open to experimentation is the change of resistance of bismuth wire when placed in magnetic fields of different intensities. This change of resistance is *as high as 100 to 1*.

Bismuth is well known in the laboratory, but because of its limited availability up to now it is not familiar to the average person. The advent of commercially available *ductile* bismuth wire opens up new fields to the experimenter. Last January the Fitzpatrick Electric Supply Company, 444 Irwin St., Muskegon, Mich., offered the market the first ductile bismuth wire and alloys.

Bismuth is a white metal. It is a poor conductor of heat and electricity, approximately 1/80 of copper, and is very diamagnetic in comparison with other metals (*Diamagnetic* means that metal, instead of being attracted to the poles of a magnet, rather is repelled by the magnet. This is opposite in effect to *paramagnetic* material which is attracted to the magnet.—*Editor*). Bismuth is the most diamagnetic metal known, a sphere or bar of it being forcefully repelled by a magnet.

Electrically, bismuth has some fascinating qualities, some highly desirable, some very unsatisfactory. When present in other metals, even in minute quantities, bismuth renders them brittle and decreases their electrical conductivity. Further notable effects are:

- Resistance change with magnetic field (Gauss effect).
- Voltage change due to Hall effect.
- Resistive change with temperature.
- Highest known thermoelectric potentials.

Possibly the effect most interesting to those concerned with electronics is the

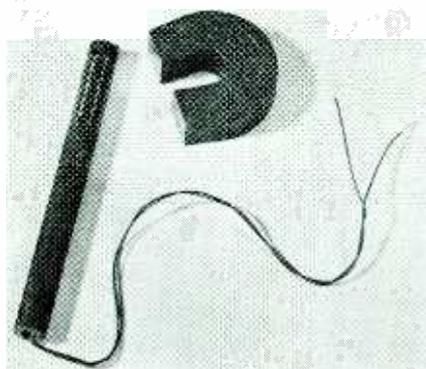


Photo A—The simplest equipment used.



Photo B—Construction of pickup coil.

change of resistance with a magnetic field, see Table I. Bismuth has a change of resistance of approximately 300% at 18° C when subject to a zero to 35,000-gauss field. At -192° C when subject to the same field, the change is close to 9,000%, or about a 100 to 1 change! Table I shows the proportional values of bismuth resistance for magnetic field

values of 0 to 35,000 gauss, and for different temperatures; assuming 100% (or 1 ohm) resistance at 0° C with no field.

The Hall effect, Fig. 1, is the generation of minute output potentials when a flat strip of metal is placed within a magnetic field with its planar surfaces at right angles to the direction of the

Table I

H Gauss	-192° C	-135° C	-37° C	0° C	18° C	60° C	100° C
0	0.40	0.60	0.88	1.00	1.08	1.25	1.42
2,000	1.16	0.87	0.96	1.08	1.11	1.26	1.43
4,000	2.32	1.35	1.10	1.18	1.21	1.31	1.46
6,000	4.00	2.06	1.29	1.30	1.32	1.39	1.51
8,000	5.90	2.88	1.50	1.43	1.42	1.46	1.57
10,000	8.60	3.80	1.72	1.57	1.54	1.54	1.62
12,000	10.8	4.76	1.94	1.71	1.67	1.62	1.67
14,000	12.9	5.82	2.16	1.87	1.80	1.70	1.73
16,000	15.2	6.95	2.38	2.02	1.93	1.79	1.80
18,000	17.5	8.15	2.60	2.18	2.06	1.88	1.87
20,000	19.8	9.50	2.81	2.38	2.20	1.97	1.95
25,000	25.5	13.3	3.50	2.73	2.52	2.22	2.10
30,000	30.7	18.2	4.20	3.17	2.86	2.46	2.28
35,000	35.5	20.35	4.95	3.62	3.25	2.69	2.45

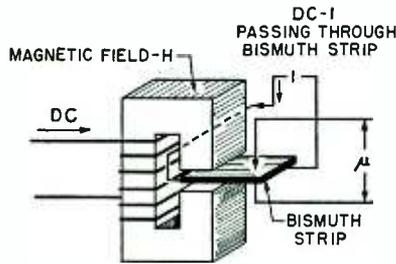


Fig. 1—How Hall effect (generation of voltage at right angles to magnetic field and current) is studied. The Hall effect is extraordinarily strong in this metal.

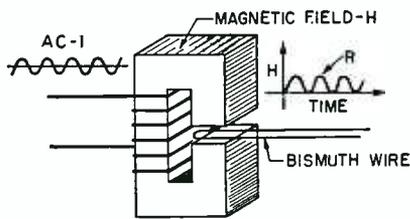


Fig. 2—Idealized illustration, setup to study change in bismuth's resistance as surrounding magnetic field is varied.

field and with a current passed through the length of the strip. The difference of potential μ occurs between the top and bottom surfaces of the strip. Bismuth exhibits this property to an unusual degree, and many physicists have explored the phenomenon. Output microvolts may vary from several microvolts to over 15,000 for a field strength of 4,200 gauss (See Table II). The residual e.m.f. is the potential difference caused by the fact that the pickup fingers which pick up the transverse Hall potential cannot possibly be placed at exactly equipotential spots with regard to the longitudinal current (with present techniques). The net Hall e.m.f. was

obtained by subtracting column 2 from column 3. A longitudinal current of 1.5 amperes was used with a sprayed .012-cm-thick bismuth film for obtaining the above data.

As a resistance material with a high coefficient of thermal electric resistance

TABLE II

HALL EFFECT IN BISMUTH FOR A SINGLE PICKUP

Field Strength Gauss	Residual e.m.f. (μ Volts)	Residual Hall e.m.f. (μ Volts)	Net Hall e.m.f. (μ Volts)
.08	14.0	15.5	1.5
.10	14.2	15.8	1.6
.25	14.0	16.4	2.4
.30	14.5	19.8	5.3
.50	14.6	22.7	8.1
1.00	14.6	20.6	15.0
1,000.	14.0	1,889.0	1,875.0
2,500.	14.0	7,514.0	7,500.0
4,220.	14.0	15,320.0	15,300.0

change Fitzpatrick bismuth wire is excellent, running 720 ohms/mil foot. In this respect, bismuth is the most negative material known for thermocouples, exceeding all others by over 100%, giving 69 microvolts per degree Centigrade change from 0 to 100° C compared with platinum.

The Gauss effect

The Gauss effect is very interesting. Probably the most important characteristic of bismuth wire is its large increase in resistance when placed in a magnetic field (Fig. 2). Between the values of 2,000 and 35,000 gauss, its proportionate response is approximately 214% at 18° C. From 300 to 2,000 gauss, the proportionate response is less though sensitive enough for electrical instrumentation.

The gauss fields indicated in tables, Fig. 3, and in the article to this point,

are much higher than normally available in amateur laboratories. High field strengths are normally found only in close-gap apparatus. A conventional d.c. motor, for example, generally has a 6,000-gauss field, or about 40,000 lines per square inch. Low- to medium-strength fields are not high enough to give more than a fraction of 1% to several percent change in resistance of the bismuth at normal ambient temperatures.

Simple tests

The author, using the equipment shown in Photo A, about three feet of .011 Fitzpatrick bismuth wire wound on a 24-turn pregrooved $\frac{3}{8}$ -inch form and an Alnico horseshoe magnet, could deflect the galvanometer on an impedance bridge. The deflection was not momentary, as will occur due to generator effect with a coil of copper wire, but permanent until the magnet was removed. The galvanometer deflection was slight, but easily visible. With a stronger field (800-2,800 gauss such as produced by a surplus magnetron magnet), the effect is much greater and more readable in terms of resistance change. The change in resistance is easily visible and possible to read when a more sensitive Wheatstone bridge is used.

In all tests employing a galvanometer for indication, the coil was first disconnected and the magnet brought close to it while the galvanometer was observed to be sure that the magnetic field of the magnet was not directly affecting the galvanometer. It was also noted that the thermal effect was much greater than the magnetic effect for a low gauss field. In measuring the change of resistance on a bridge, a change of 0.2% (about .04 ohms, 16-ohm coil) was visibly induced by the horseshoe alnico magnet. This small magnet had about a 200-gauss field. Later a magnetron magnet of 2,800 gauss was used. The same pickup coil with 16.37 ohms ambient resistance increased to 17.20 ohms when placed in this field. This was an increase of 5½%. Putting the fingers on the coil resulted in a thermal resistive change of possibly several times this magnitude.

Measuring errors

It is preferable then, in design, to obtain a strong enough field to reduce any thermal change to a small percentage of the gauss resistive change. Otherwise it is necessary to introduce a thermal compensating coil in series or parallel with the bismuth coil to prevent thermal effects from introducing errors.

It must also be noted that the wire changes electrical resistance with the passage of current due to the resultant thermal I^2R heating. If the current is held to a low value, this effect may be negligible. For higher currents, but below the fusing value, the wire may change its resistance by approximately 50% as indicated in Table III. The .011 wire used for these preliminary experi-

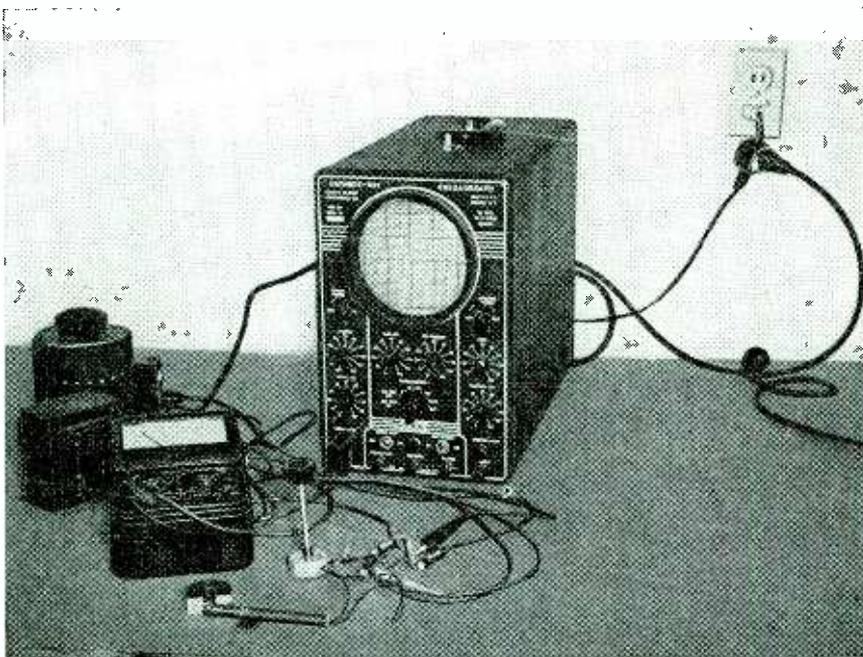


Photo C—Equipment of Fig. 4, used to detect effect of magnetism on resistance.

ments ran warm at 1/2 ampere, and fused at 1 1/2 amperes.

TABLE III

Current (Amperes)	Resistance (Ohms)
0	24.0
.4	25.5
.45	25.75
.5	26
.6	30
.7	32
.8	35

Consideration must be taken when making bridge measurements not to exceed these currents and to allow the bridge to stabilize until the thermal conditions in the coil are completely equalized before making any gauss measurements.

Care in handling

In handling the wire, do not make sharp bends or flex the wire. The wire is not as ductile as copper; it will break after a few bends. After the pickup coil is made, cement the wires in place and connect the bismuth wires to light-gauge, flexible, extension leads (see Photo B). The melting point of bismuth is 520° F, so conventional solder cannot be used. Instead, a low-temperature-melting alloy must be used. The author used Cero-bend, but Woods metal or others of the same class are applicable.

The joint between the bismuth wire and the tinned-copper wire strictly speaking is not a soldered joint, as the Cero-bend does not bond to the copper wire. These low-temperature joints are mechanical. If a soldering iron is used to melt the low-temperature alloy, allow the melted metal to cool before use or its higher-than-500° temperature will cause the bismuth wire to melt. The joint in any case will look dirty and like a very poor cold solder connection.

Noting field intensities

With the fine bare bismuth wire wound into a flat coil or on a rod to form a prod, it may be used directly with a high-sensitivity Wheatstone bridge for exploring the intensity of magnetic fields in many types of magnetically operated apparatus. Coated bismuth wire also may be obtained, and with

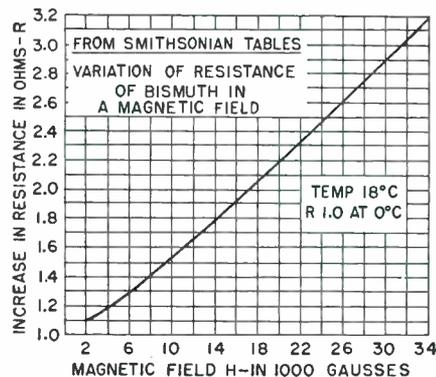


Fig. 3—Gauss effect in strong fields.

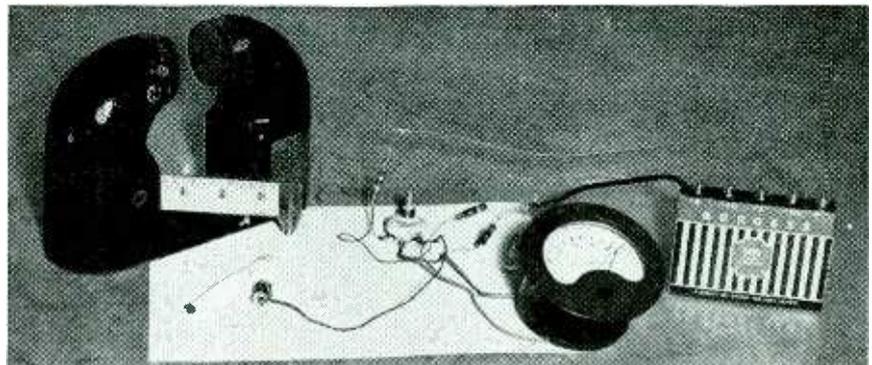


Photo D—This simplified setup follows Fig. 5, with a meter instead of 'scope.

this it is comparatively easy to wind any type of coil. A typical coil wound by the author had an ambient resistance of 60 ohms which increased to 63 ohms when subjected to a 2,800-gauss field from a surplus magnet.

Since the coil resistance will increase directly in proportion to the intensity of the field beginning with about 2,000 gauss (under that the resistance changes are low and not linear), the use of this measurement method apparently is limited to high-intensity fields. Where high-intensity fields are available, the measurement need not be limited to a Wheatstone bridge. The change of resistance may be used to operate electronic control equipment. Slight changes of this high-intensity field by ferrous materials on a person or in material might well be detectable by this means.

Sample experiments

For low-intensity fields where the maximum resistance change might be 0.2%, (in strain gauges, typical carrier or phase sensitive amplifiers) designers might make use of bismuth's peculiar properties. A scope indication of the unbalanced bridge carrier output is shown in Photo C. Here (see Fig. 4 for the schematic) 60-cycle a.c. is fed into a Wheatstone bridge, and the unbalanced output is connected to a 5-inch oscilloscope. After potential is applied to the bridge for several minutes and the four legs resistively thermal-stabilized, the bridge is balanced. The oscilloscope amplifier used supplied enough gain to secure a change in the sine wave amplitude when the bridge balance was upset by placing a 200-gauss magnet next to the bismuth pickup coil. For a.c., the coil must be noninductively wound. A bifilar winding with opposing bucking fields is constructed.

The experimental setup shown in Fig. 5 and Photo D is the simplest circuit for the experimenter to construct. A 50-ohm coil is wound, using coated bismuth wire, and hooked into a bridge circuit as shown. It has extremely high sensitivity, giving as much as half-scale deflection using a surplus magnetron magnet. This circuit is adaptable to measuring and comparing the field strengths of

ion traps and probably to many other similar uses.

The bismuth probe is small, about 1/4 inch by 1/2 inch. The coated wire must be handled carefully the same as the bare wire. The insulating coating is easily removable with the use of acetone.

It must be noted that although an analyzer, as the Simpson 260, may be used for the bridge meter, its much higher internal resistance, even if it is used on the 100-microampere scale, will cause the bridge to be comparatively insensitive.

A bridge supply voltage of 7 1/2 volts is optimum when measuring high-intensity fields. For low-intensity PM speaker field measurements, etc., the bridge sensitivity may be increased threefold by raising the bridge voltage to 22 1/2 volts. The bridge supply voltage directly regulates its sensitivity—the higher the supply the greater the sensitivity. The maximum supply is limited by the heating in the bridge arms. With the bismuth wire used, 45 volts input should not be exceeded; higher level causes high thermal temperatures to develop in the coil.

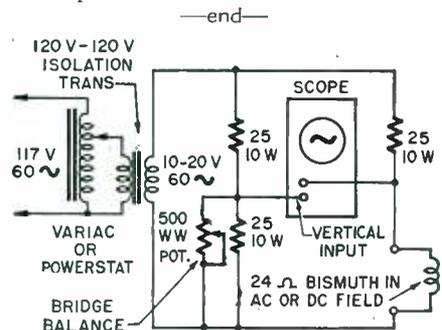
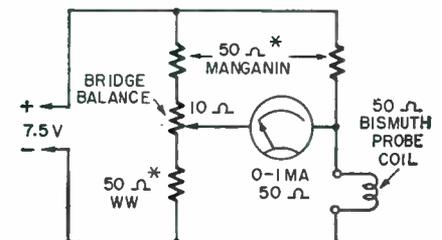


Fig. 4—Experimental setup with 'scope.



* MAY BE 0.5 WATT IRC FOR TEST PURPOSES
Fig. 5—Simplest experimental hookup.

IONOPHONE



The inventor, S. Klein, demonstrates his new and revolutionary loudspeaker.

By E. AISBERG* and M. BONHOMME**

Long the dream of engineers, the inertialess loudspeaker is now reality. It produces sound from electric current with ionized air molecules

JULY 27, 1951 will remain a red-letter day in the memory of two authors of this article. On that day they heard for the first time sounds from a loudspeaker that did *not have a single mechanical part in movement* and was designed on an absolutely new principle.

The device is the fruit of years of patient research by S. Klein, a young French physicist, who for years struggled over the problem of producing sounds

*Publisher of *Toute La Radio*
**Chief Editor of *Toute La Radio*

loud enough to raise his invention above the category of a mere scientific toy. He has succeeded, and at present the biggest French manufacturer of loudspeakers is tooling up for mass production of Ionophones, as the new speakers are called.

Yesterday's dreams make tomorrow's inventions. Electronicians always dislike to use moving parts, and nowhere more than in loudspeakers, where they result in an efficiency of less than 5 per cent and in imperfect fidelity. Why should

radio receivers be required to pass the audio frequency currents which have been carefully protected against distortion through a part which—by its very nature—cannot but distort the sounds it engenders?

The best diaphragm has its natural vibration period and enough weight to be a factor, without possessing that ideal rigidity which forms the piston described in manuals on acoustics. In spite of setting the resonant points beyond the limits of the frequencies being reproduced, all diaphragms cause linear and nonlinear distortion, not to mention bad reproduction of transient phenomena.

Inventors have long tried to get rid of the unfortunate diaphragm. One of the earliest attempts was probably Edison's Thermophone. Duddell's singing arc and the talking flame also might be mentioned. Hugo Gernsback, whose ideas seem so fanciful but whose predictions usually come true, called for a speaker without moving parts¹ ten years ago.

¹*Molecular music* is another subject which as yet has not been exploited at all. Years ago, it was discovered that it is possible to make dynamos sing or talk by merely vibrating the dynamo's molecules. In this case, nothing moves. There are no diaphragms, no loudspeakers, but the entire iron frame of the machine gives forth sounds, speech, or music.

I can visualize, therefore, a future all-steel auditorium giving forth super-music by energizing the entire auditorium in such a manner that the walls, ceiling, and floor will have their molecules vibrated. Entirely new effects undreamed of today will thus be obtained.

(From an editorial in *Radio-Craft*, April, 1941.)



Closeup view of the ionization unit. The opening is down, in the aluminum collar.

RADIO-ELECTRONICS for

This new loudspeaker comes very close to being the fulfillment of that prediction. It is based on the phenomenon of *ionization*. By raising the temperature of certain bodies they can be made to emit ions. Under the influence of intense thermal agitation, not only are electrons torn off but also some molecules, which because of the fact that they have lost electrons, become ionized *positively*. The action becomes complicated because the electrons meet air molecules and tear off further electrons. We therefore have a complex mixture of ions from the emitting substance and ionized molecules from the gases of which the air is composed.

Creation of the Ionophone

The first model was made several years ago. It can be compared to a diode operating in free air. An indirectly heated "cathode" emitted positive ions toward a "plate" which was maintained at a high negative potential. When an alternating audio-frequency voltage was impressed on the direct voltage between the two electrodes, the number of ions in circulation would vary according to the rhythm of the alternating voltage and determine the corresponding movement of the air molecules, which were propagated in the form of sound waves at the audio frequency.

A better model was designed in the form of a triode where the alternating voltage was applied to a sort of cylindrical grid between the emitter and the outer cylindrical shield (Fig. 1).

The sound generated by both these was very weak and the high-voltage d.c. heating required a power in the

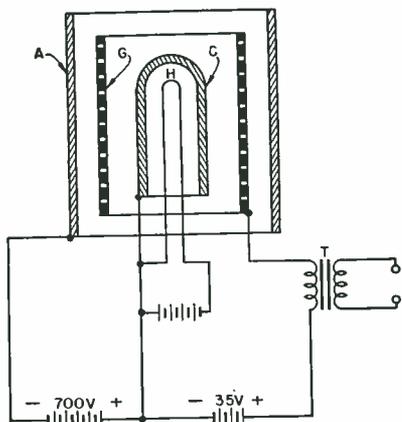


Fig. 1—The developmental model, with heater H, "cathode" C, grid G, and outer shield A at a high negative voltage.

order of 500 watts. A decisive step forward was made when Klein gave up the indirectly heated cathode and conceived the idea of a self-heating one. That idea was developed in the form of a cylinder of quartz into which a platinum wire was sealed along its axis. The cylinder was then coated with an ion-emitting substance, composed as follows:

- Precipitated platinum 50%
- Aluminum phosphate 40%
- Graphite 5%
- Precipitated iridium 5%

In this formula, the platinum (which is the principal source of ions) reaches a state of extremely fine division, which favors both the emission of ions and the renewal of the emitting surface.

This tube is sealed to the lower end of a short exponential horn (likewise of quartz) which has a double wall inside of which a high vacuum is maintained. The assembly is then placed inside a cylindrical shield, the bottom of which is steatite, so that the emitter is held in place. The mouth of the small quartz horn connects with a large exponential horn of the type ordinarily used for compressed-air public address loudspeakers.

How it operates

A high-frequency (about 400 kc) and high-voltage (10,000 to 12,000) field is set up between the outside cylindrical shielding and the platinum wire which

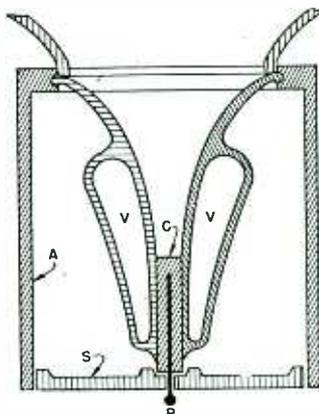


Fig. 2—Idealized cross-section of the speaker. P is the platinum wire, C the quartz cylinder, V the vacuum space in the horn walls and A the outer shield.

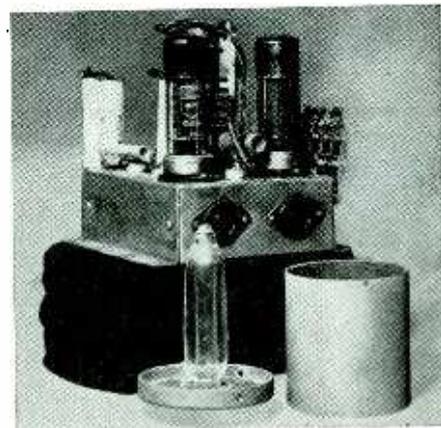
is the axis of the emitter. Through the action of dielectric losses, the quartz surrounding the platinum wire reaches a temperature of 1,000 degrees within one or two minutes.

The strong field which is established between the platinum wire and the cylindrical shielding produces emissions which also produce heat in leaving the emitter, thereby assisting to maintain a high temperature. The heat is concentrated because the vacuum chamber of the evacuated quartz horn prevents its spread by conduction. Secondly, the vacuum of this enclosure prevents the passage of electrical charges through the material.

Because of the concentrated effect of heat and the electrical discharge rich in ultraviolet radiation, the emitter releases a flow of ions. The high temperature in the neighborhood rarefies the air; consequently, the molecules are far enough apart to enable the ions leaving the cathode to follow a free course longer than they could in dense, cold air. It is nonetheless true that some air molecules are ionized by collision with ions and electrons coming from the emitter.

In short, we have before us a kind of capacitor whose plates are the coated

emitter with its central platinum wire and the exterior shield. Between these plates there is a cloud of ionized particles, which are in a state of agitation because they are in an alternating field which acts on all bodies, whether posi-



The speaker unit with its r.f. exciter.

tively or negatively charged.

If we change the strength of the alternating electric field, we also alter the amplitude of the individual oscillations of each of these bodies. Now, *molecular movement* and *heat* are two words to describe the same phenomenon. Therefore, by varying the strength of the electric field, we can obtain corresponding instantaneous variations of temperature.

Nothing is easier to the radioman than to vary the strength of a high-frequency field at a low-frequency rate. The inventor of the Ionophone simply modulated his high-frequency field at audio frequencies. The temperature in the vicinity of the emitter was varied in proportion to the low frequency. This takes us back to Edison's original Thermophone, with the exception that where Edison's heated wire was limited to the lower audio frequencies, the Ionophone reproduces with equal exactitude all frequencies within the audio range. (The old Thermophone produced sound by expansion and contraction of the air surrounding a heated wire, which of course had considerable thermal lag.)

Each variation in temperature produces an expansion of air, followed by a contraction, thereby producing a sound wave. These sound waves spread along the length of the exponential horn without friction and manifest their presence by sounds of the strength, form, and frequency desired.

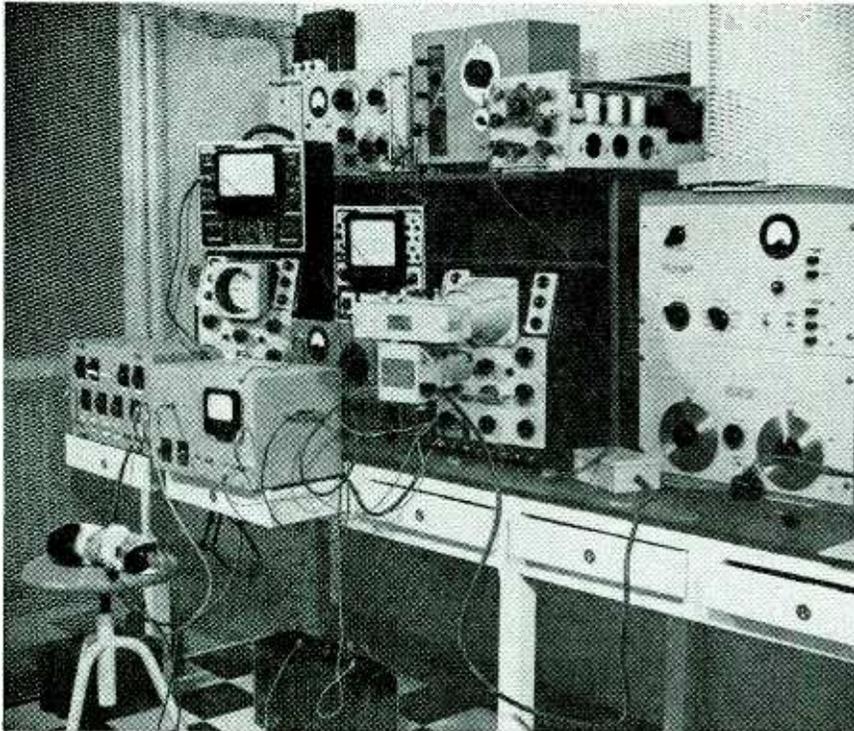
Space does not permit details of the rather special circuits used for the operation of this unconventional loudspeaker, except to point out that while it can be used with present types of radios, it also opens up the possibility of having radio receivers without either audio amplification or detection—the intermediate frequency of the receiver being sufficient to operate the loud speaker.

All these points will be covered in a succeeding article.

—end—

ULTRASONICS AND THERAPY

Medical application of ultrasonics—both in diagnosis and for treatment—has made great strides, especially in Europe, as this article testifies.



Part of the laboratories at the Institut Medical Bunge. Guinea pig, left, is wired up for simultaneous notation of myograms, electro-encephalograms, and cardiograms.

By DR. F. VAN DEN BOSCH*

ULTRASONIC waves are sound waves generated beyond the upper limit of human hearing. They are not electromagnetic waves like radio waves. Generation of heat in tissues by using them is fundamentally different from dielectric heating, for instance. Sound waves are a special kind of elastic wave. They travel in media which have two properties: inertia and elasticity. Sound waves in air are longitudinal waves; they consist of condensations and rarefactions of the air.

The characteristic field terms are pressure, P , and particle velocity V . This gives rise to a kind of Ohms law of acoustics: $\frac{P}{V} = Z$.

Z is (in the case of plane waves) the characteristic impedance of the material and is equal to DV° where D is the density and V° the propagation velocity. Z is a constant of the medium. By

*Chief of Physical and Electronic Laboratories, Institut Medical Bunge, Berchem-Antwerp, Belgium.

measuring the pressure in dynes per square centimeter and the velocity in centimeters per second, Z would have one value for air and another for liquids. The units used are sometimes referred to as "acoustical ohms."

In the study of transmission of acoustic and ultrasonic energy, the characteristic impedances of the material or medium used is important. Reflection of sound waves is a function of reflecting surface and wavelength. When ultrasonic energy is transmitted through two materials the influx of energy into the second medium will be smaller by the amount that reflection is greater in the first medium.

Comparing mechanical energy to analogous electrical circuitry, mass resistance in the mechanical system is analogous to an inductance. Ultrasonic sound energy can be measured by the sound radiation pressure, for which Lord Rayleigh calculated the formula $P = 1/2RD$; D represents energy density, P the measured radiation pressure, and R the ratio of the specific heat constants (the effective value of

specific heat depends on frequency).

Ultrasonic waves are sound waves. They are thus absorbed as well as reflected. Absorption depends upon the medium the wave travels in, and attenuation can run in the order of several decibels per meter wavelength. In CO_2 , for instance, this value sometimes reaches 300 db per meter, which is extremely large.

Transducer types

Electrical energy is changed into ultrasonic energy by means of transducers. These act as matching devices and permit maximum transfer of energy to the medium, in addition to acting as a converter of one type of energy into another. There are two types of transducers, *magnetostriction* and *piezo-electric*.

Magnetostriction transducers utilize the principle that a rod of iron or other magnetic material undergoes a change of length when magnetized.

Piezo-electricity is based on the fact that if a slice is cut from a quartz crystal and pressures applied on the opposite faces of the slice, then these faces will develop equal and opposite electrical charges. This effect is also reversible: by placing the quartz in an electric field elastic deformations are developed in it. If the field is an alternating one of frequency f , the quartz will be subject to f oscillations along its electric axis.

This principle is used in generating ultrasonic waves. A crystal which will resonate at a desired frequency is chosen. One face of the crystal is fixed, and the other side, S , left free to vibrate when acted on by the electric field. If this face S is in contact with air, water, oil, or any other fluid, waves will be generated in the fluid.

The natural frequency of vibration of the crystal is determined by its dimension parallel to the direction of vibration. Using quartz, frequencies of 5×10^7 c.p.s. may be attained, but if this is the fundamental frequency the plate is only .055 millimeters thick and very fragile. Higher frequencies are attainable by using partial tones or harmonics, and this has the further advantage that a number of different frequencies may be obtained from the same plate although the intensity is less. If the surface of the crystal plate is large compared with the thickness, the partial tones are very nearly harmonic.

The photos on page 48 show different practical forms of quartz transducers. The quartz transducer is in every case the same, the only difference being the special mounting on top of the quartz for specialized applications. Generally speaking, quartz transducers are water-cooled when they have to dissipate a

RADIO-ELECTRONICS for



**I Send You
18 BIG
KITS
OF RADIO-
TELEVISION
EQUIPMENT**

NOW-Be a Fully Trained, Qualified RADIO TELEVISION TECHNICIAN IN JUST **10 MONTHS OR LESS!**

**New "Package" Unit Training Plan
PAY AS YOU LEARN-YOU SET THE PACE!**

**No Monthly Payment Contract
to Sign!**

Now . . . be ready for Radio-Television's big pay opportunities in a few short MONTHS! Frank L. Sprayberry's completely new "Package" training unit plan prepares you in just 10 MONTHS . . . or even less! Equally important, there is NO monthly payment contract to sign . . . thus NO RISK to you! This is America's finest, most complete, practical training—gets you ready to handle any practical job in the booming Radio-Television industry. In just 10 months you may start your own profitable Radio-Television shop . . . or accept a good paying job in this fascinating expanding field at work you've always wanted to do. Mr. Sprayberry has trained hundreds of successful Radio-Television technicians—and stands ready to train you in less than one year, even if you have no previous experience. You learn by DOING . . . actually working with your hands with equipment of special design to illustrate basic theory instead of relying on books alone.

VALUABLE EQUIPMENT INCLUDED WITH TRAINING

The new Sprayberry "package" plan includes many big kits of genuine, professional Radio-Television equipment. While training you actually perform over 300 demonstrations, experiments and construction projects. In addition, you build a powerful 6-tube standard and short wave radio set, a multi-range test meter, a signal generator, signal tracer, many other projects. All equipment is yours to keep . . . you have practically everything you need to set up your own service shop. The interesting Sprayberry book-bound lessons and other training materials . . . all are yours to keep.

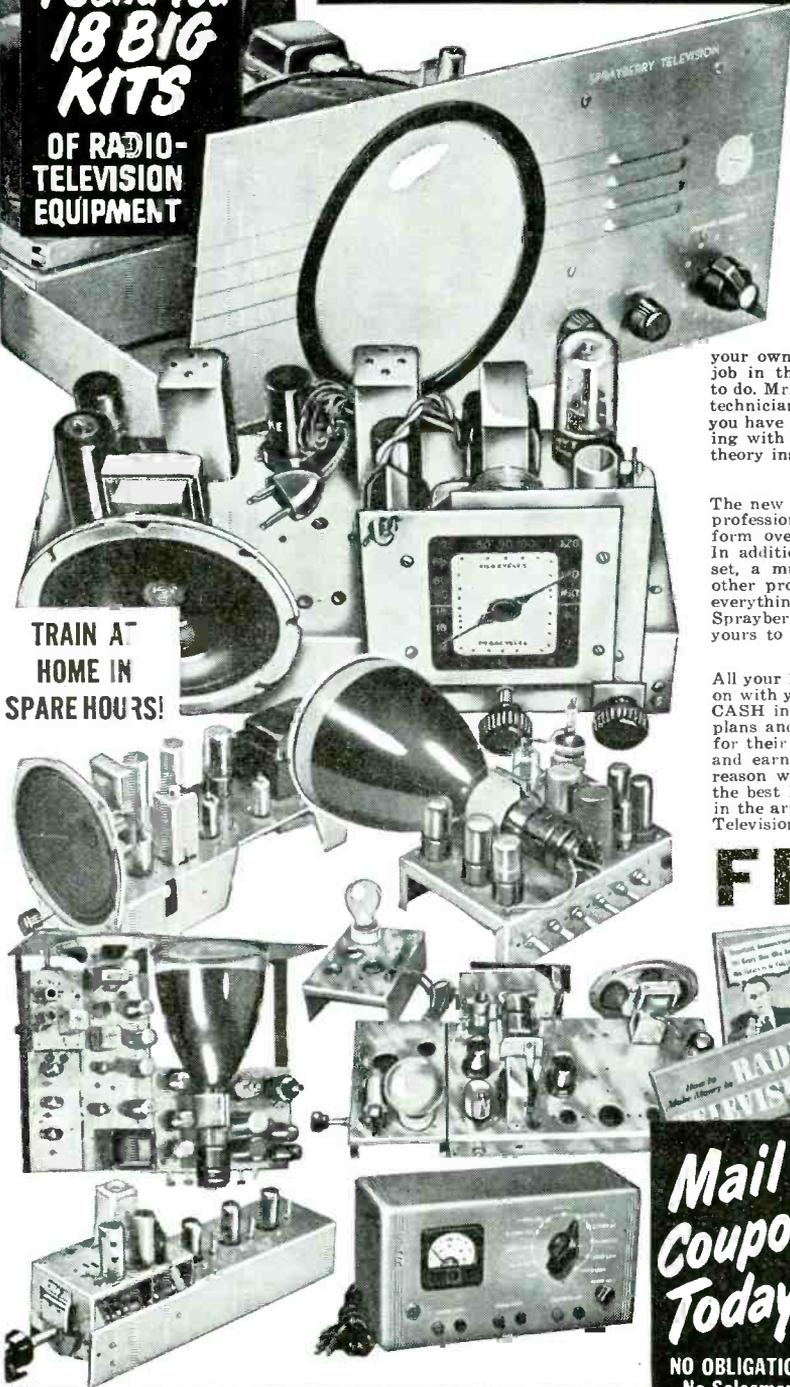
EARN EXTRA MONEY WHILE YOU LEARN!

All your 10 months of training is AT YOUR HOME in spare hours. Keep on with your present job and income while learning . . . and earn EXTRA CASH in addition. With each training "package" unit, you receive extra plans and ideas for spare time Radio-Television jobs. Many students pay for their entire training this way. You get priceless practical experience and earn generous service fees from grateful customers. Just one more reason why the Sprayberry new 10 MONTH-OR-LESS training plan is the best Radio-Television training in America today. If you expect to be in the armed forces later, there is no better preparation than good Radio-Television training.

FREE 3 BIG RADIO-TELEVISION BOOKS

I want you to have ALL the facts about my new 10-MONTH Radio-Television Training—without cost! Act now! Rush the coupon for my three big Radio-Television books: "How to Make Money in Radio-Television," PLUS my new illustrated Television Bulletin PLUS an actual sample Sprayberry Lesson—all FREE with my compliments. No obligation and no salesman will call on you. Send the coupon in an envelope or paste on back of post card. I will rush all three books at once!

**TRAIN AT
HOME IN
SPARE HOURS!**



**IF YOU ARE
EXPERIENCED IN RADIO**

Men already in Radio who seek a short intensive 100% TELEVISION Training with FULL EQUIPMENT INCLUDED are invited to check and mail the coupon at the right.

**Mail
Coupon
Today!**
NO OBLIGATION
No Salesman
Will Call

**SPRAYBERRY ACADEMY OF RADIO, Dept. 20-C
111 North Canal St., Chicago 6, Ill.**

Please rush to me all information on your 10-MONTH Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me.

Name.....Age.....

Address.....

City.....Zone.....State.....

Please check Below About Your Experience

Are You Experienced? No Experience

certain amount of power and are hermetically sealed so that they may be used to treat cases under water or in immersion baths. If they use transducers in liquids, operators must take precautions to protect their hands from the ultrasonic vibrations of the liquid. Specially adapted thick rubber gloves are often used.

Ultrasonic generator

The oscillators which drive the transducers are generally of relatively low power compared to other industrial high-frequency generators. They range from the 50-watt type to about 1 kw (output power). The circuit shown is simple to build, efficient in operation, and has the advantage of being self-rectifying, thus giving a pulse type of power which presents an advantage in ultrasonic therapy.

The frequency is determined by the tank circuit: the transducer parallels C1, the main tank capacitor. It may be difficult to get stability of the oscillator as such. In this event, adjust the decoupling capacitor C2 between grids and cathodes. Coil RFC 1 is made by winding 16 turns of No. 22 gauge wire on a coil form 1½ inches in diameter and 2 inches long. RFC 2 is 14 turns of No. 12 wire on same size coil form. The rest of the circuit is self-explanatory.

Ultrasonic uses

Among the reported chemical effects of ultrasonic vibration are: The transformation of immiscible liquids such as water and oil into homogeneous, stable emulsions; the dispersion of metals during the process of electrolysis by bombarding the anode with ultrasonic

waves; the disintegration of polymerized molecules and acceleration of peptization (convert into colloidal solutions and sols). In contrast to the *dispersive* effect which the waves produce in the case of liquids or hydrosols is the *coagulative* effect which they produce in the case of aerosols (suspensions in gases). Smoke is quickly coagulated into larger particles. These cannot remain in suspension and drop out of the air.

Biological effects

The biological actions of ultrasonic radiation are sometimes astonishing, witness the rupture of small organisms such as protozoa, the tearing-off of the gills of Triturus larvae, the complete disintegration of Arbaciae eggs, and the killing of fish and frogs. Tobacco-mosaic virus can be inactivated and the virulence of certain bacteria diminished. These effects seem to be due to the immense pressure changes which accompany the radiations.

In medical diagnostics ultrasonics undoubtedly will present certain undeniable advantages. For example where ordinary means fail, using ultrasonics it is easy to detect an empty or full organ, such as the projection of the heart, spleen, liver, bladder, kidneys, and the stomach.

By its nature ultrasonics allows the differentiation between a normal and abnormal organ. An enlarged liver can be diagnosed as being an ordinary enlargement—or a tumor, for the tumor will present a different coefficient of absorption than the liver itself. Ultrasonics is probably most useful in this type of field since the basis of medical therapy is correct diagnosis.

Solid objects such as gallstones can

be detected by ultrasonics based upon pure reflection phenomena. Kidney and bladder stones are easily detectable, for their size is usually greater than gallstones. Abnormal bone structures can also thus be mapped where the patient's sensitivity to X-ray radiation makes radiography impossible or inadvisable.

Medical therapy

Medical ultrasonic therapy has been extensively used in recent years. Ultrasonic therapy is as yet in its infancy, as the application is varied and results are sometimes contested. Medical practitioners should start ultrasonic therapy with small power so as to avoid injury. To avoid injury to the patient, it is generally accepted that the threshold of pain indicates a maximum limit of power dosage. This should never be exceeded. For deep therapy it is advisable to use the fundamental wavelength, while harmonics are more useful for surface treatment. Since attenuation in tissues is rather large, intensity should be proportional to the depth which it is desired to attain, while the time will be a function of the area to be treated.

Here are some successful cases using ultrasonic therapy which have been reported, mainly in Germany and France. G. Barth and F. Wachsmann (Medical University Clinic Erlangen) have published in *Strahlentherapie* 78 (1948) some of their results which follow:

Neuralgia: Patients were neglected cases. No results had been obtained through other methods. Good results were obtained especially with sciatica, with a decrease in the pain noted.

Myalgia: After one to three treatments, pain subsides.

Arthritis: Arthritis, especially of articulations, reacts favorably with ultrasonics.

Infections: Abscess and maxilar empyema generally respond well to ultrasonic treatment.

Prostates: Relief of individual pain.

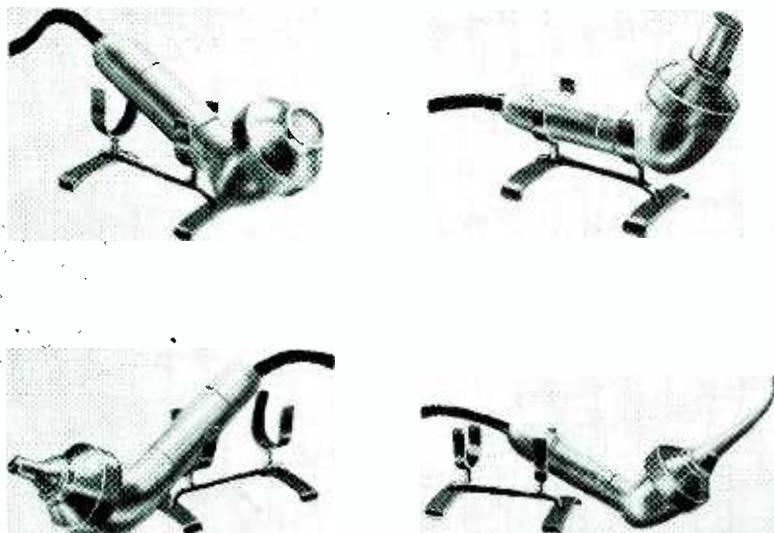
Carriers of Diphtheria microbe: Among 21 cases treated, only two did not react; it was not possible to eject the microbes *in vitro* even with large intensities.

Malignant tumors: In the cases of small tumors these have disappeared, while in some cases they disappeared to re-form again later on. The authors cannot recommend the use of ultrasonics as a therapy, but they seem of the opinion that results justify further investigation and research.

These results are confirmed by the Röntgenabteilung der Chirurgisches Universitätsklinik Würzburg.

Ulcer therapy

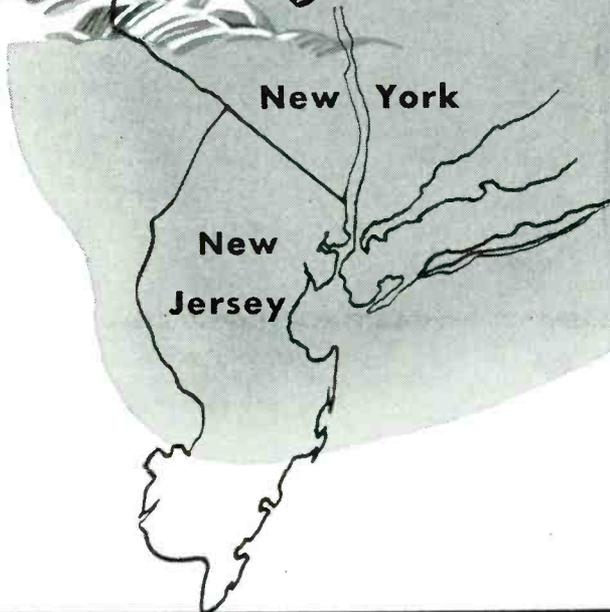
A. Stoltz of the Strahlenabteilung des Medische Klinik, Giessen (*Strahlentherapie* 79-1949;4:641) has experimented with ultrasonic therapy on gastric and duodenal ulcers. 93 persons, sufferers from ulcers (47 ulc. ventr. and 45 ulc. duod.) have been treated. Without special diet or medical therapy, 89 cases felt total relief, after the sixth treat-



Four quartz transducer ultrasonic applicators. The vibrating quartz units in these are identical; their difference is due to the specialized mounts, which make them convenient to apply to different parts of the human body.

A Guiding Beacon For
Quality Electronic Parts

Your Local
RADIART
Distributor



BUY OF THE MONTH

When you buy a RADIART YAGI antenna you KNOW it covers the entire 6 megacycle band width in the specific channel for which it was designed! It assures balanced performance on both audio and video signals . . . and is the perfect answer to the need for maximum signal pickup in "fringe" areas. May be used singly or double stacked . . . pre-assembled fold-out design for fast installations.

**These Are The Cities With RADIART Distributors in New York And New Jersey
Served by BLAIR-STEINBERG CO. New York City**

State of New York

- | | | |
|---------------------|-------------------|------------------|
| BRONX | FLUSHING | MOUNT VERNON |
| BROOKLYN | HEMPSTEAD | NEW YORK CITY |
| CROTON-ON-HUDSON | HICKSVILLE, L. I. | PATCHOGUE, L. I. |
| DONGAN HILLS, S. I. | JAMAICA | POUGHKEEPSIE |
| DOUGLASTON | LONG ISLAND CITY | ROSEBANK, S. I. |
| | | WHITE PLAINS |

State of New Jersey

- | | | |
|-------------|---------------|-------------|
| BLOOMFIELD | HOBOKEN | PASSAIC |
| COLUMBIA | JERSEY CITY | PERTH AMBOY |
| CLIFTON | KENILWORTH | RED BANK |
| EAST ORANGE | NEWARK | TRENTON |
| HACKENSACK | NEW BRUNSWICK | |

FOR NAME OF YOUR NEAREST RADIART DISTRIBUTOR
USE COUPON BELOW

BLAIR-STEINBERG CO. 395 Broadway, New York 13, N.Y.

.....Please send names of the Radiart Distributors in my area stocking the following Radiart products in which I am interested: Tele-Rotors, Vibrators, TV and FM Antennas, "Spee-Dee" Chimney Mounts, Lightning Arresters, Auto Aerials, Power Supplies

.....Please have a Radiart Distributor call on me.

Name.....

Address.....

City..... State.....



THE RADIART CORPORATION CLEVELAND 2, OHIO

VIBRATORS • AUTO AERIALS • TV ANTENNAS • ROTATORS • POWER SUPPLIES

IT'S AUTO-RADIO TIME

Yes sir, summer and fall are auto-radio time. Thousands of auto-radio sets to be repaired. Millions to be kept perking. And fast . . . for car owners are impatient folks.



**Aerovox
Vibrator
Buffer
Capacitors,
Type VBC,**
are especially
designed for
vibrator buffer
applications as
well as coupling
and many other
circuits where high-quality
tubulars are required.

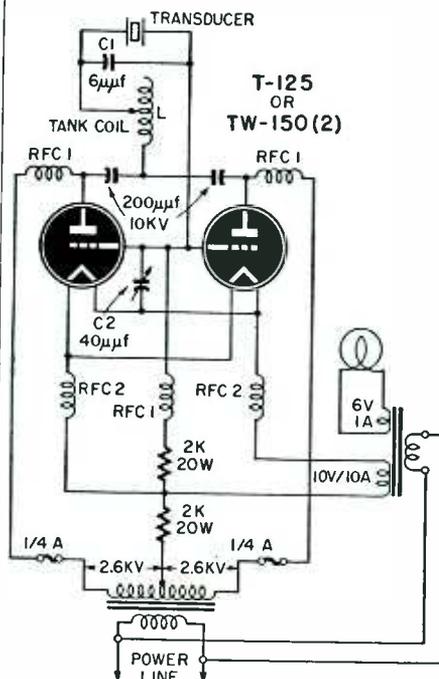
Your local Aerovox jobber carries a complete line of VBC capacitors plus a wide assortment of auto-radio suppressors and filters especially constructed to withstand the high temperatures encountered in auto-radio operation. Your local Aerovox jobber can fill ALL your auto-radio capacitor needs.



**FOR RADIO-ELECTRONIC
INDUSTRIAL APPLICATIONS**

AEROVOX CORPORATION
NEW BEDFORD, MASS., U. S. A.
Export: 41 E. 42nd St., New York, N. Y.
Cable Address: AEROCAP, N. Y.
In Canada: AEROVOX CANADA LTD.
Hamilton, Ont.

ment. Weight increased and in all cases the ulcers were cured by the end of the treatment. Frequent examinations failed to find hemorrhages as a result of the treatment. Only in 4 cases was a recurrence noted, and there the failures have been explained by other causes.



The schematic of the oscillator used to generate energy for the transducer unit.

Treatment technique: The region marked by X-ray examination was treated with vaseline (to insure good contact) and a vigorous ultrasonic massage was given, each treatment lasting 10 minutes. The first six treatments were given daily, then six treatments every 2 or 3 days, finally 3 to 8 weekly treatments after the disappearance of the symptoms. During and before treatment patients had to drink $\frac{3}{4}$ to 1 liter hot camomile tea.

These results have been further confirmed by other workers such as Ebert of the *Innere abteilung Stadtkrankenhaus Wolfsburg*.

Asthma therapy

Other interesting results are the cases reported by P. Anstett of Lyon, France (*Lyon Medical*, 1948).

The report deals with sixty cases of asthma treated with ultrasonics, 29 cases without complication (25 cases with bronchitis and emphysema have also reacted favorably); 39 cases were completely cured (observed during 10 months); 13 cases improved to a point of being negligible; 1 case slightly improved; and 1 case resisted treatment. The impression is gained that only the spasmodical fraction is influenced and not the inflammatory fraction. However, this has been improved sometimes with the injection of autovaccin.

Treatment technique: 10 minutes every day, 12 treatments in all, both sides of the sternum at the height of the ganglion stellatum. This treatment used the highest possible and bearable

ultrasonic intensity. The effect is immediate as in the case of adrenaline injection. The only complication sometimes is dizziness.

These results have been confirmed by A. Denier and H. Desgrez, and in Germany by W. Bunse and R. Muller of the Poloclinique Medicale Wirzburg.

Conclusions from results

After looking at all the published data on ultrasonic therapy one has to come to the conclusion that efficient and lasting results are obtained only when full advantage is taken of the peculiar characteristics ultrasonics possess. For example, the cases of ulcers treated use the dispersional properties of ultrasonics to effect the cure. The same can be said for asthmatical treatment. Experiments on animals have borne out that ultrasonic therapy will be most beneficial and meet real success if therapists will base their treatments on the fundamental properties of ultrasonic energy, and if when starting, they always use the smallest possible intensities.

On the other hand there seems to be an unlimited field of application in diagnostics. Ultimately ultrasonics will contribute to what is bound to come one day. Complete and rational electronic diagnosis, wherein the site of every ailment will be correctly located and the ailment evaluated by appropriate electronic apparatus. This kind of qualitative and quantitative analysis will give a faultless and unmistakable diagnosis. From the pure physical and electronic angle there is not the slightest reason why this could not be achieved even today. It can be achieved fastest by the fullest co-operation among members of the medical profession.

—end—

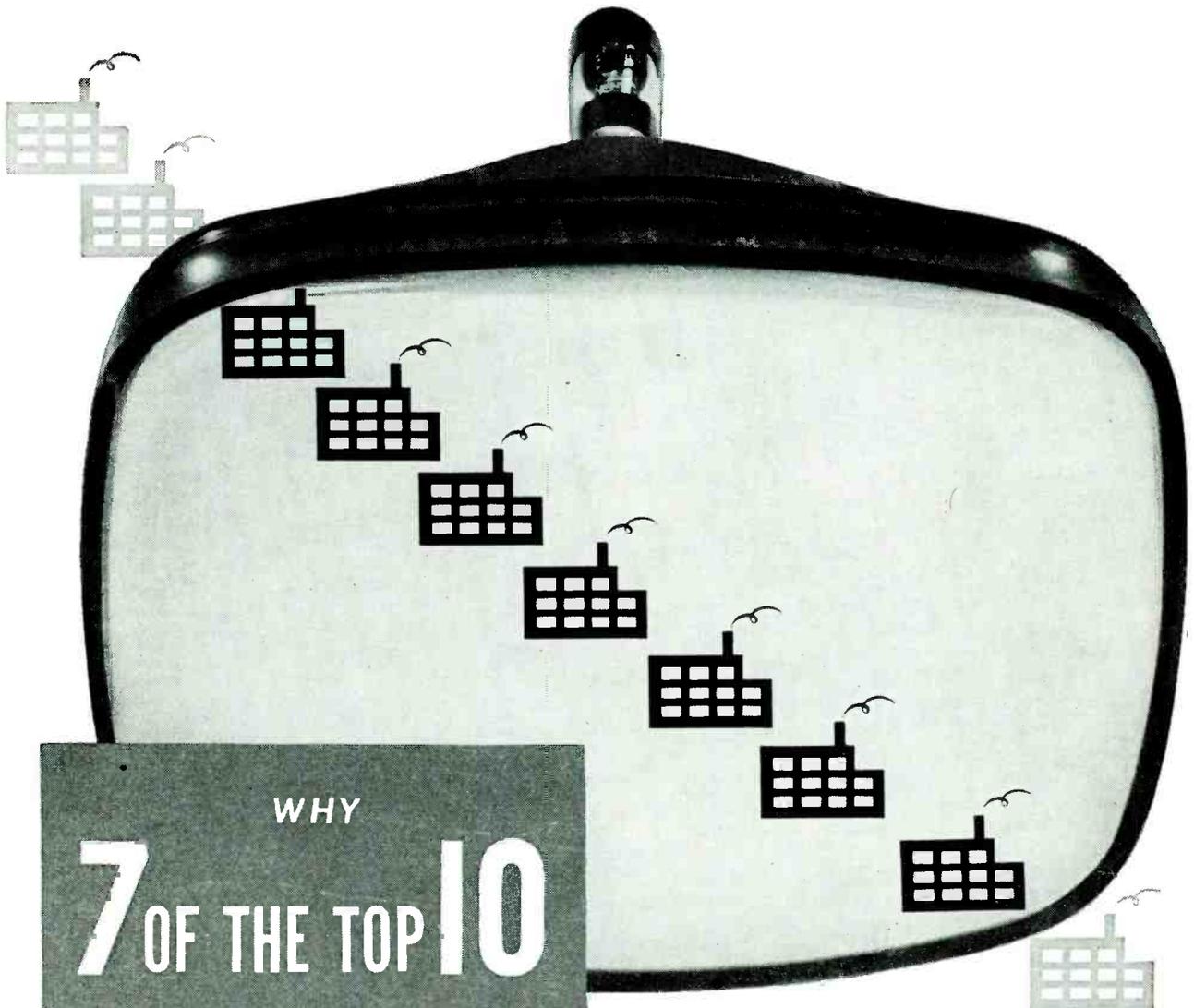
Thunderstorm Recorder?

Thunderstorms are located both in Britain and the U. S. by using networks of radar stations to determine by triangulation the location of the storm. The present American network covers an area with a diameter of 4,000 miles in the Caribbean region.

The British have now worked out a method, however, which uses an automatic recorder to pick up and compute signals received by a single radar. They measure the time interval between reception of a wave from a lightning flash as it travels along the ground and another wave from the same flash as it bounces off the ionosphere high in the sky.

Signal Corps scientists at Fort Monmouth, N. J., have analyzed similar experimental tests conducted for them by University of Florida scientists working under contract with the Army, and declare that the method is not feasible. Wave shapes from lightning patterns were not clear enough to accurately place the thunderstorms, but they used human calculation rather than the automatic recorder developed by the British.

—end—



WHY
7 OF THE TOP 10
 TELEVISION SET
 MANUFACTURERS USE
SYLVANIA
 PICTURE TUBES

The important reasons behind the steadily increasing demand for Sylvania TV Picture Tubes are: (1) high quality performance, (2) broad national recognition.

Sylvania's picture tube experience includes leadership in 4 specialized fields . . . all basic to TV picture tube production. These are *radio, electronics, lighting, and phosphors.*

A Sylvania tube engineer, for example, invented the famous Ion Trap now generally adopted, under special Sylvania license, by other leading picture tube makers.

Sylvania's 25 years of lighting research, including advances in phosphors and filamentary wire techniques and coatings, has also contributed to the outstanding clarity and long life of Sylvania picture tubes.

Popular TV show tells millions

Set owners are being kept informed of Sylvania's leadership by the big, popular television show, "*Beat the Clock*," on CBS-TV. Every week this program emphasizes Sylvania's unique background and the fine quality of all Sylvania products, thus assuring you of an enthusiastic acceptance of Sylvania Tubes used as replacements in the sets you service.

To help you choose the right Sylvania Tube for each service job see your Sylvania Distributor now for your free SYLVANIA TV TUBE SELECTOR, a handy wallet folder which explains the differences between more than 100 types of picture tubes. Sylvania Electric Products Inc., Dept. R-2411, Emporium, Pa.



SYLVANIA



MAKING BOOSTER HISTORY



THE TV-1

THE Turner Television Booster Model TV-1 has been on the market for less than a year, but already is making booster history. Reports from fringe areas all over the country are loud in their praise of the consistently superior performance of the TV-1. Wherever boosters are compared the Turner TV-1 produces the sharpest, clearest picture... the crisp, natural sound TV viewers seek.

Turner's advanced electronic engineering, plus solid, quality construction make the difference. The low-noise-level Cascade circuit stabilizes the picture, reduces noise and snow to a minimum, and produces an excellent picture under fringe area receiving conditions that nullify the best efforts of many other boosters.

Single knob continuous tuning permits fine adjustment for best possible reception of both picture and sound. Three position control switch turns on TV set only, TV set and booster, or shuts off both set and booster. The TV-1 may also be used to amplify FM, mobile and aviation radio signals.

The unit is quickly and easily installed. Attaches to any television set. Attractive styling and neutral finish harmonize with any furniture design. Contact your Turner representative or write direct.

List price ----- \$57.50

For the best possible TV reception, turn to

THE TURNER BOOSTER

THE TURNER COMPANY,

933 17th Street, N.E. Cedar Rapids, Iowa

In Canada: Canadian Marconi Co., Toronto, Ont., and Branches

Export: Ad. Auriema, Inc., 89 Broad Street, New York 4.

BIRDS AND ULTRASONICS

There has been much difference of opinion about the value of ultrasonic "scarecrows," though a number of attempts have been made to use ultrasound to scare birds away from roosting places.

The rather negative results of such attempts have led many to believe that ultrasonics is not the answer to the problem. Therefore, special interest attaches to the following letter, written by a Detroit radio engineer who is also interested in the work of the Audubon Society. It was addressed to Hugo Gernsback, in reply to a request for information on the successful experiments on bird-scaring, of which he had heard.

"The martin-starling experiment we have been working on here in Detroit has been keeping us quite busy checking and re-checking data on the effects of the various frequencies used.

"Inasmuch as this was the spontaneous application of a theory, the equipment used was all standard—oscillator, amplifier, and speakers. No special equipment was developed and therefore no special circuits were involved. The last five years we have recorded on tape some 135 half-hour reels of bird, animal, and insect sounds made throughout Michigan, on the East Coast and in Canada.

"Our findings in this work contributed to the idea of using high frequencies in forcing the movement of concentrations of birds from areas in which they come to roost each night. These concentrations, or flockings, always precede actual migration. Two or more species may gang up in this flocking; therefore the two above-named species of birds make up this particular flock of some hundred thousand individuals. The martins particularly are of inestimable value as insect killers and are protected by Federal law throughout the land. Where they have become a nuisance, however, such as in great concentrations in the middle of residential sections, wholesale killing has been quite generally sanctioned by local authorities—thoughtlessly, of course, as they might as well try to stop a hurricane or flood or any other natural happening.

"We have quite effectively proven that frequencies varied quite rapidly from approximately 9,500 to 11,000 cycles per second with substantial level as determined by distance involved, will definitely keep the birds on the wing, forcing them to go elsewhere. With strategically located speakers in the usually small areas involved the entire flock could be discouraged from landing in the area affected. These areas are usually thickly covered with old tall elms.

"We are desirous that this information be made available wherever and to whomever it may be of practical interest, in the hope that the final results may save the lives of countless thousands of one of our most valuable species of birds."—Ed. G. Boyes

—end—

RADIO-ELECTRONICS for

Over 43,000 Technicians Have Learned

HOW TO GET THE MOST OUT OF BASIC TEST EQUIPMENT

Why Not You, Too?

SERVICING by SIGNAL SUBSTITUTION

A BEST SELLER FOR OVER 9 YEARS! (NEW, UP-TO-DATE, 12TH EDITION)

The Simple, Modern, Dynamic Speed Approach To Receiver Adjustment and Alignment Problems, AM-FM-TV.

- Nothing complex to learn
- Universal — non-obsolete
- No extra equipment to purchase
- Employs Only Basic Test Equipment

Ask for "S.S.S." at your local Radio Parts Jobber or order direct from factory.

only 40¢

100 pages. Invaluable information that will help you re-double the value of your basic test equipment.

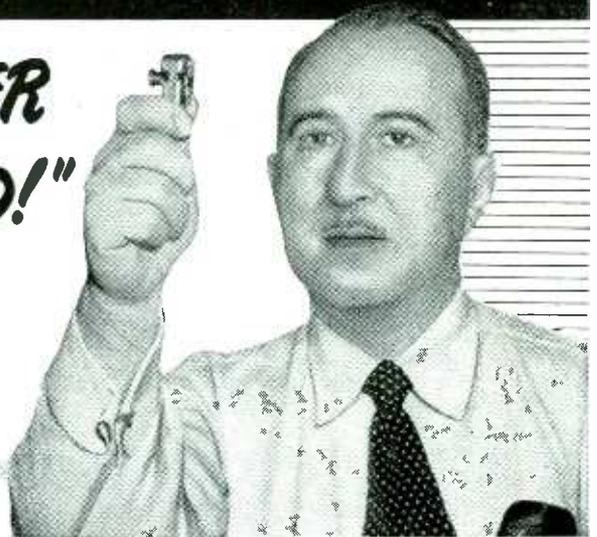
PRECISION APPARATUS COMPANY, INC. • 92-27 Horace Harding Blvd., Elmhurst 4, N. Y.



VARIABLE RELUCTANCE CARTRIDGE

**"OUTSELLS ALL OTHER
MAKES COMBINED!"**

Reports ARNOLD DEUTSCHMANN
Vice President, RADIO SHACK Corporation
Boston, Mass.



"MORE customers ask us for G-E than for all other cartridge brands combined. In our business that's an important tip-off because people who come to us usually know exactly what they want in audio performance. They demand that we stock the best. We handle every commercial cartridge—and G-E Variable Reluctance units outsell them all by at least 4 to 1!"

Famous the world over as a "quality" store for audio accessories, Radio Shack on Boston's Washington Street, is typical of finer dealers everywhere in its

support of General Electric parts and components.

Every stylus in every G-E cartridge is double-damped to absorb virtually all mechanical noise. Diamond or synthetic sapphire tips are available for standard or microgroove records.

A Sales Point to Remember—Replace with a G-E stylus and you get the equivalent of a whole new pickup! Here's why:—General Electric's single-package stylus assembly contains stylus, cantilever, and damping blocks—the only parts of your pickup that are affected by time and use. No other cartridge gives you this advantage.



SPEAKER PERFORMANCE THAT SELLS —

and stays sold! Lew Kornfeld and Arnold Deutschmann, Radio Shack experts, agree that G.E.'s 27 sizes of speakers bring quality sound within the range of every taste and budget.

**SEND FOR THIS
NEW BOOKLET!**



General Electric Company, Section 45111
Electronics Park, Syracuse, New York

Yes—send me new booklet with complete information on General Electric diamond styli.

NAME
ADDRESS
CITY..... STATE.....

You can put your confidence in

GENERAL  ELECTRIC

Filter Facts And Faddle

Filters are widely used in radio, video, and audio work. The author shows how to design many of the various types.

By JAMES R. LANGHAM

WHE FIRST began fooling with filters 'way back when we had just managed to get our tuner's over-all response up past 10 kc—up into the range where the 10-kc beat-frequency squeals between broadcast stations were coming through very well.

For a long time I was sure I had oscillation in the tuner—I don't know why an r.f. beat frequency didn't occur to me—and I had beat my head against the wall for several evenings in a row trying to de-squeal that little t.r.f. I remember dashing into the bedroom, late one evening, to wake up the XYL and tell her the squeal had disappeared and I hadn't done anything to it. I also remember her remarks. She sim-

mered down after awhile and wondered what I should have wondered straight away: "Do you suppose that could be a beat frequency between stations?"

We didn't immediately jump into filter design. We followed our usual (excuse the expression) engineering technique. We first tried several sections of resistor-capacitor tone control between the tuner and amplifier; we added R-C sections until the highs were sounding muffled and the squeal still came through. Then I remember padding the inside of the boom box (I still thought I liked them then) and even suggesting that we use cotton upholstery padding for grill cloth. It was the XYL who got us started. "Listen," she said. "Why don't you design a filter? I'll build it."

I dug into books then while the XYL played records. I soon decided my books weren't adequate so I called on a friend (hah!) for help. This man was a high-fidelity fan who was also a physics major, and he handed me a book.

There's no question that it's a fine book but it surely wasn't for me. Lordy, I could barely count over ten without taking off my socks—and this book . . .

Around midnight the XYL peeked over my shoulder on her way to bed. "Hmmm," she yawned. "I didn't know you liked mathematics, dear."

"I find it extremely fascinating," I snarled at her.

Her laugh was silvery and gay, so I added: "—especially with you playing *Pictures At An Exhibition* at a 34-db level."

She trilled a merry goodnight in my direction and went in to bed, yawning loudly and sighing luxuriously as she relaxed. I ground my teeth, made more coffee and tried to think. I couldn't find the information for the mathematics, as the author had done a beautiful job of hiding it. I finally gave up that night but the next day I tried some more. I wasn't curious about how the formulas were derived—I just wanted to know how to work it. After awhile I tried other books, looking for answers. My eyes became bloodshot, the circles underneath them became bags, and my skin took on the tone of a slightly soiled mushroom.

The M business bothered me a great deal because I couldn't find out what it meant. I was very annoyed at myself for not learning how to apply the math I didn't understand. Nowhere could I find any explicit directions about filter design.

Actually, the design of a simple low-pass (or high-pass) filter is quite easy—now that I know how to do it.

Filter types

The main classes of filters are: T, Pi, and half sections. There are others but they are mostly versions of these doubled or folded. There are also constant-*k* filters and *m*-derived filters: in the *m*-derived category there are shunt and series types.

The T and Pi filters are called that because their configurations look like the Latin letter T and the Greek letter π. The half sections are also called half-tees, half-Pi's, and ladders.

Constant-*k* filters are also called constant *z*, basic type, and *m*=1 filters.

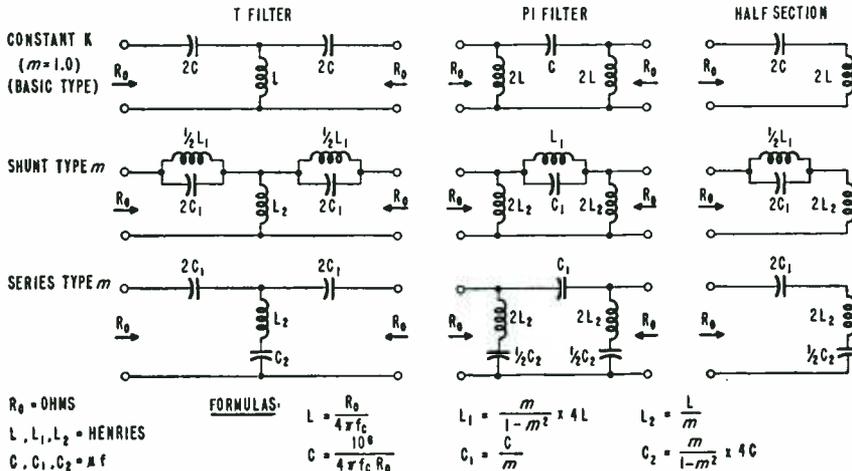


Fig. 1—Three classes of high-pass filters: T, Pi, Half sections. These can be Constant-*k*, Shunt type *m*, or Series type *m*. Note formulas for their use.

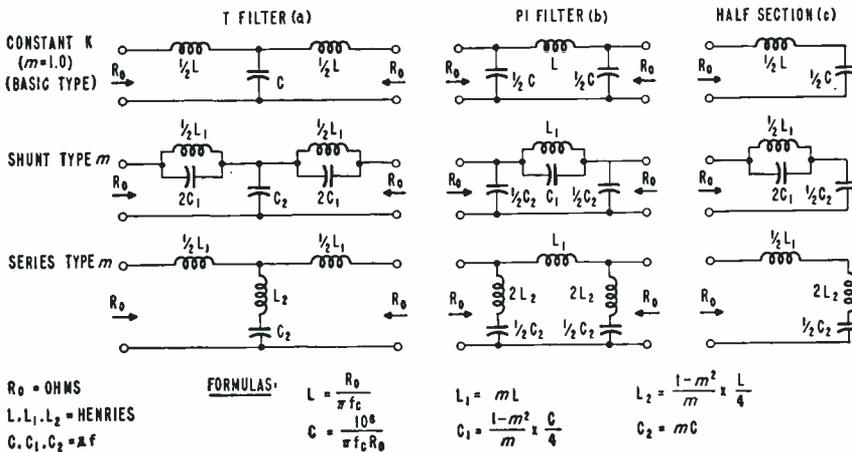
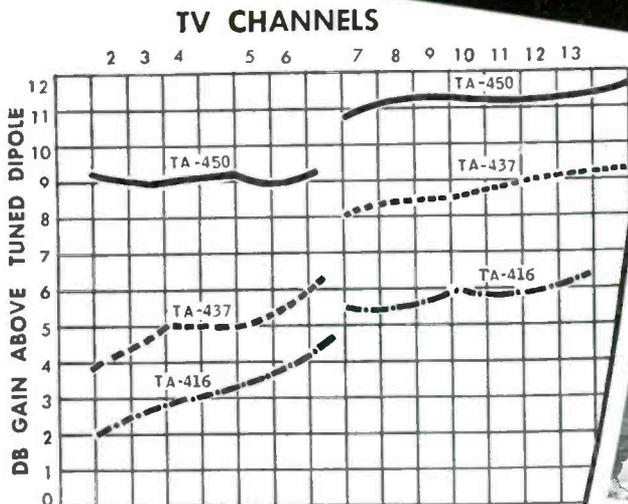


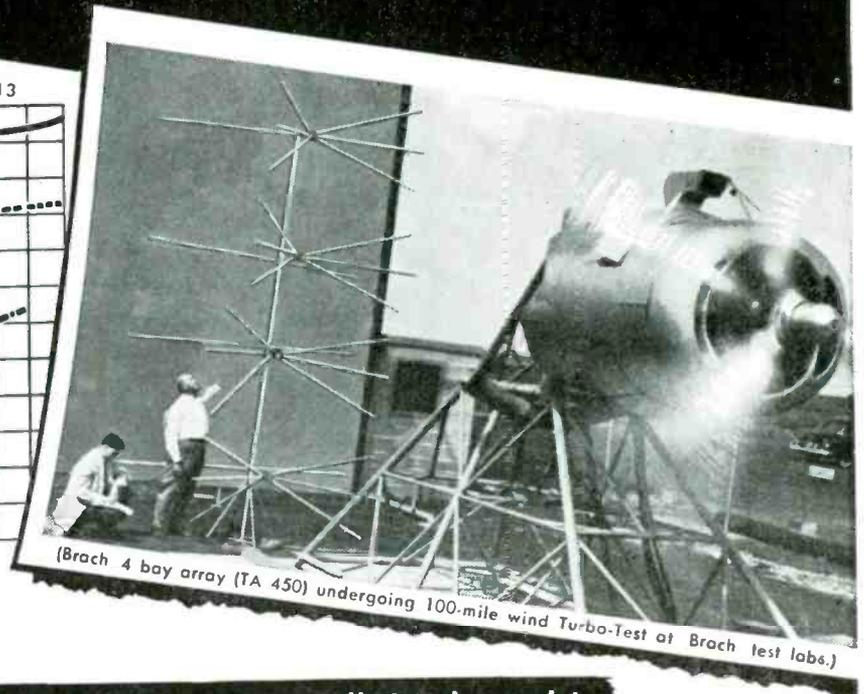
Fig. 2—Low-pass filters also fall into several classes. The math is very easy.

Test Proved!

Best Performance • Strongest Construction



BRACH DB gain-curve shows highest gain on all TV channels —



TA 450 has more gain than a stacked yagi on all TV channels!

Station signal increases are opening up new fringe areas. Capture them with Brach's proved performance antennas built to rigid specifications.

Only Brach antennas are engineered and tested to withstand gale winds...and still give the best reception. Your installation is permanent: with no



call-backs, no trouble-shooting. Once you install a Brach fringe area antenna you'll never want any other kind. Here's why: (1) It is the only antenna with a *non-hygroscopic high-impact insulator* that will not absorb moisture...minimizes signal loss. (2) The exclusive 6-element clamp secures the rugged, *seamless dowel-supported aluminum elements* which, combined with the Brach mitre lock, provide a positive lever hold to withstand high winds and ice loading. (3) Quick rig design of all parts makes easy *rooftop assembly of 4 bay array*. (4) Phasing bars used to stack Brach antennas are designed for the *highest possible "Q"*...means more signals on all TV channels.

Choose from three models...specially designed to meet your needs.

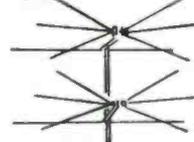
For super fringe areas. The Air General 4 bay array, Brach #TA 450 (shown under wind test). Highest gain antenna available! More gain than a stacked yagi on every TV channel.

Brach all channel signal booster 50825. No tuning or switching necessary. Averages 15 DB gain on all channels used to realize maximum TV signals in fringe installation.

Capture your share of the fringe areas now. See the Brach franchised jobber in your territory — today!



For primary areas; the single array Brach TA 416



For fringe areas; the 2 bay array Brach TA 437

FREE Send for Brach's new booklet "How to get the most out of fringe area installations," by Ira Kamen, leading TV antenna authority.

MANUFACTURING CORP.

(Div. of General Bronze Corp.)

200 Central Ave., Newark 4, N. J.,

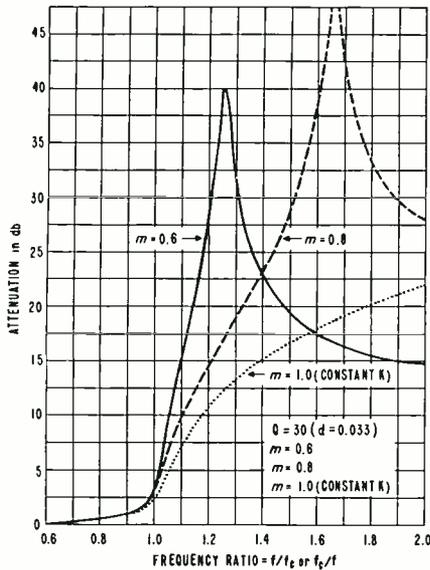


Fig. 3—Characteristics of high and low pass filter sections where Q equals 30.

They are fundamental to the evaluation of constants for the *m*-derived filters. The term *m* is best regarded as simply a dimensionless number that is used in filter work. It can be defined as the square root of the quantity one minus the square ratio of cutoff frequency to peak-attenuation frequency, thus: $m = \sqrt{1 - (f_c/f_p)^2}$.

In simpler language, *m* is a number between zero and one; the closer to one it is, the sharper is the attenuation curve and the closer together are the cutoff and peak-attenuation frequencies. The *m*-derived filters are simply filters using *m* in calculation of the capacity and inductance values.

All of these filters are critical in regard to impedances and resistances across either the input or the output. If you want to use a particular filter on a 500-ohm line, you must design it for that particular impedance or it won't play.

Filters and Q

Now there were two major faults with all those books I struggled with that time long ago: (1) Their constants were all pure reactances without resistive components, which is to say that their Q's were infinite. I was further confused in that the books did not mention Q explicitly either. They used another term, *d*, which they defined badly but which I later discovered to be nothing more than 1/Q. (2) The books had been written for people who study rather than people who just read; and one very important matter, the conversion between T, Pi, and half sections, was buried in a mass of mathematics.

The filter I ended up with that time was about an octave out of kilter. Instead of attenuating the 10-kc whistles, it had a nominal cutoff of 20 kc. I say nominal because the difference between infinite Q and the Q of the filter made for such a sloppy cutoff that I couldn't find it on my 20-to-20,000-cycle oscil-

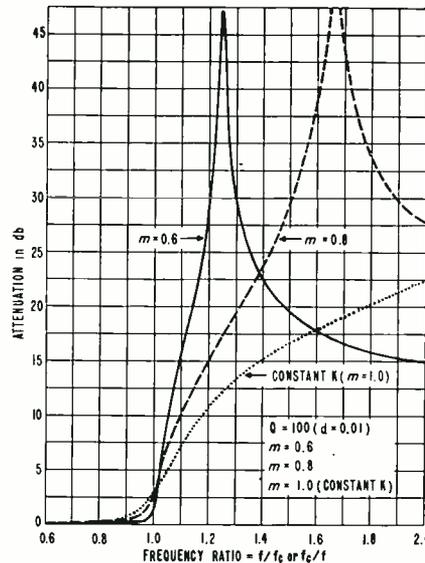


Fig. 4—Same conditions as Fig. 3, but Q is now 100. Note sharp cutoff points

lator, and I made some silly remarks about the XYL's fabrication which turned out to be very unwise after we both checked the circuit constants on the bridge. With the bad filter design, my headaches, and the XYL's remarks, I was having a pretty unhappy time all around.

The Q's you are likely to encounter around the audio band range from 30 to 100 for the coils and you can stop worrying about the capacitors. Away up in the ridiculous frequencies where they have things like television, I am told conditions are likely to be opposite—the capacitor Q's are the worry items and the coils pretty much forgotten. Down in the high-fidelity band, the coil Q is the circuit Q and there's no nonsense about it.

Practical filters

Fig. 1 shows *high-pass* filters and Fig. 2 illustrates the *low-pass* units. In each case, the formulas are right there too, and about the only item to worry you is grade school arithmetic.

Fig. 3 and 4 show the curves you will get from practical filters. In Fig. 3 are the attenuation characteristics of a basic constant-*k*, an *m*=0.6 and an *m*=0.8 filter with a Q of 30. Fig. 4 is the same except that there the Q is 100. You can see a strong resemblance between the two sets of curves but I'm sure you can also see quite a difference, especially in the cutoff region for the *m*=0.6 filter.

Now the *m*=0.6 filter is about the handiest and the most commonly used

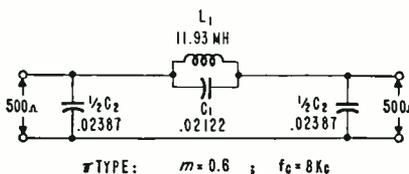


Fig. 5—Shunt Pi low-pass filter designed for *m* of 0.6 and for 8-kc cutoff.

type you're likely to need. It makes the best impedance match to any circuit with a critical source impedance, and for this reason it is very often used in two half sections, one at the input end and the other at the output end of a complex, multi-element filter.

Those of you who have delved into this stuff before might be confused as I was in the matter of impedance matching. Just from the name, I thought that a constant-*k* (which I think was called a constant-*z* in that particular book) would be better to use for impedance matching. Not so. Don't regard that name, constant-*k*, as having any more meaning than if it were called George or Terence. For impedance matching, forget names and use the *m* = 0.6 filter.

In the case that started me off, a single *m*=0.6 section is fine, but, as you can see by the curve, the attenuation simmers down once the peak is passed. There are many applications where the attenuation must continue and in one of those cases an *m*=0.8 section is very fine: its peak is farther away and its attenuation is higher except in the cutoff region. The basic constant-*k* type is also popular for providing attenuation at an even greater distance from cutoff. These three types are by far the most useful of all and you can do nearly any filter job quite easily with combinations of these three.

Combining them is quite practicable and it is common to use sections of *m*=0.8, *m*=0.6, and constant-*k* all in the same filter with an *m*=0.6 section split so that half is used at either end for impedance matching. The attenuations are in decibels and merely add arithmetically like apples and pigs.

The values across the bottoms of Figs. 3 and 4 are frequency ratios that permit you to place the curves anywhere you wish to in the band. All the values are referred to the cutoff frequency.

Designing a filter

Now let's do some. Let's assume we want a filter to fit in a 500-ohm speaker line and attenuate a strong 10-kc whistle. In this case a single *M*=0.6 section will do nicely. The cutoff is sharp and the peak attenuation comes at 1.25 times the cutoff frequency so we can set *f_c* at 8 kc. A single section should be sufficient, and, because coils are more expensive than capacitors, we'll make it a shunt type Pi section, Fig. 2, shunt type *m*, (b), which uses one inductor and three capacitors.

First we must calculate the L and C as of a constant-*k* filter because the *m*

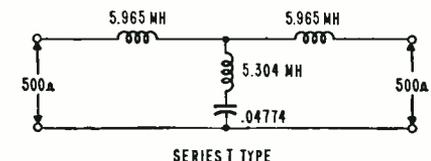


Fig. 6—Characteristics of the series-T filter are similar to those of Fig. 5.

All features add up to ...

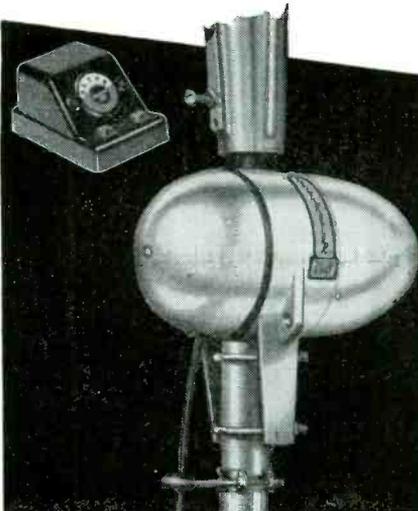
Dependability

the word that
best describes the



TELE-ROTOR

you can depend on a *TELE-ROTOR*
under any and all weather conditions



TELE-ROTOR

CUB

Ideal for average installations—easily installed. MODEL 502B . . . rotator with meter control cabinet for "hairline" tuning (uses 5 wire cable) . . . \$44.95

TELE-ROTOR

This HEAVY-DUTY "Tele-Rotor" is the most powerful TV antenna rotator made. Superbly engineered, it is the best your money can buy! Complete with "compass control" cabinet having illuminated "perfect pattern" dial (uses 8 wire cable) . . . MODEL TR-2 \$49.95



LAZY-X CONICALS



STRATE-LINE ANTENNAS



YAGI ANTENNAS



HI-LO ANTENNAS



INDOOR ANTENNAS



FM ANTENNAS



SUPER-VEE ANTENNAS

CORNELL-DUBILIER SOUTH PLAINFIELD, N. J.



THE RADIART CORPORATION CLEVELAND 2, OHIO



NOVEMBER, 1951

Specially Designed

for
TV

Technicians

New **OVER/UNDER**
WELLER
SOLDERING GUN

For ticklish TV soldering, there's no tool like the new 135-watt Weller Gun. Dual spotlights eliminate shadows. Precision balance assures accurate soldering. Long length reaches deep into chassis. 5-second heating saves time and current. Your Weller Gun pays for itself in a few months.



Check This
Exclusive
Combination
of Features

- **5-SECOND HEATING**—No waiting. Saves power.
- **OVER/UNDER DESIGN**—Tube construction gives bracing action to tip, and improves visibility.
- **DUAL SOLDERLITE**—Prefocused spotlights completely eliminate shadows—let you see clearly.
- **LONGER REACH**—Slides easily into the most complicated set-up. Reaches tight corners.
- **COMPACT DESIGN**—Streamlined and precision balanced for delicate "pin-point" soldering.
- **TRIGGER-SWITCH CONTROL**—Adjusts heat to the job. No need to unplug gun between jobs.
- **DUAL HEAT**—Single heat 100 watts; dual heat 100/135 watts; 120 volts, 60 cycles. Handles all light-duty soldering.

See new Model WD-135 at your distributor, or write for bulletin direct.

• **SOLDERING GUIDE.** Get your new copy of "Soldering Tips"—revised, up-to-date and fully illustrated 20-page booklet of practical soldering suggestions. Price 10c at your distributor, or order direct.

WELLER
ELECTRIC CORP.

828 Packer Street, Easton, Pa.



types are derived from these. Using low-pass formulas, see Fig. 2:

$$L = \frac{500}{\pi \times 8000} = 0.01989 \text{ h or } 19.89 \text{ mh}$$

$$C = \frac{10^9}{\pi \times 8000 \times 500} = 0.07957 \mu\text{f}$$

$$L_1 = 0.6 \times 19.89 = 11.93 \text{ mh}$$

$$C_1 = \frac{1 - 0.6^2}{0.6} \times \frac{0.07957}{4} = 0.02122 \mu\text{f}$$

$$\frac{1}{2} C_2 = \frac{1}{2} \times 0.6 \times 0.07957 = 0.02387 \mu\text{f}$$

The filter section is shown in Fig. 5 as a shunt type *m*. Compare with Fig. 2, and you will see that the center part of

tions. The sections are combined by adding the parallel capacitors into single units—this is just to save space and expense. If we had formed our filter of T sections we would combine them by adding the reactances of the protruding arms; inductances arithmetically, $L_a + L_b + L_c$ etc., and capacitances by using: $1/C_T = 1/C_1 + 1/C_2$.

Fig. 8 shows the over-all characteristic of our filter. The solid line is the curve for using coils with Q's of 30, while the dotted line shows how the attenuation is with Q's of 100.

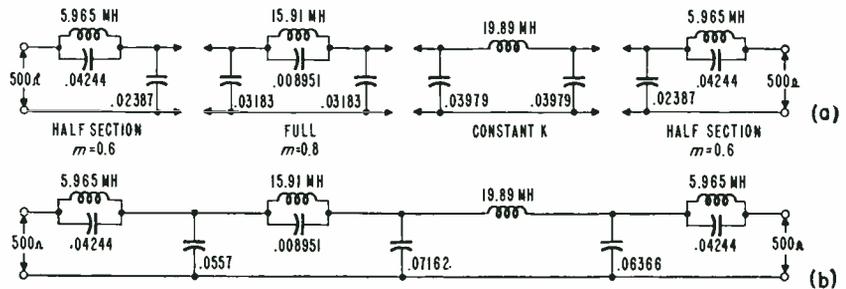


Fig. 7—Design for a low-pass filter, (b) is combined from the elements of (a).

the Pi is really a simple tuned circuit resonant at 10 kc. The capacitors on each side true up the impedance match so that the complete section looks like 500 ohms from either side. The transmission characteristic will be like the solid line in either Fig. 3 or Fig. 4, depending on whether the Q of the 11.93-millihenry coil is closer to 30 or to 100.

This particular filter configuration was selected because we preferred using capacitors. If a chap likes to mess around with inductors, he could get exactly the same results for the series T section shown in Fig. 6.

Suppose now that a single $m = 0.6$ section should not be sufficient. Suppose you wanted about 60 db of attenuation from here on up. You could add an $m = 0.8$ section and, to ensure impedance matching in and out, split the $m = 0.6$ section into halves and use half on each side of the $m = 0.8$ section.

The $m = 0.8$ constants are computed in exactly the same way as were those for the $M = 0.6$ section:

$$L_1 = 0.8 \times 19.89 = 15.91 \text{ mh}$$

$$C_1 = \frac{1 - 0.8^2}{0.8} \times \frac{0.07957}{4} = 0.008951 \mu\text{f}$$

$$\frac{1}{2} C^2 = \frac{1}{2} \times 0.8 \times 0.07957 = 0.03183 \mu\text{f}$$

Our values for the $m = 0.6$ section are for a full section, and by referring to Fig. 2 shunt type *m*, (c), we see that we want to use $\frac{1}{2} L_1$ and $2C_1$ so we double our reactances in the center of the Pi. This of course does not change the resonant frequency.

A combination of the $m = 0.6$ and the $m = 0.8$ sections provides a lot of attenuation close to cutoff, but, if we wish to maintain a full 60-db blank from here on up, we must add still another section. A constant-*k* filter will do nicely here and we already have the values of L and C worked out so all we have to do to make a Pi section is halve the capacitance according to Fig. 2 constant-*k*, (c).

Fig. 7 shows the lineup of filter sec-

There are other ways of designing filters. One of the more rigorous ways involves the consideration of various resonances and antiresonances or (if you'd like to keep in style) "poles" and "zeroes." If you like doing things the hard way that's fine, but this method will get your filters to come out as you want them and without any great strain.

The design of filters isn't hard (as you can see) but filter building is a cow from another barn. You can buy almost any value of capacitor but the inductors aren't quite so easy to come by. If you are poor you can wind them yourself. Actually coil winding isn't nearly so hard as you might think. You should have a bridge to check the reactances. These can usually be borrowed.

As I look back, I do believe a lot of my filter headaches at first were caused by nothing more than awe for a lot of mathematics that were away beyond me. There's no need for that.

—end—

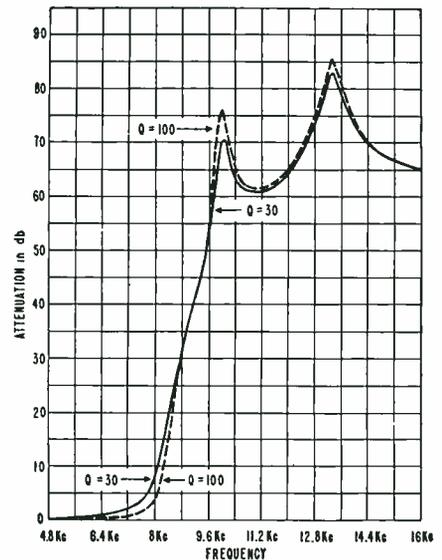
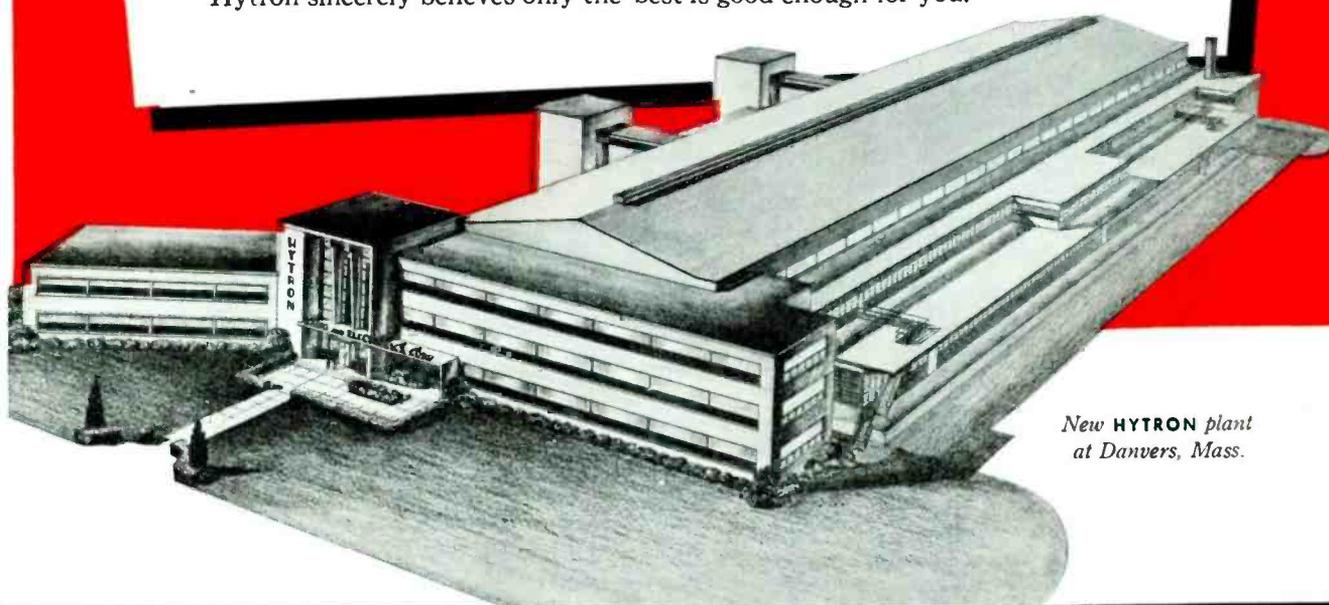


Fig. 8—Curves of filter shown in Fig. 7

YOU ARE HELPING TO BUILD THIS PLANT!

Your increasing demand for Hytron tubes is helping to build this fine, ultra-modern plant. Located at Danvers, Massachusetts, it will be the most modern receiving-tube plant that engineering know-how can build.

And this is more important to you. Its advanced equipment and skilled staff will — we promise — give you the best tubes your money can buy. Because Hytron sincerely believes only the best is good enough for you.



New HYTRON plant at Danvers, Mass.



NEW NAME ADDED

The famous red-white-and-blue Hytron carton has added a famous symbol: CBS. Yes, Hytron is proud to be a division of the Columbia Broadcasting System, Inc. — with greatly expanded opportunities to grow in service to you. Two respected names now guarantee you unsurpassed tube performance. CBS-Hytron is your sign of the very best in electronic tubes. Look for the attractive carton. Be sure to demand the best: CBS-Hytron.



MAIN OFFICE: SALEM, MASSACHUSETTS

Electronics and Music



The Baldwin uses no moving parts to generate or color the musical tones.

Part XVII—This and next month's article describe the Baldwin, an instrument of the all-electronic type.

By RICHARD H. DORF

Vibrato (frequency-modulation type) effects both manual and pedals and is adjustable. There are 25 stops and two couplers. The console is 52½ inches wide and 29 inches deep.

Model 10 is a newer and larger model, with additional stops and couplers and with pistons to select preset stop combinations. It operates like Model 5. Baldwin has also introduced a new model which operates on the photoelectric principle. In this article we shall discuss the Model 5.

General functioning

The organ is an all-electronic device with no moving parts except keys, pedals, and stop tabs. It generates a series of sawtooth-shaped waves which are passed through fixed filters to modify them and reproduce various tone colors.

Fig. 1 is an over-all block diagram. The generator assembly generates tones. A vibrato oscillator modifies the tone frequencies at the vibrato rate when the vibrato switch is operated. The gen-

DELIBERATELY introducing distortion in an amplifier is contrary to most audio principles. When the amplifier must transmit music, distortion is especially undesirable. However, when discriminating circuits are used in an instrument which generates musical tones, results may justify altering the fidelity of the amplifier.

The Baldwin electronic organ, built by the Baldwin Piano Company, Cincinnati, uses this principle of tone variation with filters to produce tone coloration almost like that of a true pipe organ. The filters in the Baldwin were

designed using the formant principle discussed here two months ago. While no electronic or electrical organ perfectly duplicates a pipe organ, the Baldwin comes so close that most lay hearers are deceived. It is used in a large number of churches. It is also used for serious recital work. Some prominent concert organists and conductors prefer it to the run-of-the-mill pipe organ.

Two Baldwin electronic models are manufactured. Model 5, (photo left) is the smaller one. It has a standard AGO (American Guild of Organists) console, with great pedal and swell manuals and a 32-note radial pedal clavier.

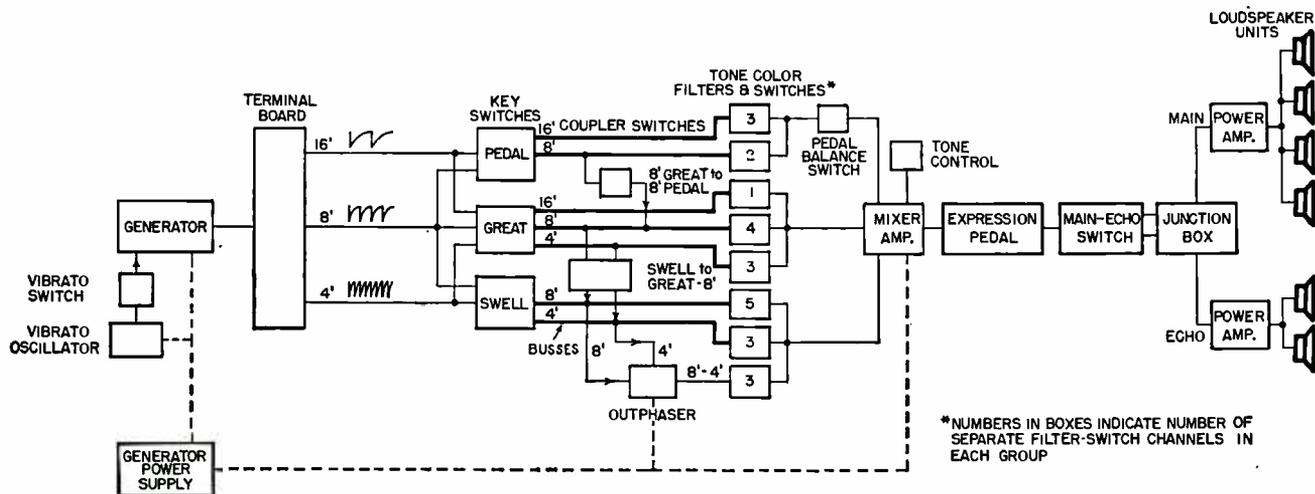
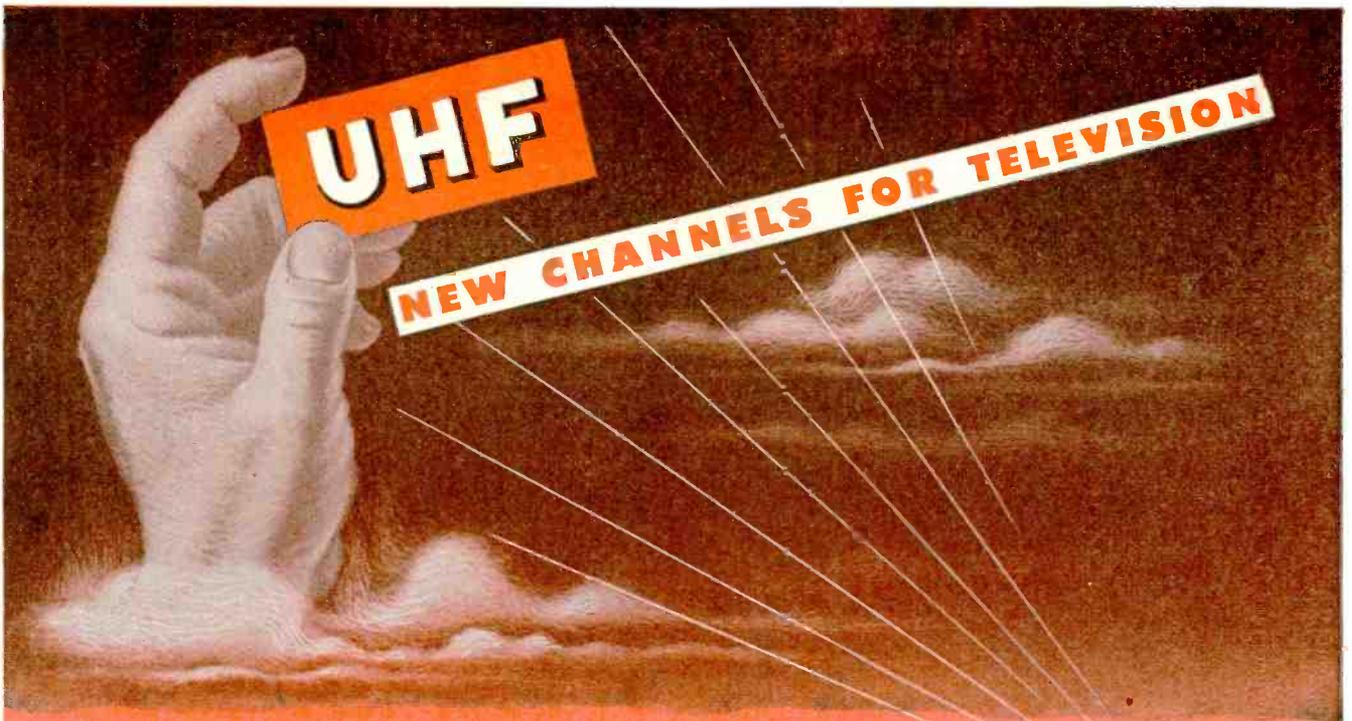


Fig. 1—Block diagram of the Model 5. The heavy horizontal lines near center are the busses referred to in the text.



A New Market for You . . . with the Mallory UHF Converter

Here is another first from Mallory—a practical converter to add UHF reception to VHF television sets.

The Mallory UHF converter can be connected to *any* TV receiver by a few external connections—involving only the power line and antenna leads. It permits the tuning of all UHF channels without internal adjustments and without sacrificing reception of VHF channels.

The secret of the Mallory converter is the Inductuner[®], pioneered by Mallory years ago. It provides continuously variable tuning, essential to complete coverage of *all* UHF channels.

Here is real sales appeal—a real sales opportunity!

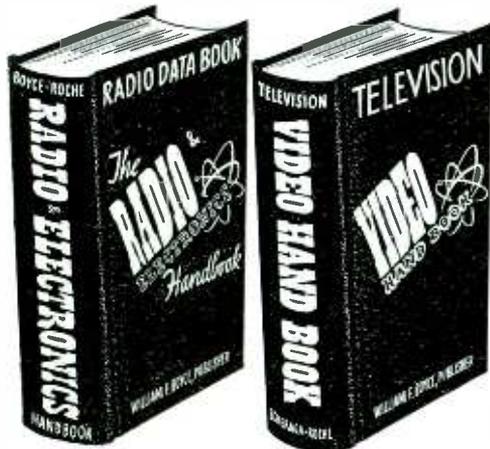


P. R. MALLORY & CO. Inc.
MALLORY CAPACITORS... CONTROLS... VIBRATORS...
 SWITCHES... RESISTORS... RECTIFIERS...
 VIBRAPACK[®] POWER SUPPLIES... FILTERS
*Reg. U.S. Pat. Off.
APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

*Make Sure!
Make it Mallory!*

ARMY—NAVY
AIR FORCE—MARINES
SERVICEMEN
TECHNICIANS
Here's Help!



Now in 1800 PAGES
THE BASIC KNOWLEDGE
AND DATA OF
RADIO & TELEVISION
A
DIGESTED INTO 32 SECTIONS
... IN A COMPLETE, QUICK-
TO-FIND, EASY-TO-READ
HANDBOOK FORM.

You can plan every operation in TV—Radio & Electronics with the Library Set. These handbooks are your lifelong tools—use them every day on the board, at the bench, or in the field—for construction, production, servicing, installation or operation—for adjusting, troubleshooting, measuring and testing. Your invaluable aid in service, research, development, design, manufacturing and maintenance. With all data & servicing procedures, these handy books work better, faster and easier.

In addition, you get complete coverage of everything you need in TV, Radio & Electronics—in practical form—everything presented in plain talk, all terms explained; schematics, working diagrams and pictures all clearly illustrated for your quick and easy reference.

These books are works of complete authority prepared by the well known engineers, Joseph J. Roche and Morton Scheraga, under the direction of William F. Boyce, famous for the preparation of hundreds of handbooks and manuals for the U. S. Signal Corps, U. S. Navy, U. S. Air Force, Western Electric Co., General Electric Co., Bell Laboratories, National Radio Co. and many others.

These Handbooks are endorsed by leading schools for instruction and reference. The armed services make them available to their technicians in libraries, schools, and in the field. Engineers, Draftsmen, Laboratory and Production men in every industry have purchased over 50,000 of these books for use in their work.

500 Radio jobbers keep them constantly in stock for the convenience of their service and industrial customers. These are the most commonly used books in Radio & TV. Whether you use these Handbooks for general reference, scientific instruction or education, one thing is certain; the practical help, the daily usefulness you will derive from them will prove to be worth many times their price.

Contents are too long & complete to describe here, so see the books at your Radio Jobber, your bookstore, or

SEND FOR TEN DAY
FREE TRIAL EXAMINATION.

RADIO ELECTRONICS HANDBOOK\$7.00
VIDEO HANDBOOK\$7.00
SPECIAL OFFER! SAVE \$2.00
The LIBRARY SET (both books).....\$12.00

BOYCE-ROCHE BOOK CO.
Caldwell 51, New Jersey

Send Library Set (2 books) @ \$12.00
 Radio Electronics Handbook @ \$7.00
 Video Handbook @ \$7.00

In ten days I will send price plus postage, or I will return books postpaid.
(Offer good in U.S.A. and to men in Armed Services overseas only)

Name.....
Address.....

Employed by.....
Save postage—we pay postage and packing if you send money NOW. Money back on same return privilege.

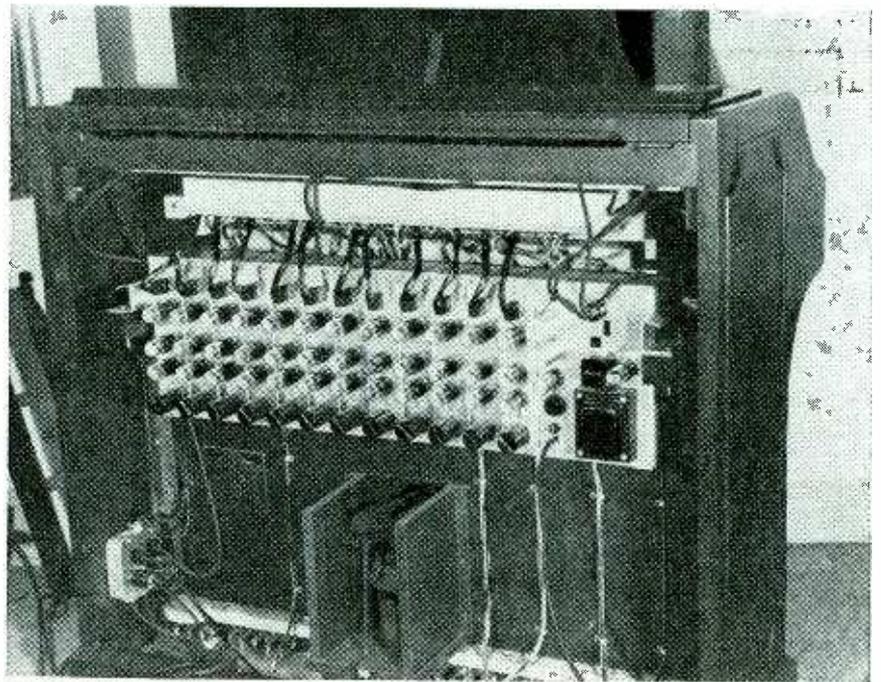


Fig. 2—This rear view of the Baldwin shows the bank of generator subchassis.

erators operate continuously. When a key on the swell manual or pedal clavier is pressed, two gradual-contact switches connect two tones to the busses for that keyboard. On the swell, for example, if the key for A-440 is pressed, a tone of A-440 is connected to the swell 8-foot bus and a tone of A-880 is connected to the swell 4-foot bus.

Each bus is connected in parallel to the input ends of a number of tone filters. As shown in Fig. 1, for example, the swell 8-foot bus goes to five filters, and the swell 4-foot bus goes to three filters. At the output of each filter is a stop switch. It is normally open, but when closed it connects the output of its filter to the common bus leading to the mixer amplifier. Thus, to set up a certain combination of tone colors, the player presses the required stop tabs, connecting the outputs of the desired filters to the amplifying system. The pedal-balance switch adjusts the outputs of the pedal-tone filters for best

balance with the manual tones, depending on room acoustics, at the time of installation.

The expression pedal operates a volume control which affects the entire instrument. The main-echo switch transfers the output of the console to either or both of two power amplifiers located at different places in the auditorium. Tone cabinets containing power amplifiers and speakers produce the music.

Tone generators

Fig. 2 shows the rear of the organ with the wooden back removed. The metal frame holds 13 subchassis, the first 12 of which are generators and the last the power supply. Each generator chassis generates a single alphabetical note of the scale, six notes similar in tone but an octave apart. The chassis, when in place, are connected to the system through bus bars and plugs.

Fig. 3 is a schematic diagram of one generator chassis. The left triode of the

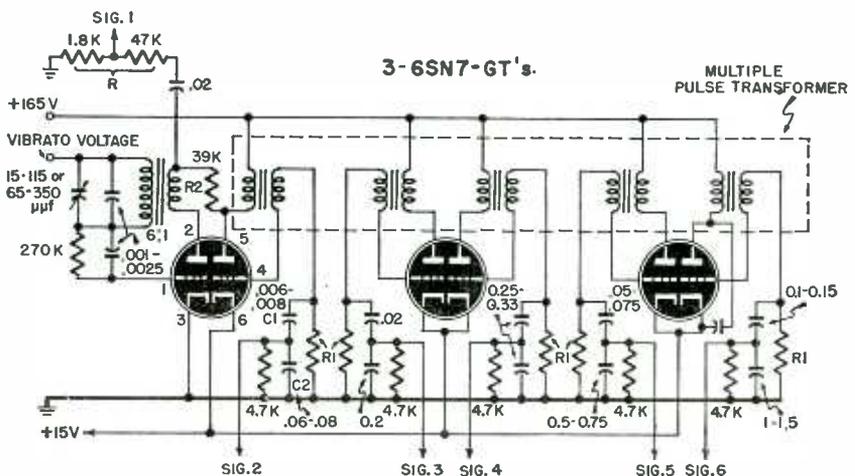


Fig. 3—One of the 12 generator chassis. An L-C master oscillator followed by five frequency dividing blocking oscillators cover the Baldwin's six octaves.

3 Important Rauland Policies

...Are they
paying off for you?

1 Did you know that Rauland's Replacement Picture Tube Warranty and Adjustment Policy provides a 6 months warranty from the date of purchase by the consumer? And that all Rauland replacement tubes now carry a triple registration card providing protection for jobber, dealer and consumer?

2 Did you know that Rauland provides a full 120-day price protection on distributor inventory of replacement picture tubes? That Rauland distributors can carry a stock adequate for their territories without risk of loss through price adjustment?

3 Did you know that Rauland offers valuable premium points for the prompt return of warranty registration cards? Each card returned promptly entitles dealer and distributor to premium points redeemable in valuable merchandise prizes.

If you have not received full details on all of the above, write, phone or wire your distributing contact on Rauland tubes. If you have not received your prize merchandise catalog, use the coupon below today.

THE RAULAND CORPORATION



Perfection Through Research

4245 N. KNOX AVE. • CHICAGO 41, ILLINOIS



The Rauland Corporation
4245 N. Knox Ave., Chicago 41, Illinois

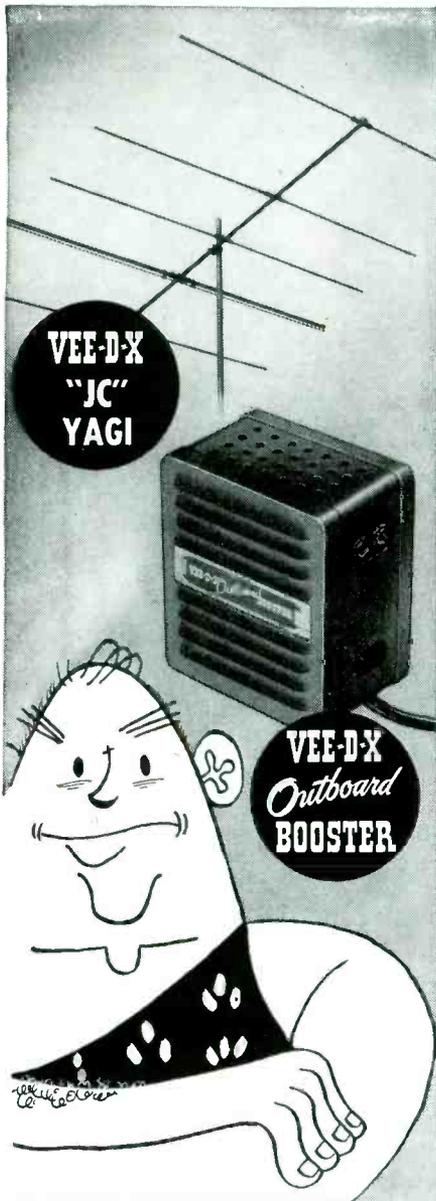
Please rush premium merchandise catalog and full information on:

Earning Premium Prizes 6 Months Warranty
 Distributor Price Protection

Name _____

Address _____

City _____ State _____



VEE-D-X
"JC"
YAGI

VEE-D-X
Outboard
BOOSTER

**MOST
POWERFUL
COMBINATION
for
SINGLE
CHANNEL
RECEPTION**

VEE-D-X

THE LaPOINTE-PLASCOMOLD CORPORATION
Windsor Locks, Conn.

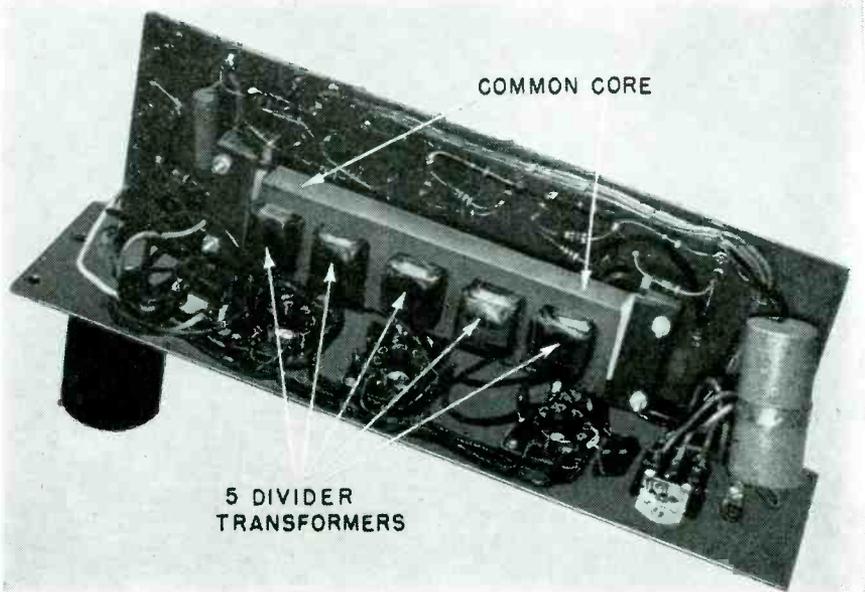


Fig. 4—The multiple pulse transformer construction is well shown in this view.

left 6SN7-GT is a self-controlled, grid-tuned, L-C oscillator tuned to one note of the octave between 1,108.7 and 2,093.0 cycles. Oscillation is caused by positive signal feedback from plate to grid through the transformer, which has a turns ratio of 6:1. The trimmer across the grid winding is used for tuning. The output of this oscillator, signal 1, furnishes the top-octave tone for the instrument. It is taken from the voltage divider R to furnish a correct load impedance for the oscillator and a good source impedance for the following keying circuits.

R2 passes part of the oscillator signal to the plate of the first frequency divider and also provides plate voltage for the top oscillator. The low side of the

grid winding of the top oscillator is grounded through the vibrato oscillator grid circuit. The vibrato oscillator, located on the power-supply chassis, furnishes a signal at about 7 cycles, which serves to vary the top-oscillator bias at the same rate. Since the bias affects the frequency, there is a small frequency change at the vibrato rate.

The five frequency dividers which follow the top oscillator are identical in principle, all being blocking oscillators. Like the top oscillator, each is a tuned-grid oscillating circuit. It has no tuning capacitor, however, and its natural resonant frequency, dependent on distributed capacitance of the transformer windings, is around 100 kc. It has a high L-C ratio and a very high grid-leak resistance R1. (Values for R1 and the unmarked capacitor are carefully adjusted at the factory.)

The plus 15 volts applied to the divider cathodes biases them so that they will not normally oscillate. The first wave transmitted through R2 to the first blocking oscillator supplies enough extra voltage to start the divider oscillating at its high resonant frequency.

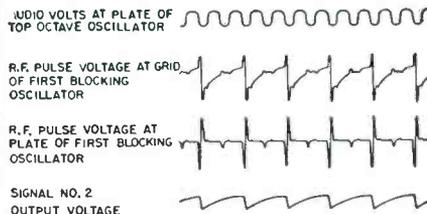


Fig. 5—Waveshapes at various points.

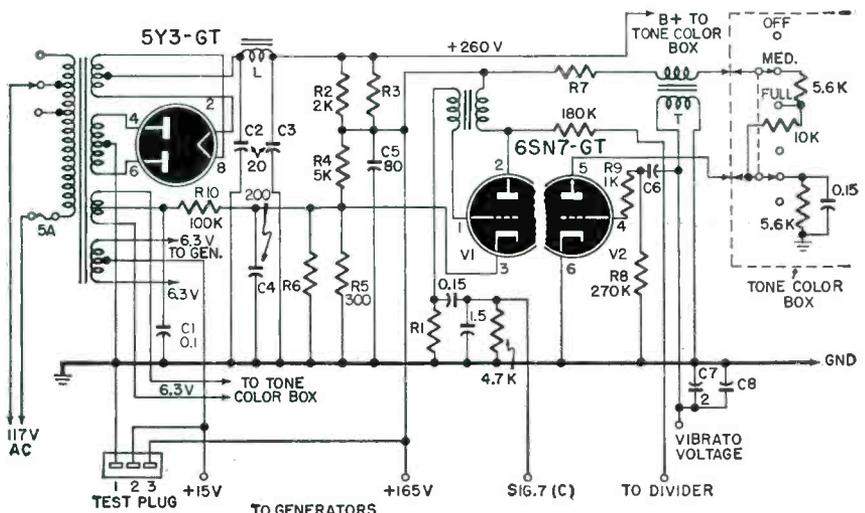


Fig. 6—The power supply also contains bottom C and the vibrato oscillator.

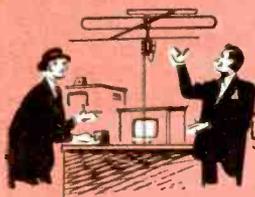


... Seen the Most in hundreds of thousands of TV homes — Alliance Tenna-Rotor is the universal favorite everywhere!

TAKE A DRIVE AROUND ANY TV TOWN—SEE FOR YOURSELF! AND, THAT'S WHY THE ALLIANCE BOOSTER'S SO POPULAR TOO!

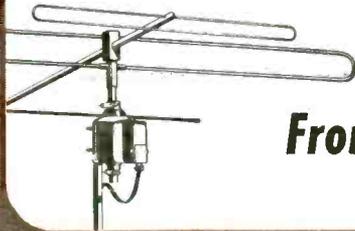


... Seen the Most because they're demonstrated right in the homes of 35 million television viewers! Both the Alliance Booster, Tenna-Scope, and Alliance Tenna-Rotor film Commercials deliver an impact that's terrific — repetitive — continuous! And, they deliver that impulse to buy!

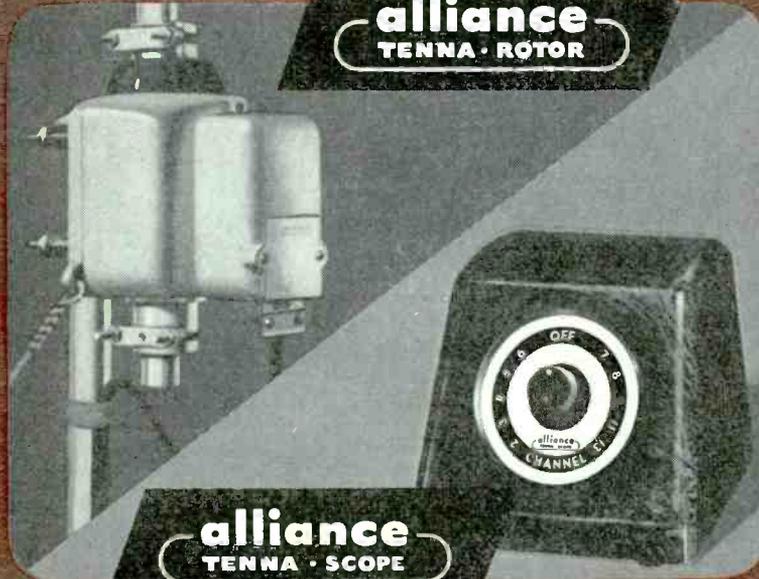


... Seen the Most on the sales counters of smart dealers! IT PAYS TO DISPLAY ALLIANCE PRODUCTS BECAUSE THEY'RE SEEN THE MOST AND SOLD THE MOST!

NOTE: Alliance Tenna-Rotor is a TV Antenna Rotator. Alliance Tenna-Scope is a TV Booster.



From Coast-to-Coast



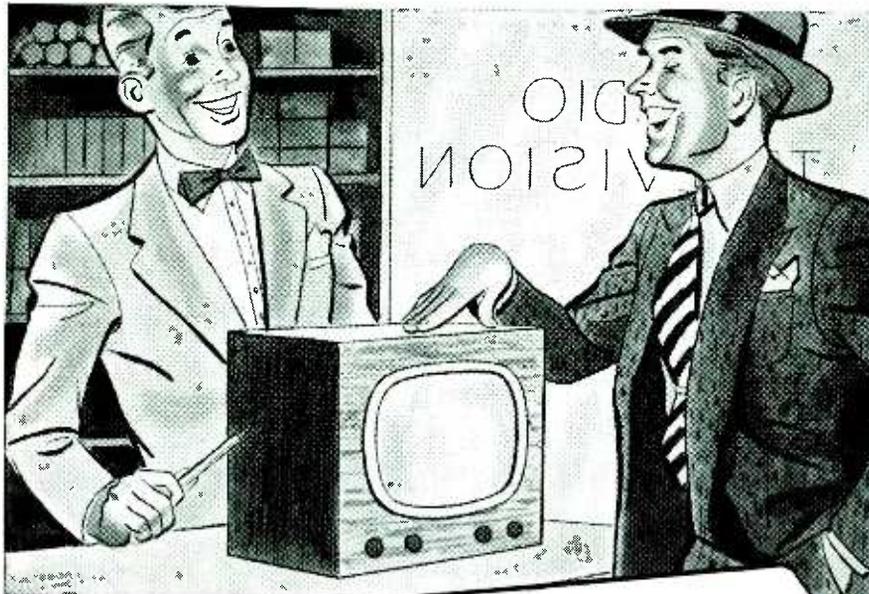
Sold the Most

BECAUSE THEY'RE

Seen the Most

*M*illions of free home demonstrations make sales! Thirty-five million viewers see Alliance TV Films in 12 million homes every week! Both Tenna-Scope, the Alliance Booster, and the famous Alliance Tenna-Rotor enjoy unequalled exposure to viewers in the major TV markets where you sell!

ALLIANCE MANUFACTURING COMPANY • Alliance, Ohio



**THIS MAN IS YOUR
MOST VALUABLE
BUSINESS ASSET!**

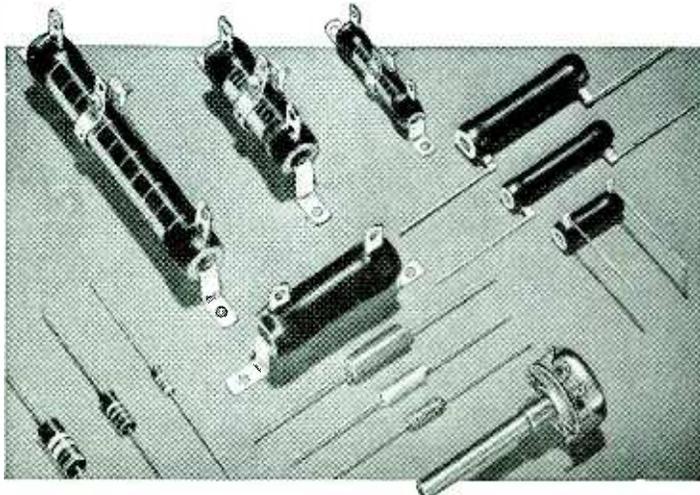
A satisfied customer—the keystone of any successful business! You endanger customer good will when you use “just-as-good” replacement parts on your repair jobs. Use quality OHMITE components—known the world over for dependability among servicemen, amateurs, and design engineers—and you can be sure of customer satisfaction every time. It's just good business!

OHMITE MANUFACTURING COMPANY
4895 Flournoy St., Chicago 44, Ill.

Be Right with **OHMITE**[®]
RHEOSTATS • RESISTORS • TAP SWITCHES



Write
FOR
STOCK
CATALOG



Within a single cycle of this oscillation, however, the grid draws so much current through the high-value grid leak that the triode is biased beyond cutoff, and it stops oscillating. The resulting charge on C1 discharges relatively slowly through R1 until the bias becomes less than cutoff value. Then another wave from the top oscillator starts the cycle over. The number of waves from the top oscillator between successive discharges of C1 depends on the time constant of R1 and C1-C2.

Because the Baldwin uses frequency division, the first divider discharges its capacitance once for every two cycles of the top oscillator. The charge and discharge is in the form of the characteristic sawtooth, which is the waveform appearing across C1-C2. The two capacitors are used as a voltage divider, with the output signal voltage taken from the junction. The output, signal 2, is 1/10 of the voltage appearing across the combination and is at a frequency just half that of the top oscillator.

The five divider transformers are all wound on a common core, as can be seen in Fig. 4. Thus, while there is no electrical connection between the dividers, the top-octave signal fed through R2 into the multiple transformer affects them all in the same way. Each divider must, of course, lock at some submultiple of the top octave.

Fig. 5 shows simultaneous wave-shapes at various points in the generator circuits. The output of the top-octave oscillator is not very complex, but this is unimportant for the later tone-shaping circuits because the fundamentals are so high that most of the higher-order harmonics would be inaudible anyway. The waveform at the plate of the first blocking oscillator shows the effect of the synchronizing waves supplied from the top oscillator—large pulses of high-frequency oscillation. The grid waveform of the blocking oscillator shows the resulting pulse of grid voltage caused by the grid current, followed by the gradual fall of voltage as the capacitance discharges. The signal 2 output voltage taken from the capacitive voltage divider is a simple sawtooth because of the capacitors' filtering action.

The schematic of Fig. 3 shows for several components a range of values rather than a single one. Components so marked are dependent for their values on the particular note to be generated by the chassis in which they are placed.

Power supply

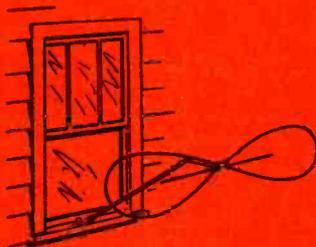
The power supply diagrammed in Fig. 6 also holds the vibrato oscillator and an extra tone generator for the lowest C of the instrument.

The primary of the power transformer is provided with three taps, one of which is selected in accordance with the average a.c. line voltage in the location. The d.c. power is supplied by the 5Y3-GT rectifier and a filter consisting of choke L and capacitors C2 and C3. The filtered 260-volt line is fed to tubes

RADIO-ELECTRONICS for

TEL-A-RAY DOES IT AGAIN . . .

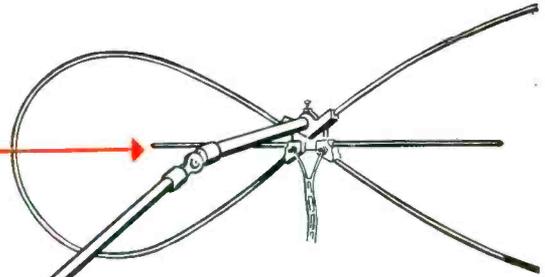
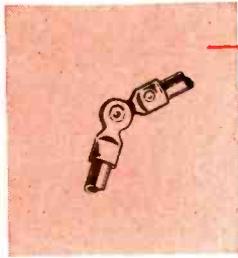
with a more
flexible, simpler,
low-cost, high-
gain Television
Primary Area
Antenna



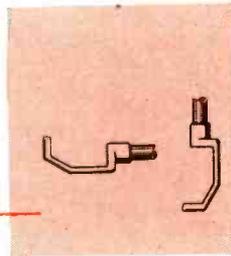
Low Priced!

The Butterfly with the three-way bracket mounting is listed at just \$4.95. For the single bay array, the suggested list price is \$12.95.

1 Easy-acting, quickly locked swivel permits simple adjustment for the best reception.



2 A three-way bracket provides for quick and easy installation on window ledge, the roof, practically any place.



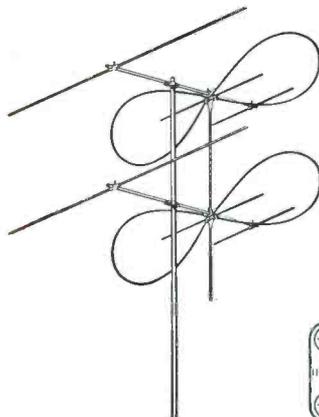
The bracket is punched for installation upright, or at either of the two angles shown. It may be used with either a 300 ohm or co-axial lead in.

Introducing the All-Channel BUTTERFLY Swivel-Positioned ANTENNA . . .

Tel-A-Ray's contributions in the field of long-distance television have been of greatest importance; the area of clear, stable, interference-free TV reception has been tremendously expanded by Tel-A-Ray long-distance antennas and the unique Tel-A-Ray Pre-Amplifier.

Now, Tel-A-Ray announces a brand new development just as important to the improvement of primary TV area reception: the new All-Channel Butterfly Swivel-Positioned Antenna. It can be installed for maximum signal gain right on a window ledge, in the attic, on the roof. It is rugged . . . quality constructed of tough extruded aluminum, guaranteed against wind and weather damage . . . easily adjusted for brilliant television reception.

Never before was a high-gain antenna so fool-proof . . . so flexible and so simple to install and adjust . . . so ideal for use in densely populated metropolitan areas where a number of stations are operating. It comes with a three-position bracket for mounting at right angles, a 30° angle, or upright, with nothing extra to buy . . . or mounted in one, two or four-bay arrays for improved reception in outer service areas and near-station dead spots. Be sure of the best primary area reception by using Tel-A-Ray Butterfly Swivel-Positioned Antenna.



The Butterfly mounted in a two-bay array . . . a low-cost way of getting improved TV reception in outer service areas, or in primary area dead spots.

Tel-a-Ray

ENTERPRISES, INCORPORATED

BOX 332E, HENDERSON, KENTUCKY



TRADEMARK



JACKSON AUDIO OSCILLATOR

*Dependable
for Audio, TV, Lab. use*

Here is a fine instrument you can always depend upon for engineering service or laboratory use. Its tuned fundamental frequency circuit provides a permanently locked calibration. Just look at these specifications:

FULL RANGE—Sine wave, 20 cycles to 200 KC with continuously variable frequency selection. Improved logarithmic calibration means no crowding at either end of dial. Four decade ranges provide over 33 inches of linear calibration.

ACCURACY—Frequency calibration accurate to within 3% or 1 cycle. Complete stability is accomplished with a constant waveform—even at the extreme ends of the range. Spurious "beats" or signals are impossible in the output.

OUTPUT IMPEDANCE—Five values: 10, 250, 500, or 5,000 ohms impedance as well as additional resistive range, all controlled by a

single selector switch.

OUTPUT POWER—500 milliwatts.

OUTPUT CONTROL—Continuously variable from zero to maximum.

WAVEFORM—Less than 5% Harmonic Distortion at all frequencies between 30 and 15,000 cycles.

FREQUENCY CHARACTERISTIC—Plus or minus 1 db between 30 and 15,000 cycles.

HUM LEVEL—Down more than 60 db of maximum power output.

VOLTAGE—For 105/120 volts, 50/60 cycles AC; 60 watts.

DIMENSIONS—13" wide, 9½" high, 9¾" deep. Net weight, 26 lbs. Furnished complete with all tubes. Model 655. Users' Net Price, \$135.00

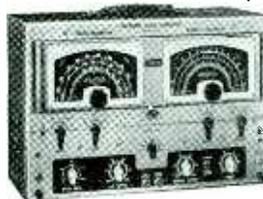


**MODEL CRO-2
OSCILLOSCOPE**

5-inch oscilloscope having a vertical sensitivity of .018 RMS v.p.i. and band width flat within 1.5 db from 20 cycles thru 4.5 Mc. Linear saw-tooth sweep oscillator 20 cycles thru 50 KC per second in 5 steps. A standard voltage provided for determining unknown Peak to Peak potentials of all waveforms. Has reversible vertical polarity and return trace blanking.

**Two Other Fine
Jackson Instruments**

**MODEL TVG-2
GENERATOR**



Sweep Oscillator in three ranges from 2 Mc thru 216 Mc, all on fundamentals. Reversible sweep direction. Sweep width variable .1 Mc thru 18 Mc. Marker covers 4 Mc thru 216 Mc. Crystal Oscillator to use as Marker or Calibrator. Video Modulation from external source for using actual video signal for check, or for use with Audio Oscillator to produce bars for linearity checks.

in the tonecolor box, where there are additional filter sections.

Resistors R2, R4, and R5 form a voltage divider to supply plate and cathode voltages to the generator chassis. The B-plus, 165 volts, comes from the junction of R2-R4, and the cathode voltage comes from R4-R5. The ratio of 11:1 between the plate and cathode voltages must be maintained exactly to keep the oscillators dividing correctly. C5 provides additional filtering for these two voltages. C4 provides still more cathode filtering.

There are three different filament windings on the power transformer. The first is a 5-volt winding for the 5Y3-GT. The next supplies 6.3-volt power for the 37 tubes (see next paragraph) in the generator assembly. The center-tap of that one is connected to the plus-15-volt line so that the cathodes and heaters of the divider tubes are at the same potential and heater-cathode leakage is minimized. The last furnishes power for the tubes in the tone color box. The center-tap is connected to plus 15 volts to minimize hum, and R10-C1 filters the connection so that no signal from the generators is transferred to the tone-color tubes.

The left section of the 6SN7-GT V1 (Fig. 6), is the blocking oscillator for the lowest C of the instrument. Each tone-generator chassis has three tubes and can put out only six tones, one for each octave of the organ. The C series must have an additional note (there are 7 C's in six octaves), so that each manual will go from C to C. The divider is identical to the others except that it receives synchronizing signals from the plate of the lowest C on the C chassis through a 180,000-ohm resistor rather than through the coupling of a common transformer core. The output tone is obtained as in the other dividers.

V2 is the vibrato oscillator. The feedback circuit includes the transformer T, C6, and R8 and R9. The vibrato frequency is largely controlled by the inductance of T and the combined capacitance of C7 and C8. C8 is selected at the factory as a final frequency adjustment, to fix vibrato rate. The grids of all the oscillators are grounded through the grid winding of the vibrato transformer.

The depth (amount of frequency swing) of the vibrato and the on-off control are combined in a 3-position switch in the tone-color box (see Fig. 6). With the switch in the off position, the vibrato oscillator plate is disconnected from the power supply. In the center or medium position, plate current passes through R7 and other components, to the plate of V1. At the same time the second portion of the switch shunts the plate of V2 with 5,600 ohms and 0.15 μ f to lower the frequency somewhat to correspond with the lowered amplitude. In the full position, the 5,600-ohm series resistor is bypassed and there is no shunt. R7 is a permanent current-limiting resistor selected at the factory to limit the maximum vibrato amplitude.

(continued next month)

JACKSON ELECTRICAL INSTRUMENT CO.

"Service Engineered"
Test Equipment

DAYTON 2, OHIO

In Canada:
The Canadian Marconi Co.



New portable radiotelephone, of less weight but longer range, designed and built by RCA engineers.

Longer range, but lighter weight for the "Take-along Radiophone"

You've read how useful our Armed Forces found their portable radiotelephones. Now this indispensable instrument has become even more efficient.

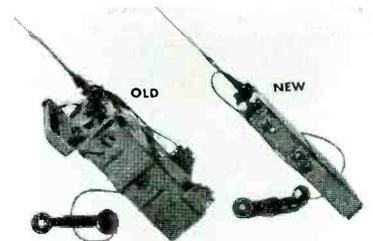
At the Signal Corps' request, RCA engineers undertook to streamline the older, heavier model—which many a soldier of World War II called "the backie-breakie." Following principles of sub-miniaturization—pioneered at RCA Laboratories—every one of its hundreds of parts was redesigned. Models were built, tested, rebuilt, and finally RCA came up with an instrument

weighing only 29 pounds. Its range is double that of the World War II model.

Even more important, under present conditions, RCA was able to beat the most optimistic estimate of the time needed to design such an instrument *by nearly three months*. Signal Corps engineers have called this "A major engineering and production achievement."

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., New York. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20, N. Y.



Comparison with the older model portable radiotelephone shows how RCA engineers have reduced its size with their new instrument.



RADIO CORPORATION of AMERICA
World Leader in Radio — First in Television

Audio Feedback Design

Part XIII—"Fifty to Five Hundred"—the story of an amplifier which should solve many of the public-address man's problems

By

GEORGE FLETCHER COOPER

THIS is the last article of this series on audio feedback design. Unlike the poet, I propose to end, not with a whimper but a bang. The topic of feedback amplifier design is by no means exhausted, even though the reader and the author may be, and I hope to discuss in some separate articles some special topics which do not fit into the framework of this series. To finish up the series, however, I propose to describe an amplifier which has been designed to act as a general-purpose public-address unit. This is not an amplifier for the home, at least not for my idea of a home; it was designed for use in a sound-distribution network, feeding from 5 to 50 loudspeakers in parallel. The particular merit of the design is its flexibility.

For public address work in which a number of loudspeakers are to be driven from a common audio line we are in rather the same position as the power engineer who provides 60-cycle supply at a number of outlets, to drive the radio and the lamps, the vacuum cleaner and the electric heater. He provides us with a fixed voltage from a low-impedance source, so that the level at one outlet does not depend on the load at another. The nominal level of the 60-cycle supply is 117 volts r.m.s. In distributing speech and music to a number of outlets it is very convenient to follow this example, but to use 50 volts r.m.s. as the nominal level. Loads of down to 50 ohms then can be connected to a 50-

watt supply, and loads down to 5 ohms to a 500-watt supply. If 10-watt speakers are used, each is bridged across the line, with a transformer giving a primary impedance of 250 ohms.

The power supply engineer provides a low-impedance source, then monitors the output so that the voltage does not vary more than about 5% as the load is changed. We shall use negative feedback to keep the audio level from varying more than about 20% as the load changes from one loudspeaker to the maximum system load.

Perhaps it is time to explain the title of this particular article. Recently I have had to design a number of public-address systems, of different sizes. Like most ingenious engineers, I am a lazy man, and I decided to design one basic amplifier which could be used as a standard brick in building up any size of public-address system. The standard unit which fitted into the scheme best turned out to be a 100-watt amplifier, using four tubes in the output stage. When operated with only two tubes it is a 50-watt amplifier, the power consumption is halved, and the two tubes which are taken out are not wearing out. When more power is needed, several amplifiers can be connected in parallel without any more precaution than the obvious check of keeping the polarities the same. So far only five have been run in parallel, but there are very few jobs for which more than 500 watts of audio is needed.

This sort of installation is ideal for the ordinary public-address operator, because with 500 watts of amplifier power he either can use it all at the one big show—the county fair, say—or he can put in 200 watts for one job, 100 watts for another, 50 watts in some small hall, and still hold one unit in reserve. The equipment load factor can be kept high, and he never has to use a big amplifier for a small job, where tube wear would eat away his profit.

A "see-saw" circuit

The amplifier circuit is a very simple one, consisting merely of a see-saw phase splitter driving a class-B push-pull output stage. In consequence, the grid input voltage is high, by the usual standards of power amplifiers (we need 15 volts to drive the amplifiers to full power.) This is only a few milliwatts, however, and is easily obtained from a normal 3-stage microphone amplifier. The voltage deliberately was made high so that the long connections used in paralleling amplifiers would not pick up serious amounts of hum and noise. Class B has been getting a bad press lately, and I have read quite a lot about *notch effect*. This is the small step at the crossover point where both sides of the push-pull circuit seem to be cut off. With a bad transformer all sorts of curious effects can occur in the gap, and if the transformer is included in the feedback path, trouble is in store for the designer. A good transformer, which must be symmetrical, seems to prevent all this sort of trouble, and in this amplifier, at any rate, the waveform looks perfectly good until the level is high enough for the peaks to start limiting. I can get the notch effect by using the wrong bias, but so long as I use the values given by the tube maker I have no trouble. Anyone who is suspicious about this might ponder on the number of AM broadcast transmitters which use high-power class B modulators. They do this in Europe, too, where state broadcasting means that low distortion is demanded with all the vigor that any taxpayer puts behind what he considers his rights.

The output tube, which is the key to the amplifier design, is a European type, the Dutch Philips EL34. There just doesn't seem to be any other tube which will do all that this excellent tube will do. It is a 6.3-volt indirectly heated tube, on an octal base, with a transcon-

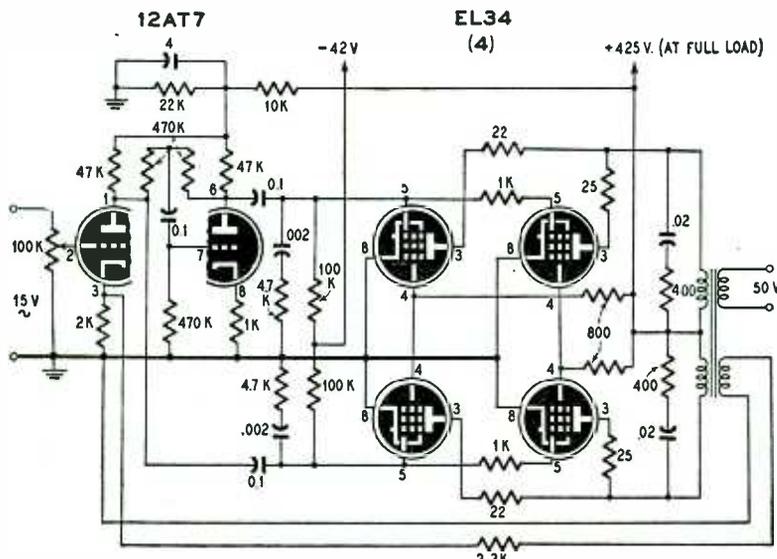


Fig. 1—The amplifier schematic. Feedback is from a special output winding.

RADIO-ELECTRONICS for

NEW PARA-CON ANTENNA COMBINES PARABOLIC & CONICAL PRINCIPLES



Barbara Lee—Rising TV Star, WEWS Cleveland

Sight Sells It

After all, people buy TV sets to enjoy the picture. It just makes sense that the antenna bringing in the best picture brings in the best entertainment and the most customer satisfaction. Hook a Para-Con onto any set and you'll agree—it sells on sight.

Any TV Set Performs Better With a Para-Con Antenna

Every set performs better when conditions are better. Install Para-Con when older sets are starving for a stronger signal. Install a Para-Con when any set is being drowned in a sea of local interference. In the majority of set installations, Para-Con makes both old and new sets perform at their peak. To be on the safe side every time, install the sensationally performing new Para-Con antenna and forestall TV troubles at both the reception and the service end.

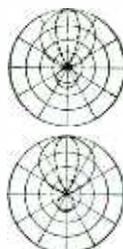
Proved in Thousands Of Installations

Spectacular success has been achieved in practically every installation. Even in locations far removed and in difficult terrain where other more elaborate arrays were tried and failed, PARA-CON aerials not only bring in brighter, clearer pictures but seize and channel in stations where dependable reception has not been possible with an ordinary antenna. Ward's new PARA-CON Antenna has been field tested in thousands of installations . . . proved far and away better.

Singles Out The Stations

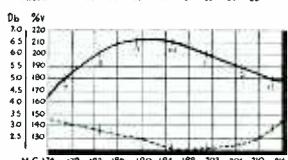
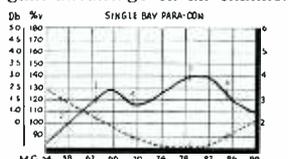
High Front to Back Ratio

The new Para-Con design achieves an unusual capacity to obtain sharp directivity over all the television spectrum. Para-Con principles afford greater power and less interfering noise on each channel.



One Antenna Covers All Channels

The Para-Con antenna reaches out and grasps all channels. The Ward Para-Con has an exceptionally low standing wave ratio combined with a spectacular high gain advantage on all channels.



No Ghost Hunts

No more skeletons in your customer's TV closets. Scientifically determined direct impedance matching characteristics eliminate many ghosts. Para-Con's revolutionary design transfers the maximum power from the antenna to the receiver with a minimum of reflections.

Profit-Wise Dealers

Prefer Para-Con*

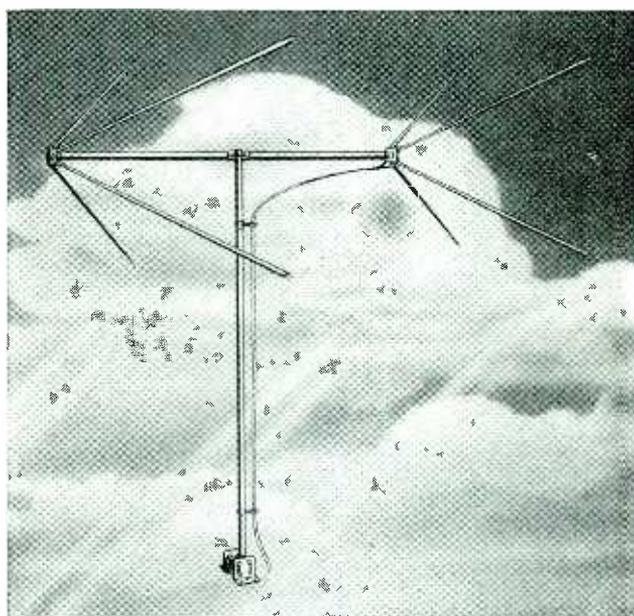
The antenna is one of the most important and critical components of a TV receiver. Nearly 20% of all TV service calls result from faulty antennas. The general all-around, high performance of Ward's Para-Con antenna gives customer satisfaction right from the initial installation. Expensive call-backs due to antennas are slashed. Ruggedly built for long lasting trouble-free service Para-Con withstands winds and weather. Easy to handle and quick to install . . . saves time and expense.

See your distributor for Ward's answer to your antenna problems.

*Trade Mark

Solves 9 out of 10 Installation Problems—Challenges Comparison

Two best features are incorporated into one BEST antenna. The praiseworthy features conical type aerials possess for supplying full audio and full video bandwidth reception are used with a parabolic design that gives the Para-Con a concentration of signals. Para-Con is engineered to concentrate the maximum wave energy on the antenna by providing all-around, unmatched performance . . . perfect picture clarity . . . long customer satisfaction.

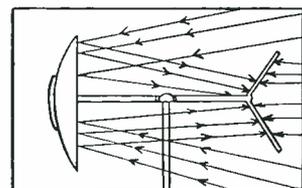


The First In TV To Use Parabolic Principle

Parabolic antennas have long been used in special applications for concentrating weak signals onto driven elements. The brilliant results of Ward Para-Con are now setting new performance standards on all channels and in most every area. Ward's Para-Con Antenna is different. It's new. Now it is possible for one antenna to meet and solve many of the local problems of installation and reception.

Ideal For All Band Fringe Areas

In fringe areas where selection of a number of channels is available, Ward's stacked Para-Con models provide the ideal compromise antenna for maximum results on all bands. Stacked in either two or four bay arrays, the Parabolic design reflectors reach out, gather and concentrate maximum energy on the antenna elements.



Diagrammatic sketch showing how parabolic reflectors gather in and concentrate energy on conical elements.

WARD
PARA-CON
(Combining Parabolic and Conical Principles)
ANTENNAS

THE WARD PRODUCTS CORPORATION, Division of The Gabriel Co.
1523 E. 45th Street, Cleveland 3, Ohio
IN CANADA: ATLAS RADIO CORP., LTD., TORONTO, ONT.

ductance of 10,000 μ mhos and can be run in class B with 0.5 megohm in the grid circuit. The full details are supplied in the appendix. Four of these tubes give a rated power output of 116 watts at 425 volts plate supply, and they can be driven by a single 12AT7. Every other tube seems to need a low-impedance driver stage, or an extravagantly high plate voltage. To us who have to get American tubes in spite of import prohibitions and exchange regulations, it would seem to be simple indeed for an American to get EL34's.

What sort of a performance will this amplifier give? Measured at 10 volts output into a 25-ohm load, the frequency response is flat within ± 1 db from 20 to over 10,000 cycles. At 100 watts the distortion is less than 2% at frequencies between 300 and 1,000 cycles. It is not much more even at 75 cycles, but this is not important, because we do not expect high levels at extreme frequencies.

Negative feedback keeps the output impedance low, so that when the load is disconnected the output line voltage rises less than 20%, which is hardly to be detected by a listener.

The circuit diagram is shown in Fig. 1. The input tube a 12AT7 double triode, operates as a see-saw type phase-splitter. The first triode is a normal amplifier, with 47,000-ohm plate load. Cathode bias is provided by a 2,000-ohm cathode resistor together with the 2,000-ohm feedback resistor, making 1,000 ohms in all. This tube drives the lower half of the push-pull stage directly. The second triode is a unity gain amplifier with a large amount of feedback from plate to grid, which gets its input through the first 470,000-ohm resistor. That, at least, is one way of looking at it. Another way of thinking of the circuit is that the grid drive of the second tube is the difference in the plate swings of the two triodes, so that the center point of the two 470,000-ohm resistors acts as the fulcrum of a see-saw. An exact balance of the plate swings is obtained by reducing the left-hand 470,000-ohm resistor slightly, and if you do want to balance the stage closely you can try something of the order of 5 megohms in parallel with this resistor, or some tens of kilohms in series with the right-hand resistor. The second triode drives the upper half of the push-pull stage. The plate-supply voltage, about 250 volts, for the twin triode is derived from the main high-voltage supply of 425-475 volts by a potential divider and decoupling capacitor.

In the power stage all cathodes are grounded. Plate stoppers of 22 ohms are mounted close to each tube, to kill any parasitic oscillations which may otherwise be produced in the wiring. Each push-pull pair has its own 800-ohm common screen resistor, which is not decoupled. The screen voltage comes straight from the high-voltage supply. Feedback is taken from a special winding on the output transformer. With 42 volts bias on the output stage, a drive of 29.5 volts r.m.s. is needed to give full output.

The output transformer

The design of the output transformer is the first and most important stage in the detailed design of the amplifier, once the framework of the amplifier is fixed. In designing this transformer for class B it is imperative to keep the inductances low and the balance between the two sides good. Balanced

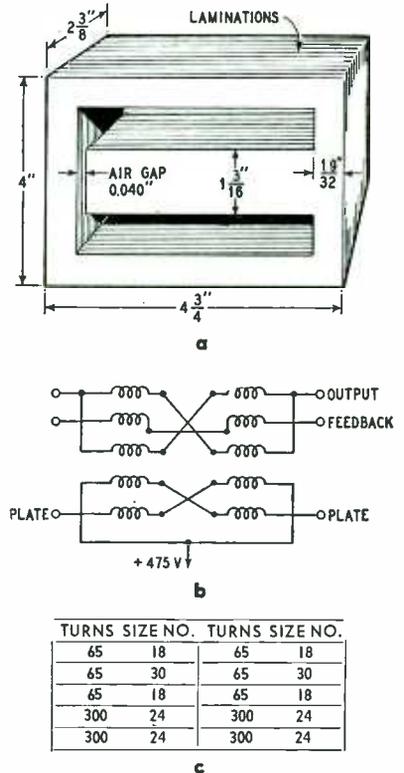


Fig. 2—The output transformer design.

direct-current polarization cannot be assumed, because we do not want to run into instability if a tube fails. We can make use of our assumption that we do not want high levels at low frequencies, and in designing the transformer I have allowed the rolloff at low frequencies to begin at 125 cycles so that the plate load is almost purely resistive down to 300 cycles, while the response is 6 db down at 60 cycles. In these circumstances the high-frequency response of the transformer alone is good up to beyond 30 kc. The inductance is easily calculated: The optimum plate-to-plate load for two tubes is 4,000 ohms, so that for 4 tubes it will be 2,000 ohms. The inductance is $2,000 \cdot 2\pi \cdot 125 = 2.54$ henries. With the core size shown in Fig. 2, and an air gap of .040 inch, ordinary 14 mil silicon steel laminations, we need 1,200 turns to give an inductance of 2.5 h. The exact core size is not critical, of course, and any core of about the same size may be used. Fig. 2-a is a rough drawing of the core.

The plate windings are put on as four separate windings of 300 turns each, two in each section of a twin former. They are cross-connected as shown in Fig. 2-b. A layer of insulation, rated at 2,000 volts, is then applied. This can be supplemented with an ordinary split screen of copper foil.

Over the plate windings three addi-

400
260
260
260

Simpson
volt-ohm-milliammeter that
outsells all others combined.

260
260

tional windings are added on each half of the former. These are output, feedback, and output in that order. No. 18 AWG wire is used for the output windings, while 30 AWG is used for the feedback winding. Each of these six coils contain 65 turns. A series-parallel connection of the output windings and series feedback windings provide very close and balanced coupling between the output circuit and the feedback winding. The window cross-section appears in Fig. 2-C.

Although this sort of amplifier is usually considered to be a 2-stage circuit, which must be stable at low frequencies, it must not be forgotten that the signal in one half of the push-pull stage passes through three stages. Adequate low-frequency stability is obtained by choosing the coupling capacitors so that the response is flat to well below the 125 cycles used in the output transformer design. I have used 0.1 μ f, which with the 100,000-ohm grid resistors gives a characteristic frequency below 16 cycles per second. This value of capacitance can be reduced to 0.05 μ f without danger, and could probably be reduced even more.

High-frequency problems

At the high-frequency end the design presented a lot of difficulties, mainly because of the need for flexibility. An amplifier to work into a normal load is quite straightforward, but if you want to be able to remove the load or to attach a long capacitive cable with no termination the problems of design become much more complicated. Separate responses must be plotted for each possible load condition, and any circuit change must be checked in at least three different plots. To add to the difficulty a really good safety margin seemed to be desirable to meet the special conditions of parallel operation. Two shunt R-C circuits, one in each stage, and duplicated because of the push-pull operation, were found to give satisfactory results. Across each half of the transformer primary a .02- μ f capacitor (1,000-volt d.c. wkg. paper tubular) is connected to prevent the load on the output side affecting the high-frequency response. The phase shift produced by this capacitance is brought back to zero in the dangerous region above 25 kc by connecting 400-ohm resistors in series with each capacitor.

An additional pair of high-frequency response control circuits across the interstage circuits of the amplifier, consisting each of a 4,700-ohm resistor in series with .002 μ f, was found to be necessary. It would probably be sufficient to combine these into a single 10,000-ohm resistor and .001 μ f, leaving out the ground point at the center.

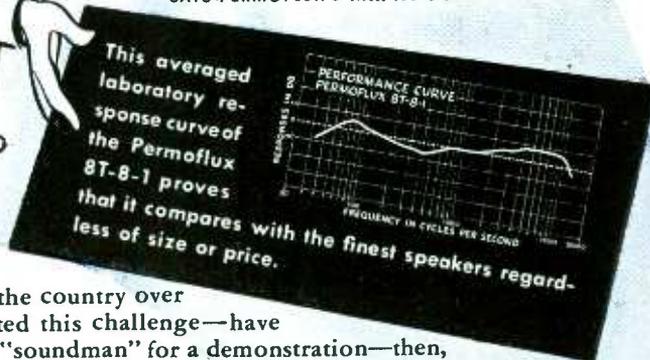
One disadvantage of the stabilizing system used must be noted. At high frequencies all the power can pass into the two 400-ohm resistors across the transformer primary. Any attempt to measure the frequency response at full power will lead to a burn-out here, unless you use unreasonably large resistors. I have used 5-watt wire-wound re-



We CHALLENGE the performance of any 12" speaker with a

Permoflux
ROYAL EIGHT"

SAYS PERMOFLUX'S MR. HY-FY

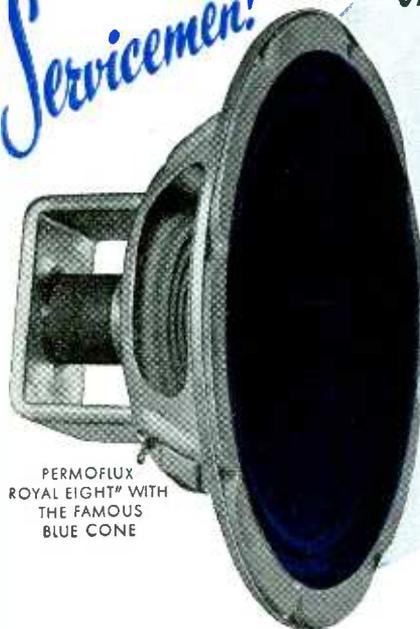


Hi-Fi Fans the country over have accepted this challenge—have asked their "soundman" for a demonstration—then, have installed a Permoflux Royal Eight" in their own audio equipment. Now they possess a magnificent speaker at a reasonable price which reproduces sound with superior sensitivity and fidelity as well as tonal qualities which YOU too will want to add to perfect the excellence of your own equipment.

Send for beautifully illustrated catalog No. J201 to address listed below for further information including a full page devoted to correct baffling of Royal Eight" and other size speakers.



Servicemen!



PERMOFLUX ROYAL EIGHT" WITH THE FAMOUS BLUE CONE

Check These Exclusive Features

Permoflux's exclusive slotted, treated cone gives the following results which makes their speaker comparable to any 12" speaker:

- Soft-suspended cone and extra-large spider provide extended low frequency response.
- Deeper, curvilinear cone greatly extends high-frequency response.
- High permeance yoke increases output.
- 8 ohm—10 watt voice coil.
- Big speaker performance in a small frame allows smaller more economical baffle.

Here's BIG SPEAKER performance—clean, brilliant, musical reproduction but at a sensible price level. Your customers will approve and buy.

ORDER FROM YOUR LOCAL INDEPENDENT PARTS JOBBERS

Hear the AMAZING ROYAL EIGHT" SPEAKER demonstrated at the AUDIO FAIR, November 1, 2, 3. Hotel New Yorker—Suite 640.

TRADE MARK

PERMOFLUX
"SOUND IN DESIGN"

PERMOFLUX CORPORATION
4912K W. GRAND AVE., CHICAGO 39, ILL. • 236 S. VERDUGO RD., GLENDALE 5, CALIF.

Canadian Licensee . . . Campbell Mfg. Company, Toronto, Canada

Look close... and SAVE!

RECEIVING • SPECIAL PURPOSE • TV TUBES

Standard brands such as RCA, Sylvania, Tung-Sol, Ken-Rad, National Union, GE, Motorola, Hytron and Philco. ALL TUBES BRAND NEW—INDIVIDUALLY BOXED. R.M.A. Guarantee.

Buy 10 or more, deduct 5%. Buy 100 or more, deduct 10%.

RECEIVING TUBES					
OZ4A	.59	6AW6	1.85	6Y6G	.84
I4A3	.89	6AX5GT	1.15	6ZY5G	1.54
I4A4P	1.89	6B4G	1.50	7A4	1.05
I4A5GT	.87	6B5	2.24	7A4	1.05
I4A6	.99	6B6G	1.54	7A8	.86
I4A7GT	.98	6B7	1.21	7A7	.86
I4B3GT	1.02	6B8	1.46	7A8	1.26
I4B4	1.59	6B9	1.74	7B4	1.24
I85/255	1.51	6BA7	1.16	7A7	.86
IC5GT	1.09	6BC5	.86	7AG7	1.54
IC8	.74	6BD6	1.35	7B7	1.09
IC7G	.74	6BE6	.82	7B4	.86
ID5GP	.73	6BF6	.89	7B5	1.26
ID7G	.74	6BG6	1.79	7B6	.89
ID8GT	.75	6BH6	.99	7B7	1.26
IF4	.74	6BJ6	.76	7B8	1.26
IF5G	.74	6BK6	1.32	7C5	.89
IF6	.74	6BN6	1.32	7C5	.89
IF7G	.74	6BQ6GT	1.44	7C6	1.19
IG4GT	.73	6BR6	1.79	7C7	1.19
IG6GT	.73	6BU6	1.15	7E5/1201	1.21
IH4G	1.04	6C4	.81	7E6	1.49
IH5GT	.74	6C5	.99	7F7	1.01
IH6GT	1.59	6C6	1.05	7F7	1.01
IJ6G	.74	6C8G	1.55	7H8	1.79
LL4	.74	6C9G	1.55	7H7/1232	1.33
LL4A	1.12	6CDDG	2.29	7J7	1.48
LLA6	1.12	6D6	1.54	7J7	1.48
LLB4	1.12	6D8G	1.94	7K7	1.39
LLC4	1.12	6E5	1.54	7L7	1.39
LLC6	1.12	6F5	.75	7N7	1.05
LLD5	1.12	6F5GT	1.10	7Q7	.89
LLG5	1.12	6F6G	.88	7S7	1.19
LLH4	1.12	6F8GT	.88	7V7	1.19
LLN5	1.12	6F8G	1.04	7W7	1.19
LN5GT	.87	6G6G	1.32	7X7	1.85
LP5GT	1.25	6H6	.79	7Y7	.89
LO5GT	.74	6I6	1.09	7Z5	1.48
LR4	.74	6J5GT	.59	10Y	.65
LR5	.82	6J6	1.09	12A6	.59
LR7	.74	6J7GT	.81	12A7	1.52
LT4	.79	6J8G	1.49	12AH7GT	1.85
LU4	.79	6K5GT	.78	12AL5	1.19
LU5	.78	6K7	.82	12AT6	.65
LV4	.74	6K8GT	.99	12AT7	1.09
LV2	.54	6K7GT	.99	12A7	1.48
1X2A	.84	6K8	1.48	12AV6	.99
2A4	1.46	6K9GT	.88	12B7	1.48
2A4G	.84	6L5G	1.45	12AW6	1.59
2A5	.84	6L6	2.75	12AX7	.99
2A6	.84	6L6A	1.45	12C34	.32
2A7	.89	6L7	1.19	12C44	.44
3A4	.39	6L7G	1.19	12C66	.86
3A5	.39	6N6G	1.19	12C82	1.17
3A5GT	1.39	6N7	1.19	12C87	2.03
3L4	1.85	6N7GT	1.19	12C8	.89
3Q4	.84	6P5GT	1.68	12F5GT	1.26
3Q5GT	1.49	6Q7	.88	12G7	.89
3S4	.78	6Q7G	.88	12J5GT	.79
3V4	.59	6Q7GT	.88	12K7GT	1.54
4T4	.84	6R6GT	1.19	12K8GT	1.54
5U4G	.55	6R7	.90	12K8GT	1.24
5V4G	1.10	6R7GT	1.85	12Q7GT	.70
5W4	.84	6S4	.81	12S7	.58
5W4GT	1.15	6S7G	.94	12S7GT	.77
5X4G	.89	6S8GT	1.32	12S7F	.90
5Y3G	.47	6S7	.68	12S7GT	.99
5Y3GT	.47	6SA7GT	.68	12S7GT	.99
5Y4G	.78	6S8Y7	1.19	12S7F7GT	.92
5Z3G	.89	6S7	.99	2X2-879	.99
5Z4	1.12	6SD7GT	.97	3C24	1.99
6A3	1.59	6S7F	.98	3C27	1.10
6A6	1.08	6S7GT	.98	3B1	1.10
6A7	1.04	6S7	.99	3C28	9.50
6A8	1.10	6S7G	.99	3C28	9.50
6A8G	1.54	6S7	.84	3C28	9.50
6A8GT	1.54	6S7GT	.84	3C28	9.50
6AB4	.96	6S7	.76	3C28	9.50
6AB7	1.39	6S7GT	.76	3C28	9.50
6AC5GT	1.44	6S7	.76	3C28	9.50
6AC7	1.21	6S7GT	.76	3C28	9.50
6AD7G	1.28	6S7GT	.76	3C28	9.50
6AF6G	.86	6S7GT	.86	3C28	9.50
6AG7	1.59	6S7GT	.86	3C28	9.50
6AH6	1.49	6S7GT	.86	3C28	9.50
6AK5	1.49	6S7GT	.86	3C28	9.50
6AK6	1.10	6S7GT	.86	3C28	9.50
6ALS	.68	6S7GT	.86	3C28	9.50
6AL7G	1.85	6T7G	1.89	3C28	9.50
6AQ5	.72	6T8	1.19	3C28	9.50
6AQ6	1.59	6U4GT	1.89	3C28	9.50
6AQ7GT	1.68	6U5	1.40	3C28	9.50
6ARS	.67	6U7G	.44	3C28	9.50
6AS5	.67	6V6	1.19	3C28	9.50
6AS7	5.39	6V6G	.88	3C28	9.50
6AT6	.72	6V6GT	.86	3C28	9.50
6AUSGT	1.59	6W4GT	.88	3C28	9.50
6AUS	.76	6W6GT	.84	3C28	9.50
6AV5GT	1.39	6X4	.74	3C28	9.50
6AV6	.62	6X5GT	.74	3C28	9.50

SPECIAL PURPOSE TUBES					
AB-150	2.75	5AP1	3.25	808	4.69
CE-1	.79	5B1A	4.69	811	1.99
CEP-220	1.29	5CP1	3.69	814	3.90
2K50TAX	1.95	5F21	19.95	815	2.95
CRP-72	.49	5FP7	6.25	818	2.95
DG1290	8.95	6C21	15.50	828	11.50
EL-134	7.95	10Y	.79	829	9.95
FK100	11.95	15R	.69	830B	12.74
HK134	9.95	15R	.69	832	3.69
HR100	11.95	18C	.49	832	5.95
JK72	.49	21A	1.29	837A	12.50
KR72	.49	100TH	7.99	837	3.49
LR105	1.32	2U5B	1.59	837	1.36
VR-105	1.19	21A	1.29	841	2.45
VR-150	1.03	217A	7.95	841	.44
VR-150	1.03	217C	8.89	843	.39
1B27	5.95	218	4.95	845	4.49
1B27	6.95	221A	1.44	849	26.75
1B29	6.95	231D	1.69	851	44.50
1B38	16.95	253A	12.95	864	5.90
2A45	.84	254	12.95	865	1.15
2B22	4.44	247A	10.95	866A	2.99
2C21	1.63	276A	9.75	876	.27
2C24	.32	282B	7.95	877	1.59
2C26	.44	304TH	11.95	905	2.29
2C40	.44	307A	4.65	913	.89
2C43	19.95	307B	4.95	915	1.39
2C51	2.95	393A	5.95	924	1.39
2E21A	.95	417A	8.99	954	.27
2J22	7.90	469	12.00	956	.36
2J25	1.95	471A	2.65	957	.39
2J27	1.95	518	5.95	958A	.95
2J30	29.95	532A	7.95	959	1.21
2J31	24.50	HY615	2.49	966A	1.98
2J32	26.50	702A	6.89	966B	1.48
2J33	26.50	703A	6.89	1613	.98
2J34	47.50	704A	.89	1616	1.85
2K25	23.95	705C	4.99	1619	.38
2K28	29.50	707A	12.95	1624	1.36
2K29	21.95	707B	11.95	1625	.38
2X2-879	.99	708A	4.99	1629	.38
3C24	1.99	713A	.95	1629	.38
3C27	1.10	715A	11.95	1630	.78
3B1	1.10	715B	9.95	1632	.75
3C28	9.50	715C	8.95	1639	1.55
3C28	9.50	715D	18.95	1642	.95
3C28	9.50	718Y	48.50	1642	.89
3C28	9.50	718YD	48.50	1851	1.69
3C28	9.50	720EL	14.99	2050	.99
3C28	9.50	721A	14.99	2051	.99
3C28	9.50	722A	2.49	8012	1.25
3C28	9.50	723A/B	14.95	8020	2.95
3C28	9.50	724A	1.69	FC-17	2.95
3C28	9.50	801A	1.69	FC-104	17.50
3C28	9.50	801B	1.69	9001	1.39
3C28	9.50	804	2.40	9002	1.39
3C28	9.50	804	2.40	9003	1.39
3C28	9.50	805	2.5	9004	.75
3C28	9.50	807	1.74	9006	.39

Special on 5 Tube All American Kit
50L6 - 35Z5 - 12SA7 - 12SA7 - 12SQ7
STANDARD BRANDS \$3.70 per kit
Buy 10 Kits or more and save 5%

TV PICTURE TUBES

Sheldon, Zetka and other Standard Brands	
14BP4	21.95
16HP4	23.95
16KP4	27.75
16GP4	29.95
16LP4A	32.95
17BP4A	22.90
17HP4	24.95
19AP4A	31.95
19EP4	32.95
19DP4	39.50
20CP4	32.95
24AP4	65.50

Battery Operated SIGNAL TRACER KIT
Complete with steel cabinet, speaker, 3 tubes, all other components, and easy-to-follow instructions.
\$9.45 (Less Batteries)

Automatic 3-Speed RECORD CHANGER
— Terrific Special —
Webster or Milwaukee
Plays 12, 10, 7 inch records at 33 1/3, 45 or 78 RPM. Twist-Needle tip (included) for standard or micro-grooved records.
Pick-up arm comes to rest-position after last record has played. New and in original factory cartons.
List \$47.95
Our Price **\$23.40**
3 for \$65.00

Terms: 20% cash with order, balance C.O.D. Prices F.O.B. N.Y. City warehouse. Min. order \$5. (Allow for postage)
NOTE: Availability of merchandise subject to prior sale. Prices subject to change without notice.

STEVE-EL ELECTRONICS CORP.
Dept. E-11, 65 READE ST., NEW YORK 7, N. Y. CORlandt 7-0086 * Free Catalog.

sisters, which do not even get warm under normal working conditions. The only other resistors with any power in them are the 800-ohm screen resistors, which should be 2-watt types.

The physical layout can follow the circuit diagram. The only precautions are to keep the stages separate, and to keep the plate stopper resistors in the output stage near the tubes. Do not forget that the output line must carry 2 amperes.

Important details

The power supply unit is required to provide 6.3 amp at 6.3 volts for the heaters, a plate supply of about 550 ma at full load, dropping to about 100 ma at no input, with a smoothed voltage of 425 volts at full load. In addition a smoothed grid supply of 42 volts is needed. For the grid supply a germanium, copper oxide, or selenium rectifier may be used, and it is a good idea to take this and the heater supply from one transformer. The grid-bias voltage can be used to operate a relay in the high-voltage supply transformer primary, so that you cannot get plate voltage without bias. More trouble, true, but so is paying for new tubes if the bias supply fails. The bias must be adjusted to 42 volts with a resistor in the bias-rectifier circuit. The high voltage is supplied by a 550-0-550-volt winding and a pair of 5Z3 rectifiers. It is a good idea to make it three 5Z3's, to keep the system working through a failure. A choke input filter, using a single 10-μf capacitor, provides sufficient smoothing, and the regulation is such that the voltage at no load rises to 475 volts.

An additional continuity of service precaution is the connection of a second 12AT7 in parallel with the one shown.

When used as a 100-watt amplifier all tubes should be in place, and the load impedance should be 25 ohms. It is, of course, quite in order to work with higher load impedances, but you will not get 100 watts, but only (50)²/R watts, where R is the load impedance. If you need only 50 watts, pull out two of the EL34 tubes and one of the rectifiers, if you are using three. That is all. If you need 200 watts, connect two amplifiers in parallel, after checking that they are set to have the same gain. The load impedance may then be 12.5 ohms. And so on for higher powers.

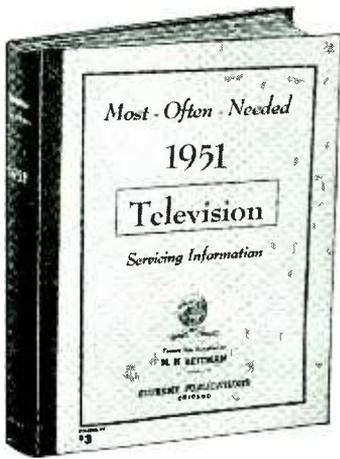
It is with some regret that I come to the end of this series of articles. I have endeavored in this series to provide a sound fundamental background for the designer and constructor of feedback circuits, without exceeding the rigid limit of mathematics set by the editor. In sorting out my knowledge I myself have learned quite a lot. I can only hope that the readers have found the series of some value.

Appendix.

Philips EL34 tube: Heater:	6.3 volts, 1.5 amps.
a.c. or d.c. Class B operation, 2 tubes:	
Common screen resistor:	800 ohms
Bias	— 42 volts
Grid drive	0 29.5 volts
Supply voltage	425 425 volts
Optimum load	4,400 ohms
I _p	2 x 20 2 x 106 ma 212
I _{g2}	2 x 2.4 2 x 28 ma 56
Power	0 58 watts
Distortion	— 4.5%

—end—

New Supreme 1951 TV Manual



New 1951 Television Manual

This newest giant volume of the series covers 1951 factory data on all popular television sets of all makes. There are circuit explanations, 192 pages of alignment procedure, test patterns, response curves, many pages of wave forms, voltage charts, service hints, and dozens of large double-page circuit diagrams. Manual style binding. At your parts jobber or by mail, special price, only... **\$3**

1950 TV Manual. Includes service information on all popular TV sets of all makes from Admiral to Zenith. Large size: 8½"x11", plus ten mammoth 11x15" blueprints. **\$3**

Amazing bargain at only.....

1949 TV Manual. Similar to the volume listed above. Has 192 extra-large pages, plus 9 double-spread giant blueprints. **\$3**

To order see coupon below, only.....

1948 TV Manual. Earlier volume has material on all popular TV sets of this period. Large size: 8½"x11". Remarkable value. **\$3**

Including 8 fold-out blueprints, only.....

1947 FM and TV Manual. Data covers all needed FM and television sets including popular R.C.A. 630TS. Size: 8½"x11". **\$2**

Service material on 192 pages. Only.....

INCLUDES ALL POPULAR SETS

The new 1951 TV manual has complete service material on every popular television set of every important manufacturer. Here is helpful, practical, factory-prepared data that will make servicing and adjustment easy for you. This new giant manual, as well as the previous four volumes listed at left, has complete circuit diagrams, alignment facts, test patterns, response curves, service hints, voltage charts, waveforms, recommended changes for improvement, and many double-spread diagram blueprints. Here is your TV service material to help you become an expert, and at only \$3 and \$2 per manual.

FIND—FIX ALL T-V FAULTS

Use the new 1951 TV manual and the earlier volumes (see listing at left) to help you with all TV repairs. Cuts hour-wasting jobs to pleasant moments. Use test patterns for quick adjustment, or look up probable cause of trouble in the pages of hints after simply observing fault in video picture. No equipment needed with these tests. Or use your voltmeter and compare values with many voltage charts included. With an oscilloscope you can get waveforms similar to hundreds illustrated using test points suggested and in a flash locate what used-to-be a hard-to-find fault. Order at our risk for a 10-day trial. Use coupon at bottom of page.



All Supreme Publications TV and Radio manuals are compiled by M. Beitman, radio engineer, teacher, author, and serviceman.

AMAZING BARGAIN OFFER

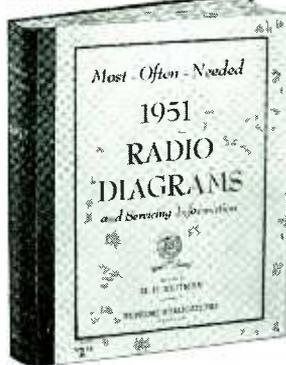
The new 1951 TV service manual is the most remarkable value offered by Supreme Publications in their 18 years of business. This giant-size television servicing manual at only \$3, or the four TV volumes for previous years for only \$3 and \$2 each, are amazing bargains and defy competition. There is nothing else like them. Each manual is a virtual treatise on practical television repairs. By normal standards, each such large manual packed as it is with practical facts, hundreds of illustrations, diagrams, charts, photographs and expensive extra-large blueprints, should sell for \$10—but as SUPREME special values they are priced at \$3 and \$2 each. Only a publisher who sold over one million television and radio manuals can give such bargains because of tremendous volume-sales.

YOURS TO USE ON TRIAL

Be ready to repair any TV set by having in your shop all five Television Manuals described at left. Or try the new 1951 TV manual to see what an amazing bargain you get for only \$3. Order on no-risk trial by using coupon at bottom of page. Also read below about Supreme RADIO DIAGRAM MANUALS.

SUPREME RADIO MANUALS

Just Out



New 1951 Radio Diagrams

Now you can benefit and save money with Supreme amazing manual scoop. This one giant volume has all the service data you need on all recent radio sets. Here you have clearly-printed large schematics, needed alignment data, parts lists, voltage values, and information on stage gain, location of trimmers, and dial stringing illustrations. This is the help you need to find tough faults in a jiffy. The new 1951 radio manual is a worthy companion to the 10 previous volumes used to an advantage by over 132,000 shrewd radio men.

RADIO-ELECTRONICS HOME-STUDY COURSE



NEW AMAZING OFFER

Here is the most amazing bargain in radio training. The price scoop of the year. For only \$3.95 (full price) you receive a complete radio-electronics course of 53 extra-large, fact-packed lessons. Covers every topic of radio fundamentals, practical servicing, TV, FM, audio, and industrial electronics. Published in three giant books, bound in one super-mammoth volume. Printed in 1951. Compares lesson by lesson with the best \$200 home-study correspondence courses; but here you get all lessons at one time at the unheard-of bargain price of only \$3.95; nothing further to pay or buy.

THREE COURSES IN ONE

The complete training of these 53 large lessons is really THREE distinct home-study courses on: (1) Practical Radio, (2) Applied Electronics, and (3) Radio Servicing. The lessons are clear, practical, easy to master and use. Early lessons will make fundamentals clear even to a beginner, while other lessons will give you the practical "know-how" of an expert. Notice in the illustration of the manuals, at top, that the wide column on each page has the text, while the narrow column contains pertinent explanations usually supplied by a teacher. These teacher comments guide you over the hard parts, stress points of importance, tell you how to perform practical experiments using any home radio. There are hundreds of review self-testing questions, 427 drawings, pictures, diagrams, and over a thousand service hints.

YOURS TO TRY FOR 10 DAYS

Just send no-risk coupon, at right, and receive the 3-volume COURSE for a free examination. Use all this material a full 10 days in your own home. Read a few lessons, examine the hundreds of illustrations, apply some of the hints to fix a couple of radios. Only then, if you are pleased, the complete course of 53 lessons. In three volumes, is yours to keep for only \$3.95, full price; otherwise, it costs you nothing for the use and examination. Fair enough? The available quantity is limited. This is the most amazing offer ever made by any school or publisher. Please rush coupon or see your jobber while your special price is still only **\$3.95**

Supreme Publications

Sold by all Leading Radio Jobbers

NOVEMBER, 1951

BIGGEST BARGAIN IN SERVICE DATA

Wise servicemen know that Supreme Publications manuals supply all material needed at the lowest prices. For the remarkable bargain price (only \$2 for most volumes) you are assured of having on hand needed diagrams and all other essential repair facts on almost all sets you will ever service. Every popular radio of all makes, from old-timers to new 1951 sets is covered. Select manuals wanted, see list below.

SUPREME RADIO MANUALS for PREVIOUS YEARS



1950 1949 1948 1947 1946 1942 1941 1940 1939 1926-1938
SUPREME Most-Often-Needed RADIO DIAGRAMS
 Each Manual only \$2 ('50, '49, \$2.50); 192 pages of diagrams, alignment data, voltage, values, parts lists, and service hints; large size, 8½" x 11". To order see coupon below. **RADIO DIAGRAMS 240 PAGES PRICE \$2.50**

NO-RISK TRIAL ORDER COUPON

SUPREME PUBLICATIONS, 3727 W.13 St., Chicago 23, ILL.

Send on trial the manuals checked below and at right. You guarantee complete satisfaction.

- New 1951 Television Service Manual, only... \$3.
- 1950 Television Manual, \$3. 1949 TV, \$3.
- 1948 TV Manual, \$3. 1947 TV & FM, only \$2.
- Radio & Electronics Course, 53 lessons..... \$3.95
- I am enclosing \$..... Send postpaid.
- Send C.O.D. I am enclosing \$..... deposit.

Name:

Address:

- RADIO Diagram Manuals**
- New 1951 Manual, \$2.50
 - 1950 Radio
 - 1949 Manual } **\$2.50**
 - 1948
 - 1947
 - 1946
 - 1942
 - 1941
 - 1940
 - 1939
 - 1926-1938 Manual, \$2.50
- PRICED AT ONLY \$2 EACH**

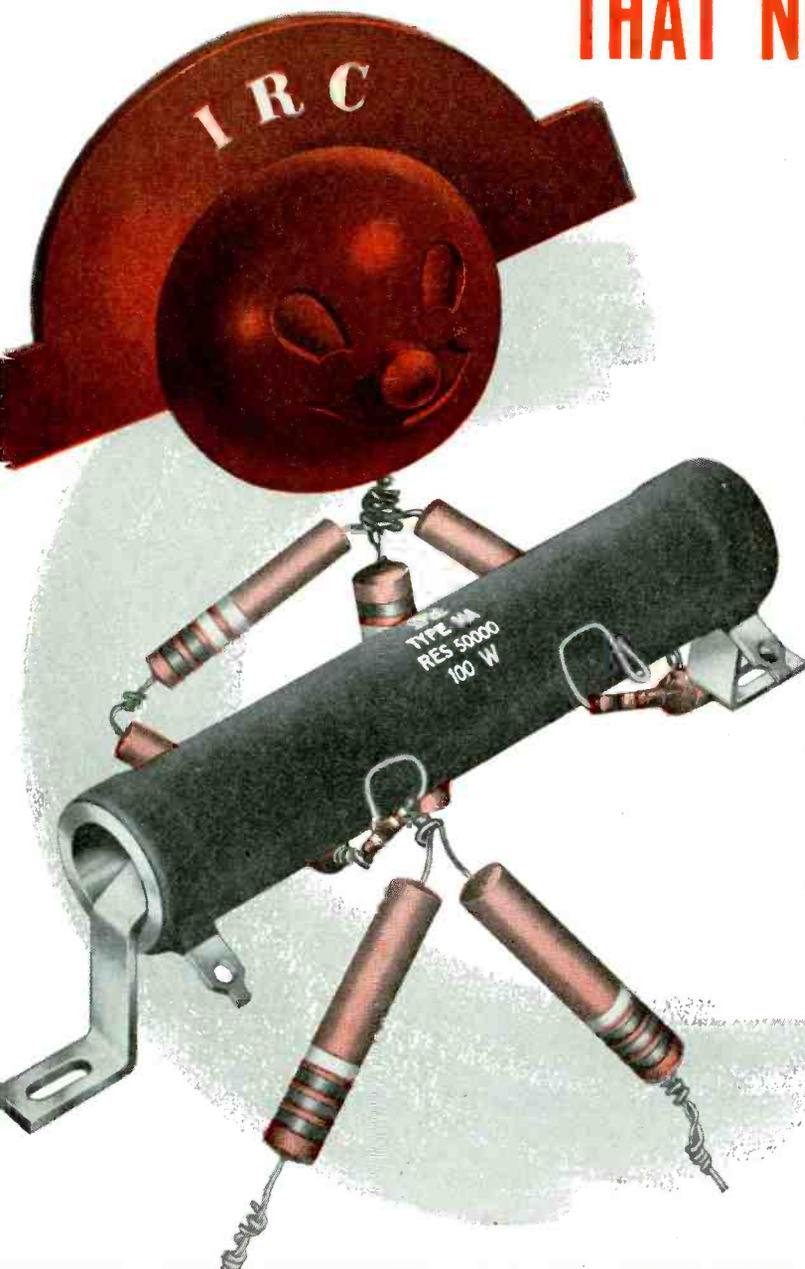
HERE'S THE POWER RESISTOR THAT NEEDS NO DE-RATING

IRC PWW's Carry Full Wattage in **ANY** Range!

What is the function of this type of resistor? To handle POWER!

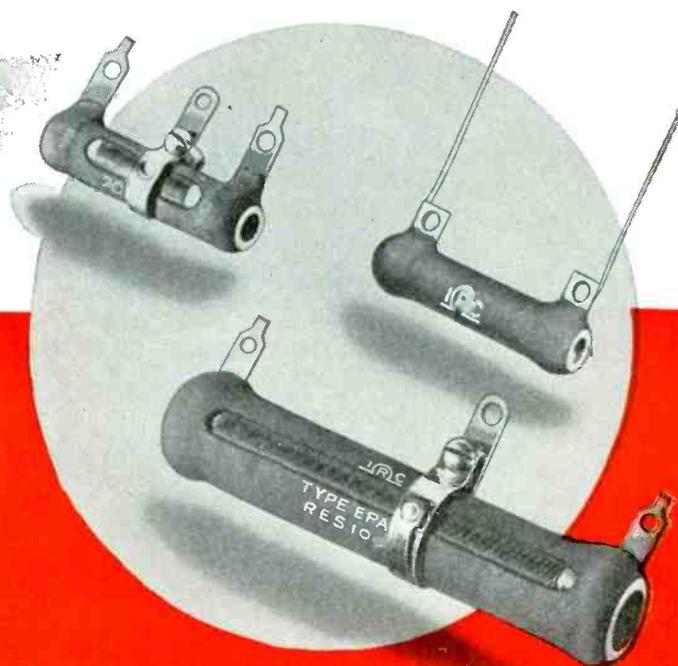
Power rating of many power resistors is derated sharply—as much as 75%—in the higher resistance values—to prevent voltage breakdown between winding turns and resultant turnouts.

IRC PWW's need no derating because of resistance value! These rugged, full size power wire wounds carry full wattage rating—even in the highest stock resistance values—without failure. Ample core sizes produce larger heat-radiating surface areas and the special rough, dark coatings dissipate heat fast—so IRC PWW's operate at lower temperatures. Low temperature processing preserves fine wires and prevents turns of windings from shifting—reduces likelihood of hot spots and voltage breakdowns.



THERE JUST ISN'T A BETTER POWER WIRE WOUND FOR CONTINUOUS OPERATION AT FULL RATED POWER FOR LONG, DEPENDABLE TROUBLE-FREE PERFORMANCE . . .

You can get fixed and adjustable IRC PWW's in a full range of power ratings, resistance values, sizes and terminal types . . . adaptable to any rig or use. In adjustable types, contact is made by a metal band which can be positioned anywhere along the resistor. By using additional bands, various taps can be obtained—permitting the resistor to be used as a voltage divider. Tolerances: Fixed types—standard tolerance $\pm 5\%$ for 50 ohms and over, $\pm 10\%$ below 50 ohms. Adjustable types—standard tolerance $\pm 10\%$.



For exacting, heavy-duty applications—high-voltage bleeders, bias supply, grid and filament-dropping resistors—leading technicians and industrial users have specified IRC PWW's for more than 15 years.

COMPARE IRC PWW'S WITH ANY OTHER POWER RESISTOR

Feature by feature, IRC PWW's *prove* their superiority over ordinary resistors. PWW's give balanced performance in every characteristic. Here's why...

Uniform, High-grade Alloy Windings. Unusually rigid specifications govern resistance value, diameter, elongation, and weights. Resistor elements are wound with uniform spacing and tension, and wire is secured to terminal electrically and mechanically.

Rugged Steatite Winding Forms. Carefully selected steatite tubes have superior mechanical strength, withstand sudden variations in temperature, are impervious to moisture.

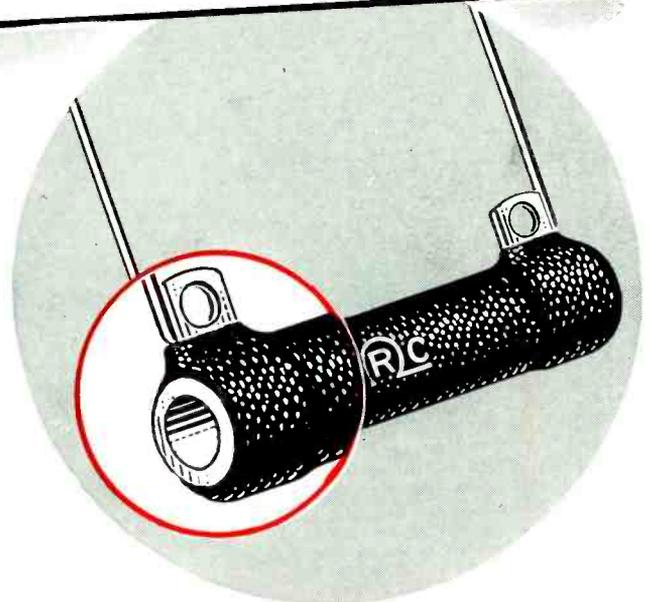
Special Heat-dissipating Cement Coatings. IRC's exclusive dark, rough coatings are used for 3 specific reasons: (1) They can be processed at lower temperature, which does not harm the wire windings or cause them to shift. (2) The rough surface provides a larger area for faster heat radiation. (3) The porous cement coatings do not trap moisture which might cause windings to corrode.

Adjustable Bands. IRC Adjustable PWW's are fitted with adjustable bands specially designed to maintain constant pressure. Bands feature a stainless steel spring with a silver contact button, which is oxidation free and cannot corrode to cause open circuits or high resistance at point of contact.

Full Size for Cooler Operation. Ample size is essential to fast heat dissipation. Because IRC PWW's are full-size units, they operate at much lower temperatures. This cooler operation assures long life for the resistor, and also safeguards critical components mounted nearby.

UNIQUE LUG-AND-LEAD DESIGN GIVES FLEXIBILITY IN MOUNTING

An exclusive feature of IRC 10- and 20-watt Power Wire Wound Resistors is the combination lug-and-lead terminal for flexibility in mounting. In tight space applications, lugs may be cut off without disturbing lead, and in other installations the leads may be removed. Leads are a full 1 3/4" and all terminals are hot tin dipped for easy soldering.



INTERNATIONAL RESISTANCE COMPANY

401 N. Broad Street, Philadelphia 8, Pa.

Wherever the Circuit Says 

In Canada: International Resistance Co., Ltd., Toronto, Licensee



SEND TODAY

INTERNATIONAL RESISTANCE COMPANY

417 N. Broad St., Phila. 8, Pa.

Please send me full information on IRC Fixed and Adjustable Wire Wound Resistors,

NAME

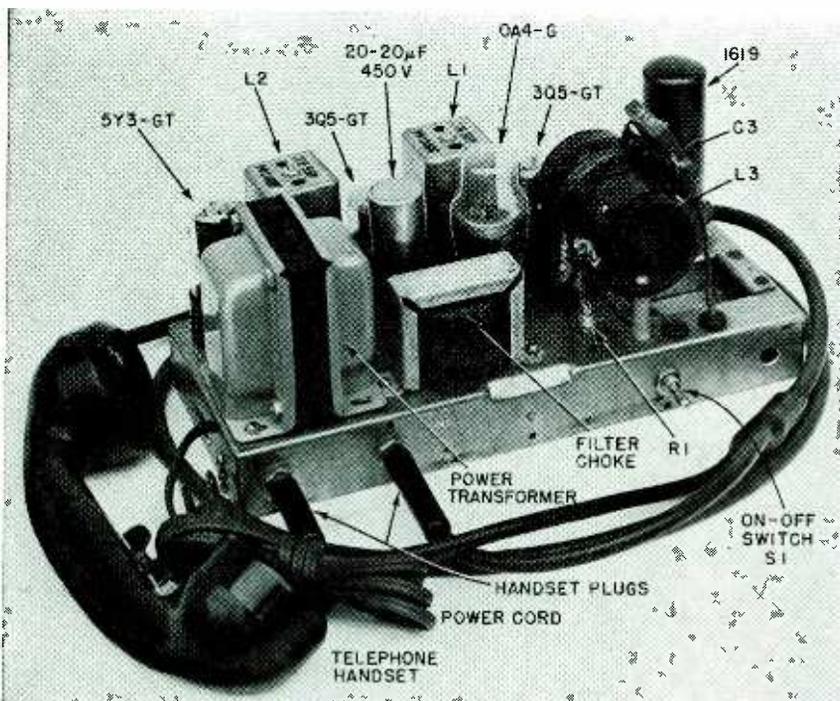
COMPANY

ADDRESS

J. F. ARNDT & CO., ADV. AGENCY

Versatile Intercom Unit "Rings Up" Called Party

By BOB WHITE



The complete equipment is mounted on this easily transported chassis. Note especially construction and mounting of the oscillation transformer L3.

A PORTABLE short-range carrier-current telephone system can be a useful thing to have. Two units were constructed using this principle. Each unit is plugged into a standard power outlet and is then ready for operation without additional connecting wires.

When the power switch is turned on in one unit, an alarm is sounded in the other. Telephone handsets are used and simultaneous operation of receivers and transmitters provides duplex operation. The warmup period for each telephone unit is less than one second because tubes with directly heated cathodes are used. Each unit uses five tubes in a circuit that includes an alarm, a power supply, a receiver, and a modulated transmitter built on a single chassis measuring 11 x 4½ x 5 inches.

Signalling

A type 0A4-G cold-cathode, gas-filled tube operates an alarm relay when a carrier-current signal of a certain frequency is impressed across the series-resonant circuit including C1 and L1. L1 was made from a standard 455 kc i.f. transformer; one of its coils was removed for later use by careful heating to soften the wax. The trimmers provided with the transformer are shunted across the remaining coil to tune the series circuit. (See Fig. 1.)

A sufficient voltage is developed across the coil (when a carrier-current signal of the correct frequency is applied) to initiate a glow discharge between the starter-anode and cathode through the 100-µf coupling capacitor. The potentiometer R1 is adjusted to provide an a.c. bias so that less r.f. voltage is required for conduction of the tube. When the starter-anode ionizes the gas, conduction from the main anode to the cathode occurs and a current flows through the relay coil.

Since the cathode is so much larger than the anode, a greater flow of electrons can take place toward the anode than toward the cathode with the impressed a.c. so that a rectified voltage is produced for the d.c. relay. The 0.2-µf capacitor shunting the relay coil eliminates relay chatter. The relay contacts can control an alarm bell or signal lamp.

If desired, the relay mechanism itself can serve as a buzzer by merely removing the shunting capacitor. With the contacts in vibration the controlled output should not be used because of the arcing that would result. With S1 in the off position the 0A4-G circuit will signal when a carrier-current signal is

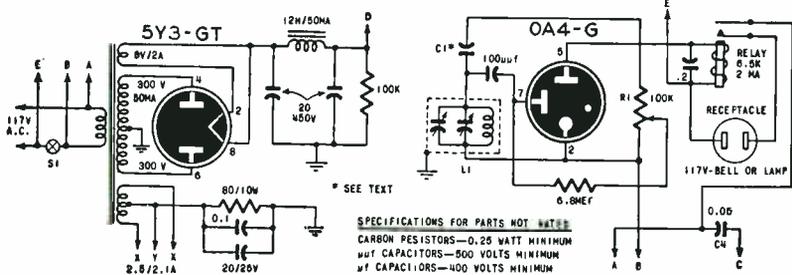


Fig. 1—The alarm or ringing circuit and power supply appear in this diagram.

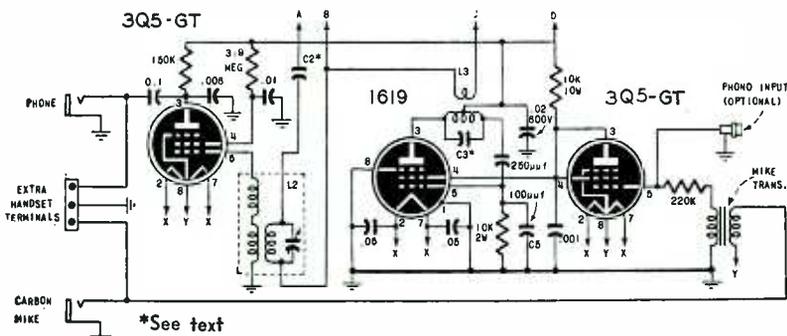


Fig. 2—Transmitter-receiver. Leads with same letter are connected together.

present. With S1 on, the 0A4-G circuit is shunted and inoperative. A toggle switch was used by the author, but a micro-switch operated by hanging up the telephone handset could be used.

Power supply

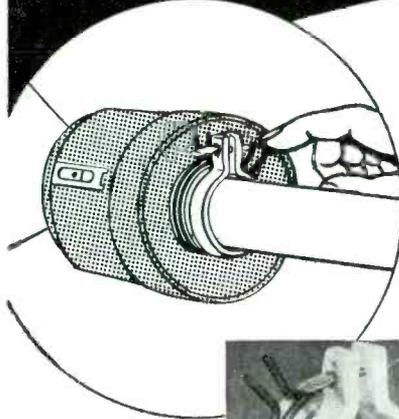
When S1 is turned on, the power transformer is energized and in less than one second the four directly-heated-cathode tubes become operative. The 5Y3-GT acts as a full-wave rectifier. Two plates are connected to the ends of the high-voltage winding as is standard practice. The 20- μ f capacitors and 12-henry choke provide adequate smoothing of the direct current for the carrier-current receiver and transmitter. The 100,000-ohm bleeder resistor aids voltage regulation. The 80-ohm carbon resistor connected from the center-tap of the 2.5-volt filament winding to ground carries the current from the cathode circuits of the detector, modulator, and oscillator tubes and develops a small potential of about 2 volts. This acts as grid bias for all three stages and also as a d.c. source in the carbon microphone circuit. This resistor is shunted by two capacitors to prevent audio oscillation and loss of gain.

The receiver

The receiver uses a single 3Q5-GT, see Fig. 2, in a grid-bias detector circuit. The tuning coil L2 was made from a 455-kc i.f. transformer plus the winding removed in making L1. The added winding was slipped next to one of the two coils in the can. Then, the trimmer capacitor was disconnected from the coil closest to the added winding and these two windings were joined in series so that their magnetic fields aid each other.

The trimmer across the primary winding does the tuning. This primary winding was moved closer to the secondary coils for greater transfer of energy. The primary which is connected

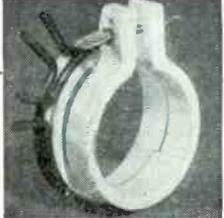
**FOR PERFECT PICTURE CENTERING
IN ELECTRO-STATIC TUBES**



**Use the NEW
PERFECTION
Kine-Center**

Here is the simplest of all centering devices for the new electrostatic tubes. It is also the most efficient and positive—as your own tests will prove.

- **Quickly Mounted.** Slip the Kine-Center over the tube neck and tighten the holding screw. It stays firm. No wobble. No wiggle.
- **Finger-Tip Control.** Picture is centered by rotating the two rings either independently or together.
- **Positive Centering.** Once adjusted, the rings stay put.
- **No Distortion of Focus** as with many other centering devices.



MORE EFFICIENT
Rings are closer to deflection yoke (the most effective operating area) and to the tube neck. They are stabilized magnetically.

Order today from your supplier!

PERFECTION ELECTRIC COMPANY
2635 South Wabash Avenue, Chicago 16, Illinois
MAKERS OF PERFECTION SPEAKERS AND TELEVISION COMPONENTS



ON-THE SPOT BATTERY RECORDER
WALKIE-RECORDALL 8 lb. miniature BATTERY RECORDER-PLAYBACK
Continuous, permanent, accurate, indexed recording at only 5c per hr. Instantaneous, permanent playback. Picks up sound up to 60 ft. Records conferences, lectures, dictation, 2-way phone & sales talks; white walking, riding or flying. Records in closed briefcase with "hidden mike"! Write for details.

MILES REPRODUCER CO., INC.
812 BROADWAY Dep't RET1 NEW YORK 3, N. Y.

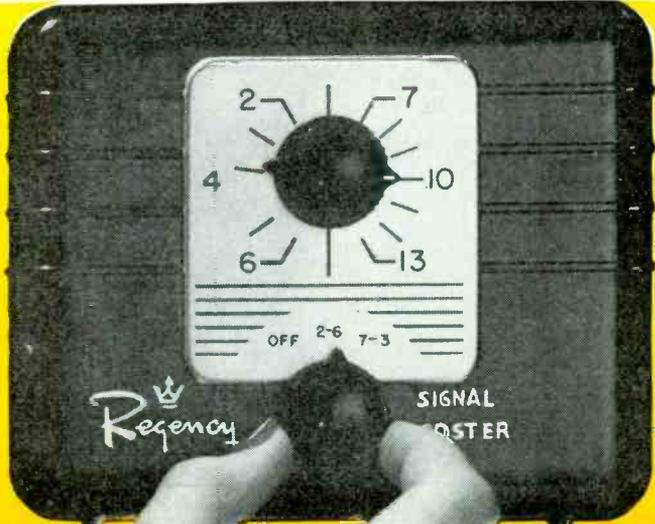
Every RADIOMAN can use these SERVICE HINTS!
Valuable Manual Yours—FREE
Write today—no obligation

Every page of "How to Simplify Radio Repairs" is packed with on-the-bench, practical ideas.

FEILER ENGINEERING CO. Dept. 11RC1-1
8026 N. Monticello Ave., Skokie, Ill (Suburb of Chicago)

Largest Selling Booster

AT ANY PRICE !



Regency



Sensationally NEW for 1952!

MIDWEST TELEVISION

A Magnificent New Line of Beautiful CONSOLES and Complete CHASSIS featuring This MAMMOTH

20-Inch
Rectangular
PICTURE TUBE

FACTORY-TO-YOU



"CONSTELLATION"
20-Inch Television Console

Powerful
20-Inch MIDWEST
TELEVISION CHASSIS
For Easy Installation
In Your Own Cabinet

**EASY TERMS
FACTORY-TO-YOU**



Video Grand
**20-Inch TELEVISION-RADIO-
PHONOGRAPH CONSOLE**

A luxurious instrument that offers the Mammoth 20-Inch Rectangular Picture Television, plus powerful AM-FM Radio, plus 3-Speed Automatic Intermix Record-Charging Phonograph in a beautiful mahogany veneer console.

Also—Powerful New 1952 World-Ranging
MIDWEST Series of RADIOS
For Beautiful Consoles and Complete Chassis



An entirely new line of radios featuring the powerful Series 16 five wave band AM-FM Radio Chassis and the magnificent Symphony Grand Radio-Phonograph with 3-Speed Automatic Intermix Record Player.

Easy Terms



WRITE or PHONE
For This NEW 1952

**FREE MIDWEST
TELEVISION
RADIO CATALOG**

If You Live In One of These Cities
Phone and Ask for Your Catalog

- NEW YORK Murray Hill 2-6810
- CHICAGO State 2-5600
- PITTSBURGH Grant 1-0609
- CLEVELAND Prospect 1-7450
- DETROIT Woodward 3-1233
- ST. LOUIS Grand 1161
- PHILADELPHIA Locust 4-1035

or Send Coupon Below

WRITE IN NAME AND ADDRESS (PLEASE PRINT) ON COUPON OR 1c POSTCARD

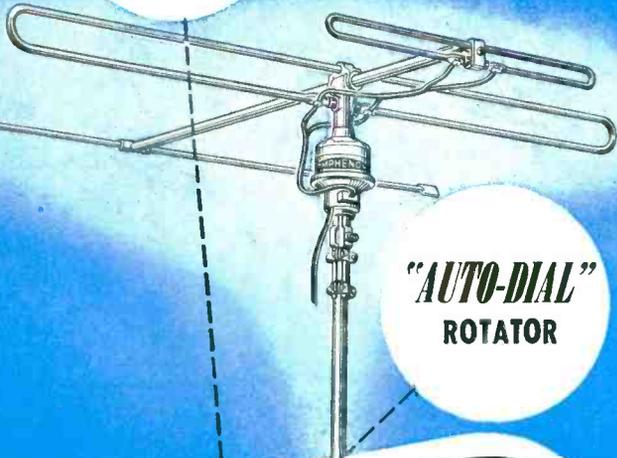
MIDWEST RADIO & TELEVISION CORP.
Dept. 384, 909 BROADWAY • CINCINNATI 2, OHIO

Please send me your new FREE 1952 Catalog.

NAME _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

MIDWEST RADIO & TELEVISION CORP.
DEPT. 384, 909 BROADWAY, CINCINNATI 2, OHIO

INLINE*
ANTENNA



"AUTO-DIAL"
ROTATOR

**Perfect
TV Picture
COMBINATION**



REISSUE
PAT. NO. 12,273

Technical men know that Amphenol's patented "Inline" antenna construction means superior electrical characteristics i.e., a single forward lobe to "pick up" the strongest signal — no minor lobes to receive reflected or spurious radiations. When this single lobe is accurately pointed to the desired signal by Amphenol's "Auto-Dial" antenna rotator, technical men know what any layman can see . . . the picture is the best there is!

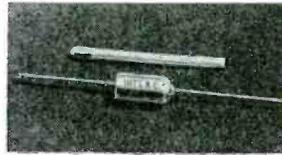
For the best TV picture on any channel, from any direction, Amphenol's "Inline" antenna and Auto-Dial rotator . . . the unbeatable combination by **AMPHENOL**

AMERICAN PHENOLIC CORPORATION
1830 SOUTH 54th AVENUE CHICAGO 50, ILLINOIS

New Devices

SEALED RECTIFIERS

International Rectifier Corp., 6809 S. Victoria Ave., Los Angeles 43, has developed a new line of hermetically sealed selenium rectifiers. They are assembled in half-wave cartridges with current ratings from 300 μ a up to 60 ma. The individual cartridges accommodate up to 400 cell elements with d.c. voltage ratings up to 8,000 volts per cartridge. By connecting a number of cartridges in series, voltages up to 250,000 have been obtained.

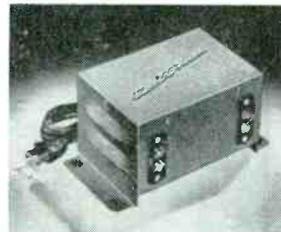


The assembly is rugged and impervious to the effects of outside atmosphere. The units are capable of withstanding 100 G's of acceleration, and are ideally suited for airborne applications. They can be operated in ambient temperatures up to 100° C. Outside diameters vary from 3/16-inch up to 1 1/4-inches, depending upon current rating.

These rectifiers are designed for applications such as air-borne radar components, guided missiles, bias supplies, inverse peak clippers, oscilloscope power supplies, solenoid power supplies, modulators, etc.

BROADBAND TV BOOSTER

Electro-Voice, Inc., Buchanan, Mich., announces the new model 3002 Tune-O-Matic two-stage broad-band automatic self-tuning TV booster, for fringe and intermediate areas. It uses two type 6BK7 tubes (one on the high bands and one on the low) in an exclusive low-noise circuit, and provides uniformly high usable gain with very low internal noise, on all channels, 2-13.



Tuning is automatic—no booster dials to turn—and it is turned on or off by the TV receiver switch.

The all-electronic circuit is a.c.-powered and has high stability, insuring long, trouble-free service.

The booster is finished in baked lacquer copper tone. It is 6 7/8 x 3 1/8 x 3 5/8 inches and weighs 1 pound, 13 ounces. It has rubber grommet feet to protect polished surfaces.

VIDEO AMPLIFIER

Polaroid Electronics Corp., 100 Metropolitan Avenue, Brooklyn 11, N. Y., announces a new, improved wide-band video amplifier, model V-2. It has a flat amplitude response ± 1.5 db from below 10 cycles to 20 megacycles.

It is designed for use as an oscilloscope deflection amplifier for the measurement and viewing of pulses of extremely short duration and rise time. It is a tool for laboratory and industrial use to extend the amplitude

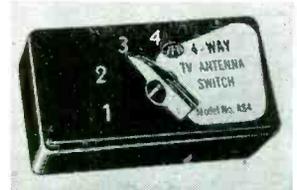


All specifications given on these pages are from manufacturers' data.

range of vacuum-tube voltmeters and signal generators. Its extended low-frequency responses permit accurate analysis of television signals. Sixty-cycle square waves are passed with less than 5% tilt.

4-WAY SWITCH

JFD Manufacturing Co., Inc., 6101 Sixteenth Ave., Brooklyn 4, N. Y., is producing a new four-way antenna switch. The new accessory supplies swift, low-loss switching facilities in any TV installation, local or remote, where up to four antennas are used. A constant-impedance rotary switch with low-loss-resistance silver-to-silver contacts provides maximum energy transfer. The new JFD accessory is housed in a compact bakelite case.



TEST PROD ADAPTER

United Technical Laboratories, Morristown, N. J., announce a new test prod adapter specially designed for use with standard R.T.M.A. test points or the phonograph needle type so that any point in miniaturized or other compact electronic circuits may be conveniently contacted by a self-holding prod.

The new *Klipzon* type L *Klipze* adapter provides a slender, insulated point for reaching into crowded circuits without danger of shorts, shock, or accidental disconnect. A unique self-holding point permits measurements with both hands free for circuit adjustment, soldering, or other work.

Klipzon type L adapters, which are about 3 inches long and are available in red and black, clip onto wires ranging from the finest to No. 12 AWG. Prod points are made of nonmagnetic alloy steel and are needle sharp for easy piercing of insulation, protective coatings, and fungus. The adapters are easily slipped onto standard test prods.



BASIC CHASSIS

Alden Products Company, 117 North Main St., Brockton 64, Mass., has designed a new basic chassis on which most circuit elements can be laid out and easily fabricated as unit sub-assemblies.

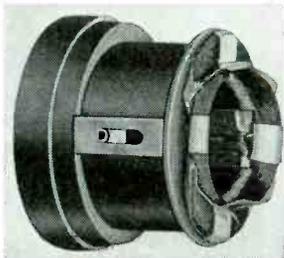
Heart of the chassis is the terminal mounting board system whereby tube sockets and all associated circuitry are mounted and interwired as an individual subassembly for mounting in basic chassis. Mounted on both sides of the chassis, terminal boards are instantly accessible for inspection or removal. Hundreds of prepunched holes on the terminal boards permit an almost unlimited number of circuit patterns to be wired without modification of any sort. Alden miniature terminals staked into holes as per optimum pattern hold components firmly for soldering without time-consuming wrap-around of leads.

The simplified production methods made possible by the new chassis speed up production. When an electronic design is ready to go into production, the schematic is divided into functional blocks of circuitry. These blocks can readily be laid out on the standard components of the Alden basic chassis. Costly intermediate steps of housing design, modification of the prototype, tooling, ordering of special connectors, plugs, etc., are eliminated. On the production line, terminal boards, front panel, back connectors, and cabling are all wired as subassemblies, resulting in increased production efficiency.

RADIO-ELECTRONICS for

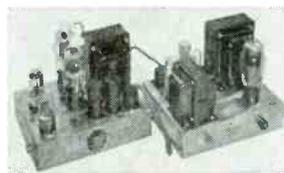
DEFLECTION YOKE

Cleveland Electronics, Inc., 6612 Euclid Avenue, Cleveland 3, Ohio, has designed a deflection yoke with anastigmatically corrected coils to provide a sharper focus over the entire picture area. Insulated against high temperature throughout with materials to withstand temperatures up to 90 degrees Celsius. Quadruple Formvar wire insulation used on all horizontal coils for maximum protection against high voltage. Easily installed with a floating type cage nut that permits rapid and accurate adjustment.



WILLIAMSON COMPONENTS

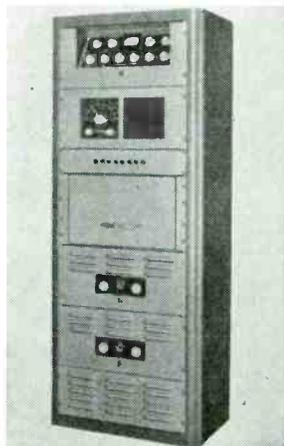
Standard Transformer Corp., 3580 Easton Ave., Chicago 18, announces Stancor components for the famous Williamson amplifier, designed to make high-fidelity audio available at low cost. The new Stancor components include a high-fidelity output transformer A-8054, power transformer PC8412, and filter choke C-1411.



Tests made by an independent testing laboratory on a unit built from standard stock parts show zero db frequency response from 20 cycles to 50 kc at the B-watt level, remaining unchanged at the low level of 0.5 watts. Intermodulation distortion measures 3% at 8 watts output. Total harmonic distortion at 1,000 cycles is extremely low and may be considered nonexistent below the 10-watt power level, the tests showed.

RACK ASSEMBLIES

Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Cal., offers basic elements for custom, cabinet-type rack systems. Designed for flexibility, these assemblies enable the engineer to install PA equipment to meet individual requirements. All standard Newcomb amplifiers are available mounted in panels, as well as a record changer, radio, intercom amplifier, and other special equipment. Mounting holes are RMA standard 1/4- and 1/2-inch spacings. Panel mounting holes are tapped in 1/8-inch stock. Fully ventilated rear door provides easy access.



ability. Entire cabinet is a welded assembly with dark grey hammertone finish, and has provision in rear for nine 1/2-inch conduits. A removable terminal-strip mounting plate is included near conduit inlets. Dimensions are 59 1/2 x 23 x 16-inches.

PICK-UP STICK

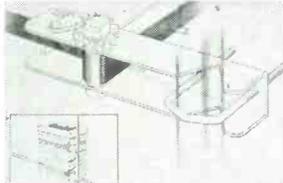
Hytron Radio and Electronics Co., Salem, Mass., has brought out an in-



teresting and useful novelty in the form of a pencil with an adhesive wax tip in place of the eraser. This special wax tip picks up screws, nuts, etc., dropped into inaccessible spots in radio chassis. It also holds head of screw in those impossible-to-reach spots while starting nuts. Just a slight pressure of the special wax tip does the trick. The Pick-Up Stick doubles in brass as a pencil too.

CHIMNEY MOUNT

The Radiart Corporation, Cleveland 2, Ohio, announces the development of an entirely new idea in chimney mounts for TV antennas. Known as the Spee-Dee chimney mount, it is swiftly installed without the usual nuts and bolts for tightening the straps around the chimney. A slip-proof aluminum ratchet



lock winds up the straps and locks them tightly in place. Use with masts up to 1 3/4 inch O.D. is made possible by the large U-bolt.

JUNIOR VOLTOHMYST

RCA, Harrison, N. J., announce the latest addition to RCA's Blue Ribbon test equipment line, the new WV-77A Junior VoltOhmyst meter, measuring a.c. volts, d.c. volts, and resistance in five different ranges. The all-electronic meter features a high-impedance diode tube as a signal rectifier, an electronic bridge circuit similar to

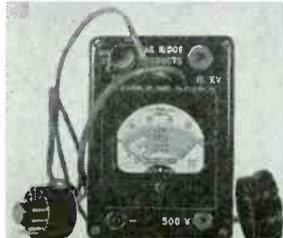


the one used in RCA's Senior Volt-Ohmyst meter, a 200 microampere movement, and carbon-film multiplier resistors.

PIC TUBE TESTER

Oak Ridge Products, 37-01 Vernon Blvd., Long Island City 1, N. Y., announces the Cathette, a tester for checking C-R tubes in the television set under high-voltage operating conditions.

This compact tester measures only 5 1/2 x 3 1/8 x 2 1/4 inches. It checks all magnetic and electrostatic focused tubes and has a large full-scale meter, calibrated with GOOD-BAD scales.



Build
15 RADIOS AT HOME

With the New Improved 1951 Progressive Radio "EDU-KIT"

ONLY \$19.95

**ABSOLUTELY NO KNOWLEDGE OF RADIO NECESSARY
FREE TOOLS WITH KIT • NO ADDITIONAL PARTS NEEDED**

- EXCELLENT BACKGROUND FOR TELEVISION
- 10 DAY MONEY-BACK GUARANTEE

WHAT THE PROGRESSIVE RADIO "EDU-KIT" OFFERS YOU

The Progressive Radio "Edu-Kit" offers you a home study course at a rock bottom price. Our kit is designed to train Radio Technicians, with the basic facts of Radio Theory and Construction Practice expressed simply and clearly. You will gain a knowledge of basic Radio Principles involved in Radio Reception, Radio Transmission and Audio Amplification.

You will learn how to identify Radio Symbols and Diagrams; how to build radios, using regular radio circuit schematics; how to mount various radio parts; how to wire and solder in a professional manner. You will learn how to operate Receivers, Transmitters, and Audio Amplifiers. You will learn how to service and trouble-shoot radios. In brief, you will receive a basic education in Radio exactly like the kind you would expect to receive in a Radio Course costing several hundreds of dollars.

THE KIT FOR EVERYONE

The Progressive Radio "Edu-Kit" was specifically prepared for any person who has a desire to learn Radio. The Kit has been used successfully by young and old in all parts of the world. It is not necessary that you have even the slightest background in science or radio.

The Progressive Radio "Edu-Kit" is used by many Radio Schools and Clubs in this country and abroad. It is used by the Veterans Administration for Vocational Guidance and Training.

The Progressive Radio "Edu-Kit" requires no instructor. All instructions are included. All parts are individually boxed, and identified by name, photograph and diagram. Every step involved in building these sets is carefully explained. You cannot make a mistake.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" comes complete with instructions. These instructions are arranged in a clear, simple and progressive manner. The theory of Radio, Transmission, Radio Reception and Audio Amplification is clearly explained. Every part is identified by photograph and diagram; you will learn the function and theory of every part used.

The Progressive Radio "Edu-Kit" uses the principle of "Learn By Doing". Therefore you will build radios to illustrate the principles which you learn. These radios are designed in a modern manner, according to the best principles of present-day educational practice. You begin by building a simple radio. The next set that you build is slightly more advanced. Gradually, in a progressive manner, you will find yourself constructing still more advanced radio sets, and doing work like a professional Radio Technician. Altogether you will build fifteen radios, including Receivers, Amplifiers and Transmitters.

The Progressive Radio "EDU-KIT" Is Complete

You will receive every part necessary to build 15 different radio sets. This includes tubes, tube sockets, variable condensers, electrolytic condensers, mica condensers, paper condensers, resistors, tie strips, coils, tubing, hardware, etc. Every part included in addition to these parts are individually packaged, so that you can easily identify every item.

TROUBLE-SHOOTING LESSONS

Trouble-shooting and servicing lessons are included. You will be taught to recognize and repair troubles. While you are learning in this practical way, you will be able to do many a repair job for your neighbors and friends, and charge fees which will far exceed the cost of the kit. Here is an opportunity for you to learn radio and have others pay for it.

FREE EXTRAS IN 1951

- ELECTRICAL AND RADIO TESTER
- RADIO TROUBLE-SHOOTING CLUB
- BOOK ON TELEVISION
- MEMBERSHIP IN RADIO-TELEVISION LEAGUE
- ELECTRIC SOLDERING IRON
- CONSULTATION SERVICE
- QUIZZES

THE PUBLIC APPROVES!

COMMENTS FROM SATISFIED USERS OF THE PROGRESSIVE RADIO "EDU-KIT":
VETERANS ADMINISTRATION,
PHYSICAL MEDICINE REHABILITATION SERVICE,
WASHINGTON, D. C.

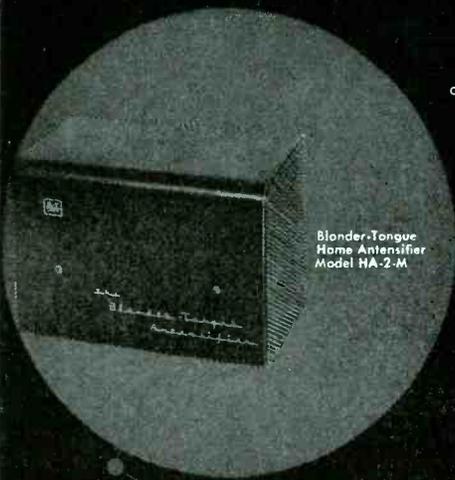
"This Morning I was showing the Progressive Radio 'Edu-Kit' to one of our representatives from our Branch Office in Richmond, and already he wants me to purchase some for his hospital. As indicated in previous correspondence, I took the Progressive Radio 'Edu-Kit' to our Veterans Administration Hospital at Fort Thomas, Kentucky. Both instructors and patients worked them, and they proved quite satisfactory."

ROBERT L. SHUFF,
1534 Monroe Ave., Huntington, W. Va.
"Thought I would drop you a few lines to say that I have bought a Progressive Radio 'Edu-Kit' and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and radio-phonographs. Friends were really surprised to see me get into the swing of it so quickly. The trouble-shooting tester that came with the kit is really swell, and finds the trouble if there is any to be found. Everything you say about your kit is true."
DOMINICK STRACUZZA,
111 Clarence St., London, Ontario
"I am very satisfied with the Progressive Radio 'Edu-Kit' which I bought from you. I did not know anything about radio, but now I feel as though I have been in the radio business for years. Your kit is simple and educational. I enjoy working with it."

Order your Progressive Radio "EDU-KIT" Today, or send for further information. Postage prepaid on cash orders—C.O.D. orders accepted in U. S. A.

PROGRESSIVE ELECTRONICS CO.
497 UNION AVE., Dept. RE-53, Brooklyn 11, N. Y.

1 x BTA = 12 x Ord U *



One Blonder-Tongue antensifier replaces 12 ordinary boosters. Automatically amplifies all channels 16 times

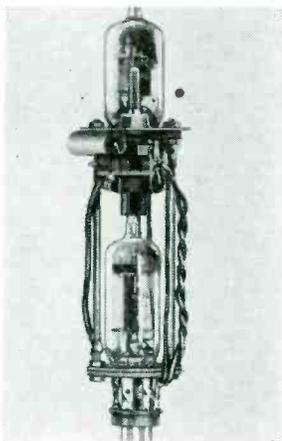
Blonder-Tongue Home Antensifier Model HA-2-M

TV boosters and master antenna systems

When you write please mention RADIO-ELECTRONICS

BLONDER-TONGUE LABORATORIES • 38 n. second ave., mt. vernon, n. y.

SIGNAL BOOSTER
 The Grayburne Corporation, 103 Lafayette St., New York 13, N. Y., has produced a new TV i.f. signal booster specifically designed for use in near-fringe as well as metropolitan or suburban areas where a moderate increase in signal will produce satisfactory results on "those weak stations" present in every TV locality.

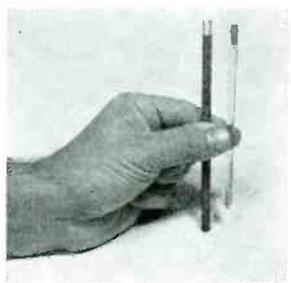


By increasing video and audio signals approximately 25%, the booster can often change unsatisfactory pictures into pleasing TV reception at nominal cost. Designated the model TSB-1, the new booster is a complete i.f. stage ready for insertion in the receiver circuit in a matter of minutes. No external cabinet to house the unit is needed, and no on-off or channel switches are required.

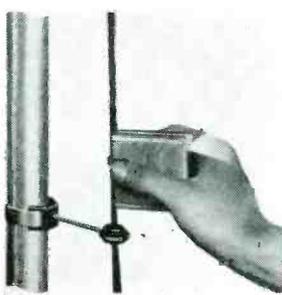
ALL-CHANNEL AMPLIFIER
 Blonder-Tongue Laboratories, 38 N. Second Ave., Mt. Vernon, N. Y., has just introduced a new type commercial TV amplifier. Their new unit, called the Commercial Antensifier, is a 4-tube, 4-stage TV signal amplifier that will supply a gain of 30 db on all channels simultaneously. Operation is automatic, without any tuning or adjustment whatever. This unit can be used with the Blonder-Tongue, and every other master antenna distribution system, to overcome line losses at any point in the system. In weak signal areas, it can be used as a preamplifier for the distribution system.



TV SERVICE TOOLS
 Insuline Corporation of America, 36-02 35th Ave., Long Island City 1, N. Y., has placed on the market two new tools designed to speed up television and radio servicing operations. The first is the No. 6247 dual-bladed Kleer aligner. This is a rod of low-loss transparent plastic, 4 1/2 inches long and



BREAK LOCATOR
 Easy-Up Tower Co., Racine, Wis., has introduced a testing device for quickly locating breaks in 300-ohm twin line. Sold under the trade name *Twin-Test*, it indicates the exact location of the break by a light. Twin line can be tested while connected to any type of antenna, whether open- or closed-circuit.



7/32 inch in diameter, fitted with corrosion-proof steel blades .018 inch and .025 inch thick, respectively. The second of these instruments is the No. 6249 tuning wand, which is a brown phenolic rod 4 3/4 inches long and 1/4 inch in diameter. One end contains a molded powdered iron core having a permeability tolerance of 2% and a Q tolerance of 10%; the other end of the rod contains a silver-plated brass core.

C-R TUBE TESTER
 Trojan Electronics, 3706 North Halsted St., Chicago, has developed a new tube tester which enables the television service technician to determine the condition of a picture tube without removing it from the chassis. The model 601 will check all the more commonly used direct-view tubes made since 1946. Condition of the tube is indicated by the fractional milliampere reading of the meter. The tester is designed for durability. Its meter is protected with a 5-ma fuse, and it is light in weight (just under 3 pounds).



V.T. VOLTMETER
 Precise Development Corp., Oceanside, N. Y., has commenced delivering its new vacuum-tube voltmeter, the model 909. It has six voltage ranges for both o.c. and d.c., five far resistance, and one decibel range. Ranges are: Volts: 0-5-25-50-250-500-1,000. Ohms: .01 to 1 billion in five ranges. Db: 20 to -55.



The voltmeter is available in kit or factory-wired form. The instrument measures 9 1/2 x 6 x 5 inches and its shipping weight is 10 pounds. —end—

How Bing Crosby's Shavex Speeds up Electric Shaving



Model 5M4 Rectifier
 Illustrated
 Current rating 75MA Max.
 Input 120V 60Hz
 Max. line voltage 300V. Size 1" square.

... THANKS TO VERSATILE SELETRON SELENIUM RECTIFIERS

A wonderful boon to faster whisker removal as smooth as Bing's voice is the Crosby Shavex* which changes household alternating current to D.C., thus boosting the power and speed of any electric razor as much as 40% . . . And built into each unit is a miniature SELETRON Selenium Rectifier No. 5M4 for trouble-free operation.

The Shavex is very small, and excessive heating within such a compact enclosure could be a problem. Yet President William H. Burgess of Shavex Division, Electronic Specialty Co., Los Angeles 39, says that extensive temperature tests under full load show SELETRON rectifiers operate much cooler than other rectifiers tested . . . and SELETRON's reliability has been confirmed by successful use of the Shavex under varied conditions of temperature and humidity over a period of several years.

SELETRON builds 'em midget size for radio, TV and other electronic circuits, all the way up to the giant stack assemblies for industrial use. Perhaps the unusual Shavex application may give you an idea for putting these versatile selenium rectifiers to work in some other unique spot . . . If so, SELETRON engineers can be of real assistance. Write us today, and request your copy of bulletin 104-R-11.

SELETRON DIVISION
RADIO RECEPTOR COMPANY, INC.
 Since 1925 in Radio and Electronics

Sales Dept., 251 W. 19th St., New York 11, N. Y. • Factory: 84 N. 9th St., Brooklyn 11, N. Y.



Converting the Mark II

By

LOUIS H. HIPPE, W6APQ

Minor changes improve the equipment. The author increased the output on phone with speech amplification and plate modulation

THE No. 19 Mark II radio set is one of the most beautifully engineered and built pieces of radio equipment to be offered to date on the surplus market. Designed to operate in combat tanks, its construction is rugged enough to stand up under almost any amateur use. In addition, its size makes it ideally suited to portable or mobile use. As for versatility, it is actually two complete ham stations in one. Set A covers the 3.5- and 7-mc bands. Set B is a high-frequency transceiver that operates on 235 mc. Both sets are tuned by variable-frequency oscillators, which adds to their usefulness.

For phone operation set A employs low-level grid modulation. The oscillator is modulated in set B.

We used the rig on 75-meter phone for several months without modifications. Reports indicated that unless we shouted into the microphone the resultant modulation was insufficient to kick the 807 final anywhere near a useable level. W6ABM suggested we use the intercom amplifier in the rig as a pre-amp to increase the output of the modulator. The changes are very simple and the changeover can be made in three easy steps.

1. Reverse the leads to prongs 3 and 1 on power socket PL2A, on lower left corner of front panel.
2. Disconnect the center wire of the shielded lead from the microphone input transformer T3A, leaving the shield connected to ground. To the center wire of the shielded line just disconnected, solder another length of shielded wire which is in turn to be connected to the secondary of the intercom output transformer. This is the tap on the left front of T6A having the white lead soldered to it.

It is not necessary to disconnect the white wire from T6A, once the new shielded wire is soldered to this terminal the output of the intercom will drive the grid of V3A and thus modulate the 807 final stage.

3. Resistor R23D (22,000 ohms), located on the grid cap of V1F can be left as is or it may be shorted out, whichever seems to give the best results.

The above will give added kick to the grid of the 807 and set A may be used according to operating instructions without having to shout into the microphone.

Plate modulation

However, on phone operation input to the 807 is only 5 watts as compared to the 30 watts input on c.w. By converting to plate modulation the power input for phone operation can be brought up to the level of that possible for c.w. This, too is a simple operation and can be completed in an evening. We do this by using the output of the intercom as a modulator for the 807 plate. Make all changes as described in 1 and 3 above. After these are completed, continue as follows:

4. Replace the 6V6-G (V8B) with a 6L6. (V8B is the tube at the left rear as you face the set from the front top.)
5. Replace R39A, the cathode resistor of V8B, with a 500-ohm, 10-watt resistor bypassed with a 4- μ f, 50-volt electrolytic capacitor.
6. Disconnect the plate of the 6L6 (V8B) from the primary of T6A.
7. Use a 10-watt modulation transformer (Hadley S-588-D, Peerless M2103X, or equivalent, provided it is physically small) to couple the output of V8B (the 6L6) to the plate circuit of the 807 final. Use the *entire* primary winding of the modulation transformer. Connect one side of the primary to the plate of the 6L6 (V8B). Leave the other side of the primary floating until step 8 is completed.
8. Break the 500-volt lead to the plate coil of the 807 final amplifier. Connect the 807 plate coil to one of the secondary leads on the modulation transformer. The other lead from the secondary and the remaining wire across from it on the *primary* side are both connected to the 500-volt lead to the power supply.
9. Replace C33B with an .002- μ f, 1,500-volt paper capacitor. (C33B is connected from the lower end of the 807 plate-tank coil to ground.)
10. Short out the *two bottom pins on the contacts nearest to the back of the set on the MCW—CW—PHONE switch*. See Photo A. This increases the power input on phone to 30 watts.
11. Change resistor R8F (from grid of V8B to ground) to 470,000 ohms, $\frac{1}{2}$ watt.
12. Use set in normal manner. Be sure the ALL switch is in the ON position to place the former intercom amplifier in operation as the modulator. The screen of the 807 is not modu-

lated. To do this would entail further modifications if you work c.w. Lack of screen modulation does not seem to affect the modulation quality, however, as reports on the air indicate.

Finding sufficient room to mount the plate-modulation transformer may seem to be a hopeless task. However, you can find sufficient space by shifting the shield located between the 807 and transformer T6A. Move it back against the side of T6A and swing the small transformer T2A back so the edge of its mounting bracket can slip under the edge of T6A. Its opposite mounting bracket is fastened to the chassis by a bolt through the extra hole drilled in the chassis. Location of the modulation transformer is shown in Photo B on next page.

Since with plate modulation the former speech input transformer T3A is no longer needed, it can be removed to provide room for a stand-by input transformer for use with other equipment you might build. Remove the tubes in the receiver section opposite the transformer. With a long, thin screwdriver carefully reach back between the variable tuning capacitor and remove the two screws that hold T3A to the chassis shield. You may have to remove the screws that hold this shield



Photo A—Underside, MCW-CW-PHONE switch. Install jumper as shown.

NOW! COLOR TELEVISION

ON YOUR PRESENT SET!

Sensational New Tri-Colored Film, will bring you colored pictures on all black and white broadcasts. Brings in any TV program in glorious color, on any TV set. Anybody can attach in less than one minute. Greatest development since advent of television. Send for yours today. Start selling this red hot item at once. When your customers see color programs with Ray Vision you will be swamped with orders.

\$1.65

10 INCH

	Retail	Your Cost
10"	\$4.95	\$1.65
12½"	5.95	1.95
14"	6.95	2.30
16 & 17" ..	7.95	2.55
19 & 20" ..	8.95	2.85

ADD 15¢ SINGLE
ORDERS WE PREPAY
SIX OR MORE

RAY CO. 441 Summit **Immediate**
TOLEDO, OHIO **Delivery**

WILL BUY OR TRADE

NEED BC-611 or BC-721 Handie-Talkie (or any part); ART-13; ARC-1; ARC-3; DY-17; TS-12; TS-13; MN-26 J or K; BC-342; BC-312; I-100; BC-348; BC-788 A, AM, B or C; I-152A, AM, B or C; TS-67; Teletype, test or any other equipment. Cash or trade. What have you?

Write: **BOB SANETT (W6REX)**

4668 Dockweiler, Los Angeles, California

Good jobs for trained men—in RADIO—TV—ELECTRONICS

In minimum time, CREI trains you for this fast-expanding field.

Start studying now at CREI Residence School, and win your place in these fields that need trained men so desperately. Average time required: 22 months.

Located in historic Washington, D.C., CREI has a 24-year history of successful technical training. Industry asks for CREI grads, and uses CREI training for their own technicians.

SEND FOR ILLUSTRATED FREE CATALOG

Write today for your copy of new descriptive catalog, with survey of opportunities, and details of course and school. New classes start twice a month.

CAPITOL RADIO ENGINEERING INSTITUTE

An Accredited Technical Institute Founded in 1927
Dent. 3011, 16th & Park Rd., N.W., Wash. 10, D.C.

Free NEW BIG RADIO CATALOG

Ready now. Complete with everything in radio, television and electronics. Newest parts, as well as old, standard lines. Paste coupon on penny postcard and mail today!

Lafayette Radio

DIVISION: RADIO WIRE TELEVISION, INC.

NEW YORK 13 100 Sixth Ave. NEWARK 2 24 Central Ave. BOSTON 10 110 Federal St. BRONX 58 542 E. Fordham Rd.

LAFAYETTE RADIO,

Dept. JK
100 Sixth Avenue, N. Y. 13

Please rush Free catalog to:

Name.....

Address.....

City..... State.....

PASTE ON PENNY POSTCARD

in place so that it may be raised to permit removal of the transformer.

A.C. operation

If you build an a.c. power pack for the unit, either you must provide 12-volts d.c. for the heaters and relays or you can cut loose the filaments so that a.c. may be used on them, thus reducing the d.c. drain so a lighter d.c. source can be used for the relays. The relays *must* be operated from d.c. Surplus selenium rectifiers solve this problem nicely. Note that the filament and relay circuits can be operated on 6 volts by reconnecting them in parallel instead of series and series parallel as they are hooked up at present.

The voltage which supplies the 807 screen, speech amplifier, and receiver is fairly critical. The voltage on the high-voltage section should not run over 600; the voltage for the low-voltage section should read not less than 300. These readings should be made at the voltage divider with the power pack under full load. If the low-voltage reading is too low, downward modulation will result. This is indicated by the down kick of the panel meter in AE position or the glow of ½ watt neon bulb.

The power supply is connected in the conventional manner but should be capable of delivering 250 ma. Be sure the components used are capable of handling the total load without overload or excessive voltage drop.

Mobile operation

If the set is intended for mobile operation, the first three steps of the conversion are all that is necessary. This limits the set to 5 watts input which is about the limit of the capabilities of the

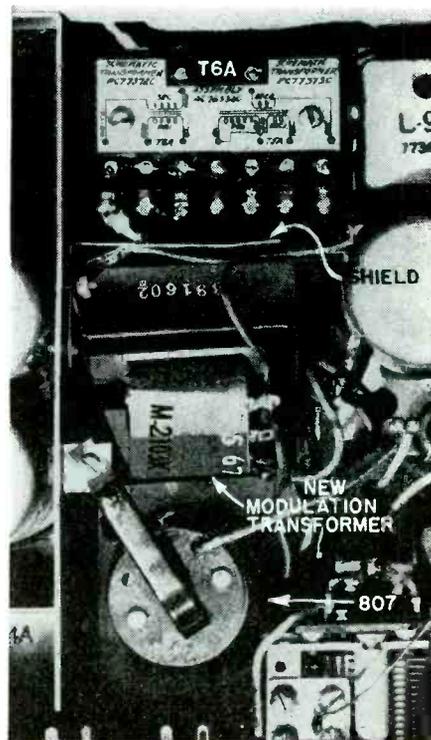


Photo B—Shield and transformer T2A are moved back to make room for transformer needed for plate modulation.

RADIO-ELECTRONICS for



ALL RANGES WITH THIS ONE CONTROL

Just *one* knob—extra large—easy to turn—flush with the panel, controls all ranges. This one knob saves your time—minimizes the chances of “burn-outs” because you don’t have to remember to set another control. You can work fast with Model 630 with your eyes as well as your hands. Look at that scale—wide open—easy to read, accurately. Yes, this is a *smooth TV* tester. Fast, safe, no projecting knobs, or jacks, or meter case. Get your hand on that single control and you’ll see why thousands of “Model 630’s” are already in use in almost every kind of electrical testing



**Model
630**

ONLY \$39.50 AT YOUR DISTRIBUTORS
Prices Subject to Change

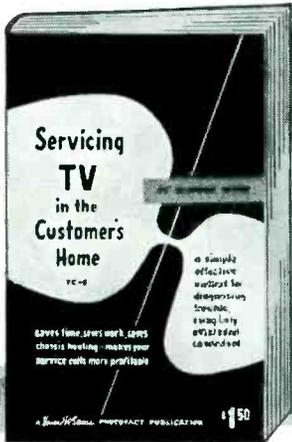
FOR THE MAN WHO TAKES PRIDE IN HIS WORK

Triplet

TRIPLET ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO, U.S.A.

NEW a "must" book
for every
TV Service Technician

**"Servicing TV
in the
Customer's Home"**



**SAVES TIME
SAVES WORK
Earns More
for You
on Outside
Service Calls**

shows how
to diagnose trouble using
capacitor probe and VTVM

Here's the book you've been asking for—practical, proved help to make your outside TV servicing really effective and profitable. Saves time, work and chassis hauling... shows you how to make successful repairs on the spot. You learn the following: 1. A simple, effective method for tracing down trouble, using your VTVM and a simple capacitor probe. 2. Methods for finding your way around a strange circuit—shows you how to "pull tubes" and diagnose trouble by observing audio and picture effects. 3. How to judge TV set performance by analysis of the test pattern. 4. Methods for making adjustments in the field. You'll want this essential, profit-building book. Handy pocket size; sturdy cover. **\$1.50**

ORDER TC-1. Only.....

Pays for itself on the very first job.

HOWARD W. SAMS & CO., INC.

Order from your Parts Jobber, or write direct to
HOWARD W. SAMS & CO.,
2201 E. 46th St., Indianapolis 5, Ind.

Send... copy(ies) of "SERVICING TV IN THE CUSTOMER'S HOME," \$1.50 per copy.

(Check) (money order) for \$.....enclosed

Name.....

Address.....

City.....State.....

**ORDER
TODAY**

dynamotor for phone operation. The 500-volt section is rated at only 65 ma; the 275-volt section at 125 ma. If you use the dynamotor after conversion to plate modulation, be sure the resistor placed in the cathode of V8B (step 5 above) does not fall below the specified value otherwise the 6L6 will draw so much current that the dynamotor will overheat. The low-voltage section of the dynamotor is well filtered (32 μ f) but the high-voltage section is not. The 0.1- μ f capacitor, C33A, is much too small. This probably explains why the c.w. note is rough. Heavier filtering helps to clear up this as well as help remove carrier hum.

Putting the B set on 2 meters

The versatility of the Mark II can be increased by further conversion of the B set for 2-meter operation. This is an even simpler conversion than the one just described for the A set. The conversion is simplest when following these steps:

1. Remove the present coil from the transceiver. (Note its connections carefully before removal.)
2. Wind a 5-turn coil, $\frac{3}{8}$ inch inside diameter, with No. 10 antenna wire. Space the coil to a length of 11/16 inch.

3. Solder the new coil in the transceiver, using the same connections as on the previous coil.

4. The transceiver is now on two meters and may be operated exactly the same as before conversion. Be sure and check with 2-meter stations for band-edge limits on the tuning dial. Adjustments can be made by stretching or squeezing the coil. See Photo C.

The low-voltage (300-volt) tap from the power supply also feeds the four tubes in the transceiver. If the plate voltage falls below 275 the sensitivity of the B set receiver will suffer and a reduction in output when transmitting will result.

Antennas for the Mark II

A 123-foot off-center fed Hertz or Marconi works best on 75. Use a transmitting-type variable capacitor (about 80 μ f) in series with the antenna lead. Set capacitor to half capacitance and peak the circuit with the variometer.

The 2-meter antenna used at W6APQ is a commercial 5-element Yagi fed with 52-ohm coax and coupled directly into the transceiver through the connector provided on set B.

—end—

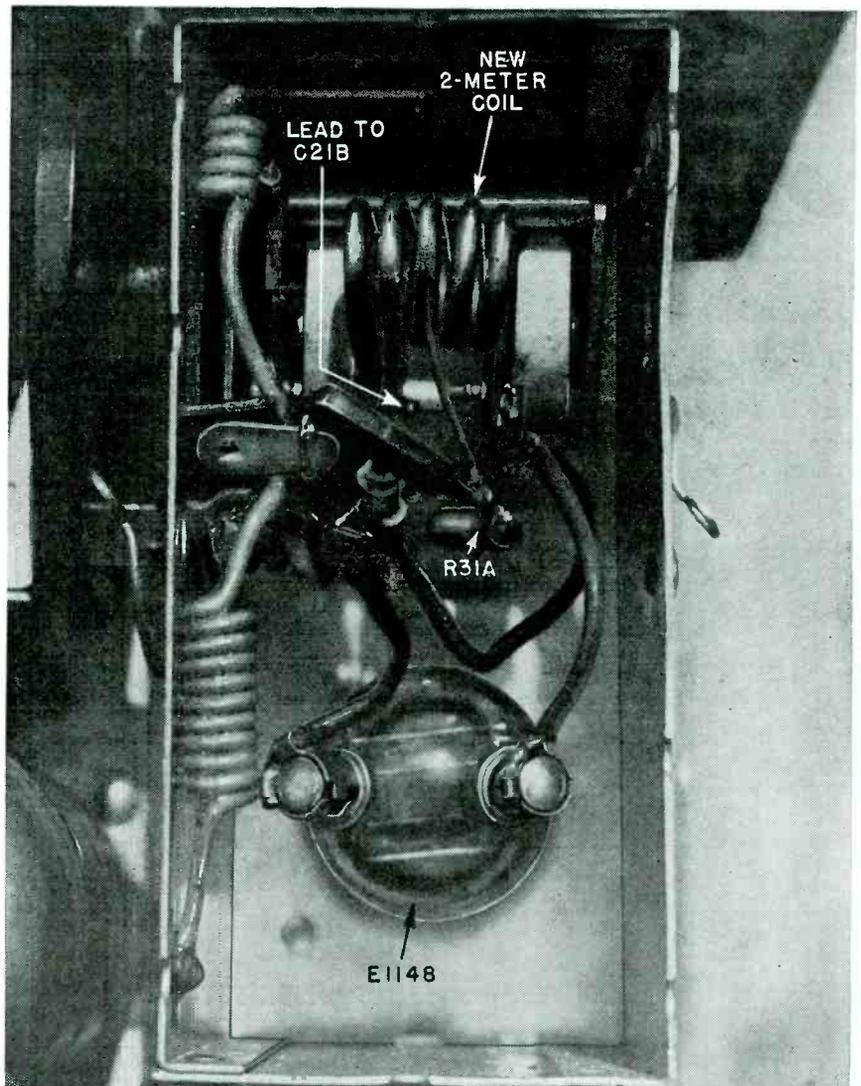


Photo C—V.h.f. compartment showing the location of the coil used for 2 meters.

RADIO-ELECTRONICS for

Your Tape Recordings Are Not Negotiable!

If you cut your own records or make tapes from radio broadcasts with your own recorder, don't try to sell them! The Metropolitan Opera Association and Columbia Records got a New York dealer into a lot of trouble because of that. The dealer tuned in the opera every Saturday afternoon, cut a master plate from the broadcast, stamped out a lot of records and sold them cheap, without paying royalties and without much overhead.

The Metropolitan Opera Association didn't like it because it was a poor recording job and made the opera sound bad.

Columbia Records didn't like it because they had exclusive rights to record the Metropolitan operas and the exclusive right to use the Metropolitan name on records. They had to have expensive special performances to record an opera.

The pirate recorder made a good case in court and almost got away with it. The copyright on all the operas expired long ago; anyone can perform *Lohengrin* or *Tannhauser* or *Carmen* or almost anything else the Metropolitan does without paying any royalty. So he claimed that he had not violated any copyright law.

The pirate said that he wasn't competing with the Metropolitan, as he wasn't trying to run a rival opera or steal customers from them, so they had no grounds to complain. And he hadn't stolen anything from Columbia; competition is legal in this country, and a business rival has no right to sue you if you are able to produce cheaper than he can. As far as this particular dealer was concerned, it was simply a matter of free enterprise.

Paul Whiteman once sued RCA for using some of his music without paying him, but the court said that Whiteman and RCA were not in the same business (Whiteman is a musician and RCA a manufacturer) and dismissed the action.

That argument was used here, but it didn't work this time. The New York Supreme Court said that the Metropolitan program had been "misappropriated and one doesn't have to be in competition with a thief to stop him from stealing the product of your expenditure and industry." The answer to this was that when a program is broadcast, it is published and abandoned; interpretive ideas are not subject to copyright; the Metropolitan didn't own the score, and by spreading the program all over the country by radio where anyone could listen to it free, they lost all exclusive right to that program. But the court wasn't having any. They laid down the law that a radio performance doesn't endanger a performer's ownership of the material used and it is against the law to copy a radio show and then sell records of it even if you give credit to the show.—Francis George

—end—

LOOK—NO HANDS!



E-V

- NO SEPARATE BOOSTER TUNING
- UNIFORMLY HIGH USABLE GAIN
- LESS "SNOW"—BETTER PICTURES
- EXCLUSIVE 4-STAGE BROADBAND CIRCUIT
- EASILY CONCEALED—HIGHLY STABLE

AUTOMATIC SELF-TUNING

SUPER Tune-O-Matic TV BOOSTER

Connect it...and forget it! Anyone... even a child...can get his favorite programs with a clarity of picture and sound like never before...on any channel... automatically...without any booster tuning!

Exclusive E-V all-electronic broadband circuit gives superb low-noise performance... provides higher effective gain on all channels... works where others have failed, even in tough fringe areas. Furthermore, the booster can be easily concealed. Installation is quick and simple. Plugs into 50-60 cycle a.c. outlet. Thousands of installations have proved it completely trouble-free. There's nothing like it!

Model 3000 TUNE-O-MATIC. List... \$59.50

Tenna-Top



First all-channel, low-noise, antenna-mounted, self-tuning TV Booster! Mounts on antenna mast ahead of the lead-in. Automatically boosts the signal—not any local noise picked up by the lead-in. Clearly brings in telecasts you could never get before. Finest booster for tough fringe areas or noisy locations in primary areas.

Model 3010 TENNA-TOP.
List Price \$89.50

Electro-Voice

TV BOOSTERS • MICROPHONES • HI-FI SPEAKERS • PHONO-PICKUPS

Patent Pending

Electro-Voice, Inc., Dept. E11-51
421 Carroll St., Buchanan, Michigan
Send Free Bulletin No. 153

Name _____
(PLEASE PRINT)

Address _____

City _____ Zone _____ State _____

Serviceman Installer Dealer TV Fan

Send for FREE BULLETIN TODAY!

4 SENSATIONAL VALUES

for immediate delivery from stock

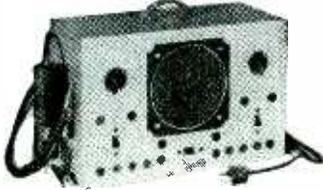
TEST-CRAFT Model TC-10 Quality Multitester



Only \$12.85

AC and DC Voltage Ranges: 0-5/15/150/1500/3000 Volts. DC Current Ranges: 0-5/50 ma. 0-1.5 Amps. Resistance Ranges: 0-100 ohms, 0-100 K. Size: 6"x3 1/2"x2". Complete with batteries and full instructions.

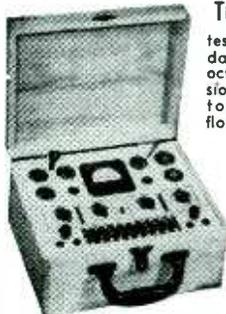
TEST-CRAFT Model TC-75 Combination Test Speaker and Signal Tracer



Only \$29.50

plus speaker substitution plus resistor tester plus condenser tester plus output indicator plus field substitutor plus voice coil substitution Complete with full instructions

TEST-CRAFT Model TC-50 Tube and Set Tester



Tube and Set Tester

tests all tubes up-to-date incl. 4, 5, 6, 7L, octals, loctals, television, magic eye, thyrtors, single ended, floating filament, mercury vapor, new miniatures, etc.

Multimeter Specifications: AC and DC Voltage Ranges: 0-1-100-1000-5000. DC Current Ranges: 0-10/100/1 Amp. Low Resistance Range: 0-10,000 Ohms. Medium Resistance Range: 0-100,000 Ohms.

Only \$39.50

High Resistance Range: 0-1 megohm. Complete with test leads and full instructions

MODEL 999 Combination F.M. and A.M. Signal Generator and Signal Tracer

Signal Generator and Signal Tracer



Only \$28.85

Generates R.F. frequencies from 150 kilocycles to 50 megacycles. Battery operated, no external source of current required. Positive action attenuator provides effective output control at all times. R.F. is obtainable separately or modulated by the Audio Frequency. Complete with test leads and full instructions 25% with order, balance C.O.D. or full check with order.

METROPOLITAN ELECTRONICS & INSTRUMENTS CO. Dept. C

106 Fifth Ave., New York, N.Y.

Universal Tester For Field Use

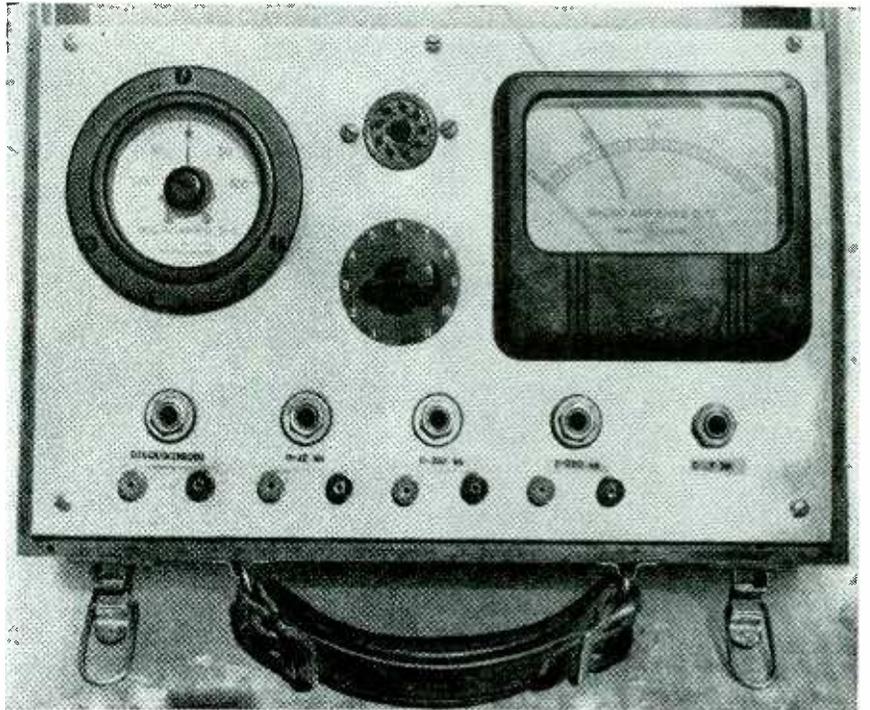


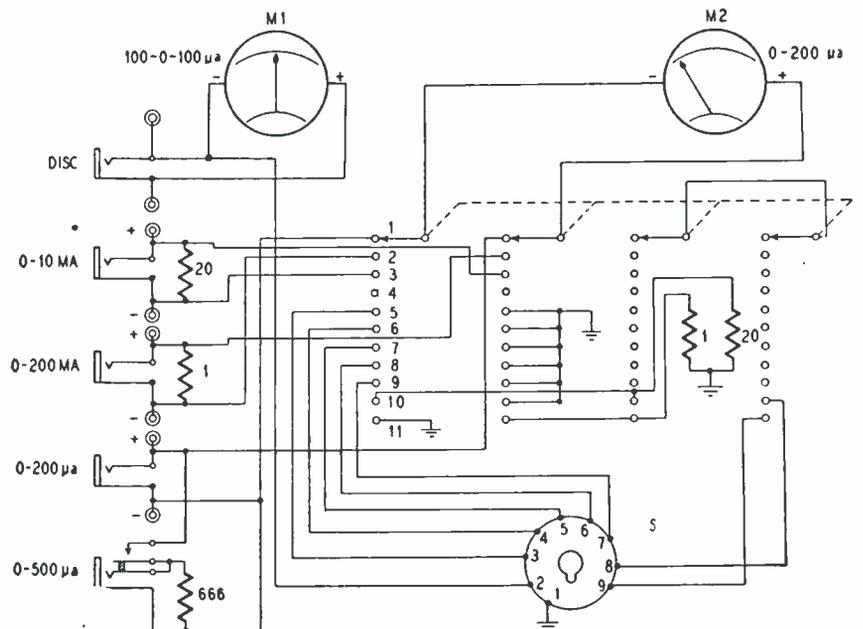
Photo of the tester. Provisions are made for multiconductor test cable and test leads with phone or tip type plugs. All jacks are insulated from the metal panel.

By LYMAN E. GRAY

A communication technician does most of his work in the field. His test equipment is necessarily limited. One way to overcome this disadvantage is to carry spare units; the defective unit can go back to the shop for repairs. This method is not often economical.

Some manufacturers supply special test apparatus for their equipment. Unfortunately, such test apparatus seldom can be used with other manufacturers' products.

This simple meter was designed for flexible field use. It has few parts and can check alignment and operation of most communication sets. A crystal-controlled frequency meter is necessary too. (The Link 2051 frequency meter, a dual-channel battery-operated unit, is ideal. It supplies a crystal-controlled signal for receiver alignment and also can be used to check carrier frequency, radiated power and frequency swing of the modulator in FM equipment.



Schematic of the tester designed for Link FMTR ED7A and similar 2-way sets.

The instrument shown in the diagram and photograph is designed especially for testing Link FMTR ED7A equipment, but it can be used with other types as well. The 9-pin socket shown between the meters is used for connections to the circuits in the FMTR ED7A. Test leads fitted with phone plugs or standard pin tips are used when testing other types of equipment. The main advantage of this test set is that discriminator voltage and limiter grid currents can be metered simultaneously. This is an important feature when checking equipment in the field and also when complete realignment is necessary.

Two meters are used. M1 is a zero-center 100-0-100 microammeter used to measure discriminator voltage. We used a meter of this type to eliminate the need for a polarity-reversing switch. M2 is a standard 200- μ a instrument. The need for a polarity-reversing switch is eliminated here by using two test cables, one of which has connections to one plug reversed.

A 3-circuit, 11-position switch is used for switching M2. The meter ranges and functions corresponding to switch positions are given in the table. Positions 5 through 11 are used for metering circuits in type FMTR ED7A equipment.

Switch Position	Range and Function
1	0-200 μ a and 0-500 μ a (0.5 ma)
2	0-200 ma
3	0-10 ma
4	Not used
5	First limiter grid current
6	Second limiter grid current
7	First doubler grid current
8	Quadrupler grid current
9	Second doubler grid current
10	Power amplifier grid current
11	Power amplifier plate current

The meter used for M2 has an internal resistance of 1,000 ohms so the current shunts were constructed accordingly. When using a meter having a lower resistance, compute the values of shunts from the formula:

$$R_{shunt} = \frac{R_{meter}}{N - 1}$$

where N is the factor by which the basic meter range is to be multiplied. Thus, if you have a 100-microampere meter and want to make it read 1 milli-ampere, N is 10 and N-1 is 9. So the shunt required is 1/9 the resistance of the meter.

If the resistance is near 1,000 ohms, simply put a resistor in series to bring the total resistance up to the proper value.

Materials for test set

Resistors: (For 1,000-ohm meter) 2-1, 2-20, 1-666 ohms, 5% or smaller tolerance.

Meters: 1-100-0-100 μ a, d.c.; 1-200 μ a, 1,000 ohms, d.c.

Miscellaneous: 1-9-Pin socket (Amphenol 77M1P9 or equivalent). 4-Tip jacks, black; 4-tip jacks, red. 4-Phone jacks, open-circuit type; 1-phone jack with separate make-contact springs (Utah-Carter type 103, Mallory type 703, or equivalent). 1-Switch, rotary, 4 circuits, 11 positions. Insulating washers for jacks, hookup wire, panel, carrying case, etc.

—end—

TRAIN for TELEVISION

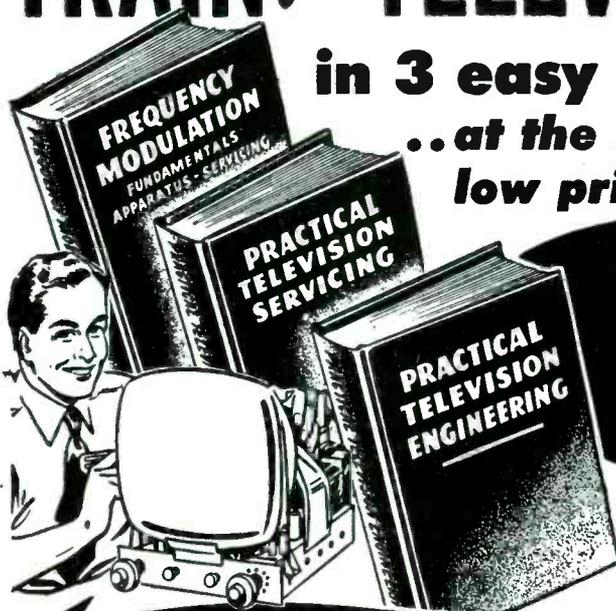
in 3 easy steps!

..at the amazingly low price of...

ONLY \$1550

for the complete training (all 3 books)

5 Months to Pay!



The famous RINEHART TV LIBRARY

●1—FREQUENCY MODULATION

The "heart" of television sound

Here, for the first time, is a complete, easily understood description of Frequency Modulation (F-M)—the circuit system by which TV sound is transmitted and on which many other important electronic developments are based. You learn all about basic F-M theory, control circuits, receivers, transmitters, mobile equipment, transmitters, detectors, amplitude limiters, antennas and dozens of related subjects. Concise, clear explanations of F-M test equipment and its use plus specific F-M service problems are invaluable to busy service men. Price \$5.00 if bought separately.

●2—PRACTICAL TV SERVICING

Complete "how-to-do-it" data

After studying this famous book, you'll find even the most puzzling TV servicing problems greatly simplified. You'll work better, faster—more profitably! Actual service case histories make things amazingly clear. Dozens of illustrations and pattern photos explain details step by step. You learn how TV differs from radio, how receivers operate and, above all, how to service them properly. Other subjects include wiring details, component replacement data, testing tips, fringe area reception hints, improving picture linearity and dozens of other vital TV service subjects. Price \$4.00 if bought separately.

●3—PRACTICAL TV ENGINEERING

Basic training for the "big money" field

The "know how" so clearly presented in this big 700-page book can quickly help you forge many steps ahead of the average television student! Starts right at the beginning with an easy explanation of all TV receiving and transmitting components and just how they are combined in the complete television system. Progresses logically through every phase of the work including transmission fundamentals, all about the cathode ray tube and how it works, camera chains, studio work, lenses, oscilloscopes, synchronizing generators, video amplifiers, power supplies, etc. 385 illustrations. Price \$7.50 separately.

**... FOR BETTER JOBS!
... FOR BETTER PAY!**

These 3 great books offer you a really outstanding LOW-PRICED OPPORTUNITY to get ahead in the greatest, fastest-growing electronics field of them all—TELEVISION!

Already, there are almost 16 million television receivers in U.S. homes. Each TV set uses from 4 to 10 times as many parts as an average radio. Within a few months TV reception will be extended to many parts of the country that never had it before. This famous library helps you get in on the "ground floor" of this giant TV business—paves your way to bigger pay and better jobs!

Read singly, each book is an authentic, easy-to-understand guide to a special phase of Television. Add all 3 together and you have a specialized training that might well spell the turning point in your life toward bigger and better things!

SAVE \$1... pay as you learn

Now—for the first time—this RINEHART TV LIBRARY is offered on 10-DAY FREE EXAMINATION. Read the books for 10 days before you decide—then make a worthwhile cash saving if you buy. Bought singly, these famous books would cost you \$16.50. Under this offer, you save \$1—and you have the privilege of paying in easy monthly installments.

You can't lose on this offer!

10-DAY FREE EXAMINATION

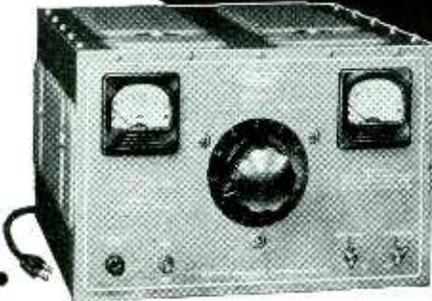
Dept. RE-111, RINEHART BOOKS, INC., Technical Division, 232 Madison Ave., New York 16, N. Y.

SAVE \$1—ORDER THE COMPLETE SET! Send me the famous RINEHART TV LIBRARY (all 3 books) for 10-DAY FREE EXAMINATION. If the books are not what I want, I will return them to you postpaid in good condition at the end of 10 days without any further obligation on my part. If I decide to keep them, I will then enclose \$3.50 as my first payment and will send you \$3 a month for 4 months until the total special price of \$15.50 is paid.

- TO ORDER BOOKS SINGLY**
- Enclosed and \$_____ for books checked; or send C.O.D. and I will pay postman. In either case, I may return books in good condition in 10 days and you guarantee to refund my money.
 - FREQUENCY MODULATION \$5.00 (\$5.50 outside U.S.A.)
 - PRACTICAL TELEVISION SERVICING \$4.00 (\$4.50 outside U.S.A.)
 - PRACTICAL TELEVISION ENGINEERING \$7.50 (\$8.00 outside U.S.A.)

Name.....
Address.....
City, Zone, State.....
Your employer.....

MEETS BIG NEED
IN INDUSTRY, RESEARCH
And DEFENSE PROGRAM



FOR TESTING
and SERVICING

- | | |
|--|----------------------------------|
| Aircraft, tank, marine radios and electronic equipment | Telephone circuits |
| Relays and solenoids | Laboratory instruments, research |
| | Low voltage devices |
| | For plating operations |

CONTINUOUSLY VARIABLE
0-28 VOLTS AT 15 AMPERES

NEW MODEL "N" UNIVERSAL
DC POWER SUPPLY

Never before has a DC power supply with this output range and dependability been available at this moderate price. The new Model "N" utilizes the "Electro" application of selenium rectifiers. This exclusive feature increases the rectifier power rating and provides lower cost per ampere output. A single control provides continuous voltage adjustments for different load conditions over the specified range. Highest quality components and special design withstand high overloads.

MODEL "B"
 DC POWER SUPPLY
 6 VOLTS 1-20 AMPS.

Send for
 Literature

MODEL "BJ"
 DC POWER SUPPLY
 6 VOLTS 1-12.5 AMPS.



ELECTRO PRODUCTS LABORATORIES • 4501-R Ravenswood Ave., Chicago 40, Ill.

\$52,000.00
AVAILABLE

TO BUY NEEDED SURPLUS
ELECTRONIC EQUIPMENT

Top Dollar Paid! Send description, condition and asking price. Prompt replies!

URGENT! NEEDED AT ONCE: BC-611
 Handie-Talkies, ARC-1, ART-13, I-152C, BC-788C, BC-348. Complete units or parts.

WEST REGION ELECTRONICS
 1437 S. Norton Ave., Los Angeles 19, Calif.

NEW CONDENSER TESTER



Finds Intermittent
Condensers Instantly
NET

Pres-probe's sliding tip with variable resistance prevents condenser heating. Tests with power on. Requires no adjustment. Stops guesswork. Saves time. Convenient probe size (7/8" long). Satisfaction guaranteed.

See Your Dist. or Order Direct

PRES-PROBE CO.

4034 N. Sixth St., Milwaukee 12, Wisc.



A-Bomb Position Locator

Radiation lampshade is a new device civil defense authorities may use to quickly and accurately determine the exact position of an atomic blast within a given target area. Such data is required immediately after the explosion to enable rescue workers to proceed with the greatest efficiency.

Developed by the Mohawk Association of Scientists and Engineers, in co-operation with Schenectady, N. Y. civil defense authorities, the instrument will determine the height as well as ground-zero—the point directly under the burst. The instrument resembles a standard lampshade approximately 12 inches in diameter at the bottom and somewhat smaller at the top. It is made of metal and is painted white inside and out. On its inside surface is a grid consisting of numbered vertical and lettered horizontal lines. A pointed brass rod projects upward inside the "shade."



Courtesy General Electric Co.

Heat generated by an atomic blast within a few miles of the device will scorch the painted inside surface. Since heat radiation travels in straight lines, it casts shadows of objects in its path in the same way that light rays cast shadows. The upper edge of the device and the pointed rod will cast shadows which appear as unscorched areas on the calibrated grid.

The lampshade will be inspected immediately after an atomic explosion. Shadows on the grid will indicate the direction and elevation of the blast. It is planned to install the devices so there will be at least four within one or two miles of any blast that may occur in a target area. By taking the readings of two or more indicators, a headquarters unit can, by triangulation, determine the elevation and ground-zero of the blast.

Crystal Quartz in U.S.A.

Quartz crystals of electronic quality have been discovered in appreciable quantity in the United States. Formerly we were dependent chiefly on Brazil for these important items. The new source of crystal quartz is on a high mesa in the Gosiute Indian reservation in Utah.

Preparations are being made by a Western mining company to excavate the quartz, the Indians to receive 10% of the company's profits. The U.S. Government (General Services Administration) has ordered the full output for the next year.

—end—

RADIO-ELECTRONICS for

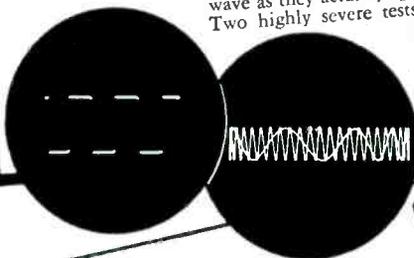
Features OF THE NEW 1952

Heathkits



PROOF OF THE NEW O-7 OSCILLOSCOPE'S OUTSTANDING PERFORMANCE

Below are actual, unretouched photographs showing the outstanding frequency response characteristics of the NEW 1952 HEATHKIT OSCILLOSCOPE, MODEL O-7. To the left is a 10 KC square wave — to the right a 4 MC sine wave as they actually appear on the screen. Two highly severe tests to make on any scope (only the best of scopes will show traces like these) — and the O-7 really comes through.



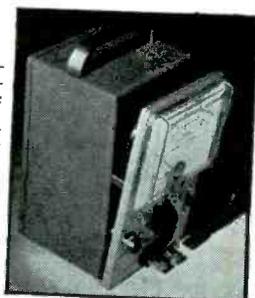
COMPANION VACUUM TUBE VOLTMETERS

Here are the two NEW 1952 VACUUM TUBE VOLTMETER COMPANION PIECES. Matched instruments of new design to open up the whole field of DC, AC, and resistance measurements for you. The new greatly reduced size combines style, beauty, and compactness — The V-5 and AV-1 have the new panel and cabinet construction as shown on the right. A tremendous pair of voltmeters. Small in size but virtual giants in the range of measurements they make.



NEW STYLE AND BEAUTY

Style that's modern, yet functional — that's the trend of today — and Heathkits are right up to the minute. Note the cut showing the new V-5 and AV-1 cabinet and panel construction. The front panel and rear cover slide right over the recessed flange of the case thereby eliminating sharp edges and pointed corners. The voltmeter kits aren't "shelf" or "mounted" instruments — they're moved about on the bench a lot and thus the new compact size and specially designed cabinets — Another 1952 Heathkit feature.



A STATEMENT FROM SIMPSON ELECTRIC CO.

In choosing Simpson Meters for their Heathkit VTVM, the Heath Co. has set a new high standard of kit meter quality. The same high quality of material, workmanship and design that has given Simpson the reputation for building "Instruments That Stay Accurate" is found in the Heathkit Meter Movement.

SIGNED
SIMPSON ELECTRIC CO.



A STATEMENT FROM CHICAGO TRANSFORMER

It is indeed gratifying to note the outstanding sales records you are building with your Heathkits.

This sales success is readily understandable, since we are cognizant of the high quality standards you have established for your component suppliers.

We at Chicago Transformer are proud that our product has contributed to the recognized quality and increasing popularity of Heathkits.

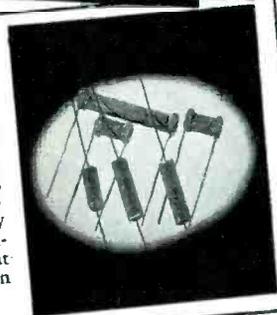
CHICAGO TRANSFORMER DIVISION
Essex Wire Corporation

L. S. RACINE
Vice-President and Sales Manager



HEATHKIT PRECISION RESISTORS

Where exact resistance values are required for instrument accuracy, the Heath Co. has spared no effort in supplying the finest resistors available. Precision resistors as manufactured by Continental Carbon Inc., and Wilcor Corp., meet the rigorous JAN (Joint Army-Navy) specifications and are small in size, extremely non-inductive, highly stable, have a low temperature coefficient, and can be held to great accuracy. You'll find quality components in Heathkits.



COLLEGES USE HEATHKITS

Colleges and Universities throughout the country are using Heathkits in their electrical engineering, radio, and physics laboratories — Heathkits are the answer to good test equipment at low cost, plus being rugged, dependable, and accurate. Trade schools are having their students build Heathkits to obtain a first hand working knowledge of test equipment and to get the practical experience gained by construction. Heathkits fill school needs.



YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE: AR14B-N.Y.

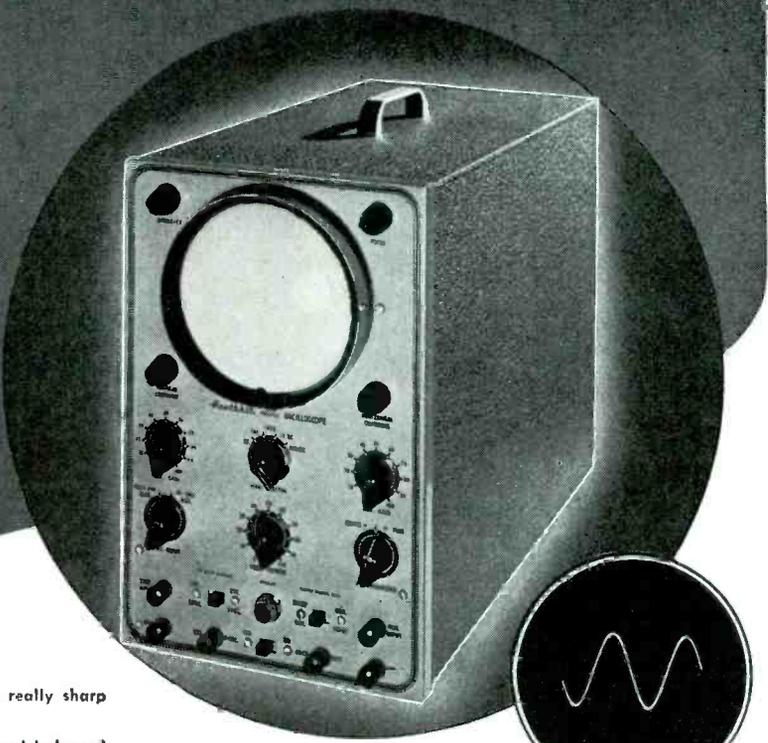
The HEATH COMPANY

... BENTON HARBOR 20, MICHIGAN

THE *New* 1952
Heathkit
**OSCILLOSCOPE
 KIT**

MODEL O-7
 SHIPPING WEIGHT 24 LBS.

\$43⁵⁰



Features

- New "spot shape" control for spot adjustment — to give really sharp focusing.
- A total of ten tubes including CR tube and five miniatures.
- Cascaded vertical amplifiers followed by phase splitter and balanced push-pull deflection amplifiers.
- Greatly reduced retrace time.
- Step attenuated — frequency compensated — cathode follower vertical input.
- Low impedance vertical gain control for minimum distortion.
- New mounting of phase splitter and deflection amplifier tubes near CR tube base.
- Greatly simplified wiring layout.
- Increased frequency response — useful to 5 Mc.
- Tremendous sensitivity .03V RMS per inch Vertical — .6V RMS per inch Horizontal.
- Dual control in vernier sweep frequency circuit — smoother acting.
- Positive or negative peak internal synchronization.

The performance of the NEW, IMPROVED, HEATHKIT 5" OSCILLOSCOPE KIT is truly amazing. The O-7 not only compares favorably with equipment costing 4 and 5 times as much, but in many cases literally surpasses the really expensive equipment. The new, and carefully engineered circuit incorporates the best in electronic design — and a multitude of excellent features all contribute to the outstanding performance of the new scope.

The VERTICAL CHANNEL has a step attenuated, frequency compensated vertical input which feeds a cathode follower stage — this accomplishes improved frequency response, presents a high impedance input, and places the vertical gain control in a low impedance circuit for minimum distortion. Following the cathode follower stage is a twin triode — cascaded amplifiers to contribute to the scope's extremely high sensitivity. Next comes a phase splitter stage which properly drives the push-pull, hi-gain, deflection amplifiers (whose plates are directly coupled to the vertical deflection plates). This fine tube lineup and circuitry give a sensitivity of .03V per inch RMS vertical and useful frequency response to 5 Mc.

The HORIZONTAL CHANNEL consists of a triode phase splitter with a dual potentiometer (horizontal gain control) in its plate and cathode circuits for smooth, proper driving of the push-pull horizontal deflection amplifiers. As in the vertical channel, horizontal deflection amplifier plates are direct coupled to the CR tube horizontal deflection plates (for improved frequency response).

The WIDE-RANGE SWEEP GENERATOR circuit incorporates a twin triode multivibrator stage for producing a good saw-tooth sweep frequency (with faster retrace time). Has both coarse and vernier sweep frequency controls.

And the scope has internal synchronization which operates on either positive or negative peaks of the input signal — both high and low voltage rectifiers — Z axis modulation (intensity modulation) — new spot shape (astigmatism) control for spot adjustment — provisions for external synchronization — vertical centering and horizontal centering controls, wide range focus control — and an intensity control for giving plenty of trace brilliance.

The Model O-7 EVEN HAS GREAT NEW MECHANICAL FEATURES — A special extra-wide CR tube mounting bracket is provided so that the vertical cascade amplifier, vertical phase splitter, vertical deflection amplifier, and horizontal deflection amplifier can mount near the base of the CR tube. This permits close connection between the above stages and to the deflection plates; distributed wiring capacity is greatly reduced, thereby affording increased high frequency response. The power transformer is specially designed so as to keep its electrostatic and electromagnetic fields to a minimum — also has an internal shield with external ground lead.

You'll like the complete instructions showing all details for easily building the kit — includes pictorials, step-by-step construction procedure, numerous sketches, schematic, circuit description. All necessary components included — transformer, cabinet, all tubes (including CR tube), completely punched and formed chassis — nothing else to buy.

NEW INEXPENSIVE *Heathkit*
ELECTRONIC SWITCH KIT

The companion piece to a scope — Feed two different signals into the switch, connect its output to a scope, and you can observe both signals — each as an individual trace. Gain of each input is easily set (gain A and gain B controls), the switching frequency is simple to adjust (coarse and fine frequency controls) and the traces can be superimposed for comparison or separated for individual study (position control).

Use the switch to see distortion, phase shift, clipping due to improper bias, both the input and output traces of an amplifier — as a square wave generator over limited range.

The kit is complete; all tubes, switches, cabinet, power transformer and all other parts, plus a clear detailed construction manual.



Model S-2
 Shipping Wt. 11 lbs.

Only
\$19⁵⁰

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

EXPORT AGENT
KOCHER INTERNATIONAL CORP.
 13 E. 40th ST.
 NEW YORK CITY (16)
 CABLE: ARKAB-N.Y.

The **HEATH COMPANY**

... BENTON HARBOR 20, MICHIGAN

RADIO-ELECTRONICS for

THE *New* 1952

Heathkit
**VTVM
KIT**

MODEL V-5
SHIPPING WT. 5 LBS.

\$24.50

Features

- New styling, — formed case for beauty.
- New truly compact size. Cabinet 4 1/8" deep by 4-11/16" wide by 7 3/8" high.
- Quality 200 microamp meter.
- New ohms battery holding clamp and spring clip — assurance of good electrical contact.
- Highest quality precision resistors in multiplier circuit.
- Calibrates on both AC and DC for maximum accuracy.
- Terrific coverage — reads from 1/2V to 1000V AC, 1/2V to 1000V DC, and .1 to over 1 billion ohms resistance.
- Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, and DB — has zero set mark for FM alignment.
- New styling presents attractive and professional appearance.

A real beauty — you'll have only highest praise for this NEW MODEL VACUUM TUBE VOLTMETER. Truly a beautiful little instrument — and it's more compact than any of our previous models. Note the new rounded edges on the front panel and rear cover. The size is greatly reduced to occupy a minimum of space on your workbench — yet the meter remains the same large size with plainly marked scales.

A set of specially designed control mounting brackets permit calibration to be performed with greatest ease — also makes for ease in wiring. New battery mounting clamp holds ohms battery tightly into place, and base spring clip insures a good connection to the ohms string of resistors.

The circuitry employs two vacuum tubes — A duo diode operating when AC voltage measurements are taken, and a twin triode in the circuit at all times. The cathode balancing circuit of the twin triode assures sensitive measurements, and yet offers complete protection to the meter movement. Makes the meter burn-out proof in a properly constructed instrument.

Quality components are used throughout — 1% precision resistors in the multiplier circuit — conservatively rated power transformer — Simpson meter movement — excellent positive detent, smooth acting switches — sturdy cabinet, etc.

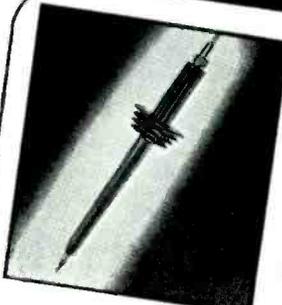
And you can make a tremendous range of measurements — 1/2V to 1000V AC, 1/2V to 1000V DC, .1 to over 1 billion ohms, and DB. Has mid-scale zero level marking for quick FM alignment. DB scale in red for easy identification — all other scales a sharp, crisp black for for easy reading.

A four position selector switch allows operator to rapidly set the instrument for type or reading desired — positions include ACV, DC+V, DC-V, and Ohms. DC- position allows negative voltage to be rapidly taken. Zero adjust and ohms adjust controls are conveniently located on front panel.

Enjoy the numerous advantages of using a VTVM. Its high input impedance doesn't "load" circuits under test — therefore, assures more accurate and dependable readings in high impedance circuits such as resistance coupled amplifiers, AVC circuits, etc. Note the 30,000 VDC probe kit and the RF probe kit — available at low extra cost and specially designed for use with this instrument. With these two probes, you can make DC voltage measurements up to 30,000V, or make RF measurements — added usefulness to an already highly useful instrument.

The instruction manual is absolutely complete — contains a host of figures, pictorials, schematic, detailed step-by-step instructions, and circuit description. These clear, detailed instructions make assembly a cinch.

And every part is included — meter, all controls, pilot light, switches, test leads, cabinet, instruction manual, etc.

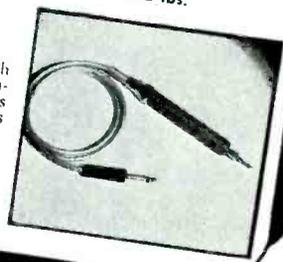


Heathkit 30,000V DC PROBE KIT

A new 30,000 V DC Probe Kit to handle high voltages with safety. For TV service work and all other high voltage applications. Sleek looking — two color molded plastic — Red body and guard — jet black handle — Red body with connector, cable, and PL55 type plug. Plugs into Heathkit VTVM so that 300V scale is conveniently multiplied by 100. Can be used with any standard 11 megohm VTVM.

\$550

No. 336 High Voltage Probe Kit
Shipping Wt. 2 lbs.



Heathkit RF PROBE KIT

This RF Probe Kit comes complete with probe housing, crystal diode detector, connector, lead and plug and all other parts plus clear assembly instructions. Extends range of Heathkit VTVM to 250 Mc. ± 10%. Works on any 11 megohm input VTVM. Specify No. 309 RF Probe Kit.

\$550

Ship. Wt. 1 lb.

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARIAB-N.Y.

The **HEATH COMPANY**
... BENTON HARBOR 20, MICHIGAN

Heathkit SIGNAL GENERATOR KIT

Model SG-6
Shipping Wt. 7 lbs.

The new Heathkit Signal Generator Kit has dozens of improvements. Covers the extended range of 160 Kc to 50 megacycles on fundamentals and up to 150 megacycles on useful calibrated harmonics; makes this Heathkit ideal as a marker oscillator for TV. Output level can be conveniently set by means of both step attenuator and continuously variable output controls. Instrument has new miniature HF tubes to easily handle the high frequencies covered.

Uses 6C4 master oscillator and 6C4 sine wave audio oscillator. The kit is transformer operated and a husky selenium rectifier is used in the power supply. All coils are precision wound and checked for calibration making only one adjustment necessary for all bands.

New sine wave audio oscillator provides internal modulation and is also available for external audio testing. Switch provided allows the oscillator to be modulated by an external audio oscillator for fidelity testing of receivers. Comes complete, all tubes, cabinet, test leads, every part. The instruction manual has step-by-step instructions and pictorials. It's easy and fun to build a Heathkit Model SG-6 Signal Generator.



\$19.50

Heathkit CONDENSER CHECKER KIT

Only
\$19.50

Model C-2
Shipping Wt. 6 lbs.



Checks all types of condensers — paper — mica — ceramic — electrolytic. All condenser scales are direct reading and require no charts or multipliers. Covers range of .00001 MFD to 1000 MFD. A Condenser Checker that anyone can read. A leakage test and polarizing voltage for 20 to 500 V provided. Measures power factor of electrolytics between 0% and 50% and reads resistance from 100 ohms to 5 megohms. The magic eye indicator makes testing easy.

The kit is 110V 60 cycle transformer operated and comes complete with rectifier tube, magic eye tube, cabinet, calibrated panel and all other parts. Has clear detailed instructions for assembly and use.

NEW Heathkit SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

\$19.50

Model T-2
Shipping Wt. 7 lbs.



The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker — locates intermittents — finds defective parts quicker — saves valuable service time — gives greater income per service hour. Works equally well on broadcast, FM, or TV receivers. The test speaker has an assortment of switching ranges to match either push-pull or single output impedances. Also tests microphones, pickups and PA systems. Comes complete: cabinet, 110V 60 cycle power transformer, tubes, test probe, all necessary parts, and detailed instructions for assembly and use.



Model TC-1
Shipping Wt. 12 lbs.

\$29.50

Heathkit TUBE CHECKER KIT

The Tube Checker is a MUST for radio repair men. Often customers want to SEE tubes checked, and a checker like this builds customer confidence. In your repairing, you will have a multitude of tubes to check — quickly. The Heathkit tube checker will serve all these functions — it's good looking (with a polished birch cabinet and an attractive two color panel) — checks 4, 5, 6, 7 prong Octals, Loctals, 7 prong miniatures, 9 prong miniatures, pilot lights, and the Hytron 5 prong types. AND IT'S FAST TO OPERATE — the gear driven, free-running roll chart lists hundreds of tubes, and the smooth, acting, simplified switching arrangement gives really rapid set-ups.

The testing arrangement is designed so that you will be able to test new tubes of the future — without even waiting for factory data — protection against obsolescence.

You can give tubes a thorough testing — checks for opens, shorts, each element individually, emission, and for filament continuity. A large BAD-?-GOOD meter scale is in three colors for easy reading and also has a "line-set" mark.

You'll find this tube checker kit a good investment — and it's only \$29.50.

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARLAS-N.Y.

The HEATH COMPANY

... BENTON HARBOR 20, MICHIGAN

New LABORATORY LINE HEATHKITS



MODEL AV-1
Shipping weight 5 lbs.

NEW *Heathkit*
A.C. VACUUM TUBE
VOLTMETER KIT

Now — as a Heathkit — at a price anyone can afford, an AC VTVM. A new kit to make possible those sensitive AC measurements required by audio enthusiasts, laboratories, and experimentors. Here is the kit that the audio men have been looking for. Its tremendous range of coverage makes possible measurements of audio amplifier frequency response — gain or loss of audio stages — characteristics of audio filters and attenuators — hum investigation — and literally a multitude of others. Ten ranges consisting of full scale .01, .03, .1, .3, 1, 3, 10, 30, 100, 300 volts RMS assure easy and more accurate readings. Ten ranges on DB provide for measurements from -52 to +52 DB. Frequency response within 1 DB from 20 cycles to 50 KC.

The ingenious circuitry incorporates precision multiplier resistors for accuracy, two amplifier stages using miniature tubes, a unique bridge rectifier meter circuit, quality Simpson meter with 200 microampere movement, and a clean layout of parts for easy wiring. A high degree of inverse feedback provides for stability and linearity.

\$29⁵⁰

Simple operation is accomplished by the use of only one control, a range switch which changes the voltage ranges in multiples of 1 and 3, and DB ranges in steps of 10.

The instrument is extremely compact, cabinet size — 4 1/8" deep x 4-11/16" wide x 7 3/8" high, and the newly designed cabinet makes this the companion piece to the VTVM. For audio work, this kit is a natural.

NEW *Heathkit*
AUDIO FREQUENCY METER KIT

MODEL AF-1
Shipping weight 12 lbs.



\$34⁵⁰

A NEW Heathkit Audio Frequency Meter — the ideal instrument for determining frequencies from 20 cycles to 100 KC. Set the selector switch to the proper range — feed the signal into the input terminals — and read the signal frequency from the meter — completely simple to operate, and yet dependable results.

Quality Simpson 200 microampere meter has two plainly marked scales (0-100 0-300). These scales, read in conjunction with the seven position selector switch, give full scale readings of 100, 300, 1000, 3000, 10,000, 30,000, and 100,000 cycles. Convenient ranges for fast and easy readings.

For greatest accuracy, the 1-3-10 ratio of ranges is maintained and each range has individual calibrating control.

Input impedance is high (1 megohm) for negligible circuit loading. A signal and a change in signal voltage between these limits will not affect the meter frequency of either sine wave or square wave input).

The tube complement consists of a 6SJ7 amplifier and clipper, 6V6 amplifier and clipper, 6H6 meter pulse rectifier, 6X5 power supply rectifier, and OD3/VR150 voltage regulator.

Construction is simple, and quality components are used throughout.

NEW *Heathkit*
INTERMODULATION ANALYZER KIT

Intermodulation testing of audio equipment is rapidly being accepted by more and more engineers and audio experts as the best way to determine the characteristics of audio amplifiers, recording systems, networks, etc. — shows up those undesirable characteristics which contribute to listening fatigue when all other methods fail.

The Heathkit Intermodulation Analyzer supplies a choice of two high frequencies (3000 cycles and a higher frequency (60 quency) and one low frequency (60 cycles). Both 1:1 or 4:1 ratios of low frequencies can be set up for IM testing, and the ratios are easily set by means of a panel control and the instrument's own VTVM. An output level control supplies the mixed signal at the desired level with an output impedance of two thousand ohms. The Analyzer section has input level control and proper filter to circuits feeding the instrument's VTVM to read intermodulation directly on full scale ranges of 30%, 10% and 3%. Built-in power supply furnishes all necessary voltages for operating the instrument.

You won't want to be without this new and efficient means of testing



MODEL IM-1
Shipping wt. 18 lbs.

\$39⁵⁰

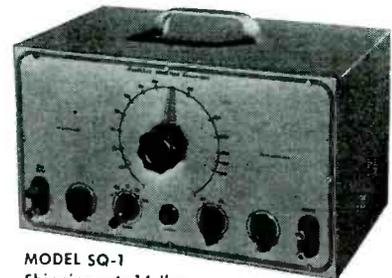
NEW
Heathkit **SQUARE WAVE GENERATOR KIT**

The new Heathkit Square Wave Generator Kit with its 100 KC square wave opens an entirely new field of audio testing. Square wave testing over this wide range will quickly show high and low frequency response characteristics of circuits — permit easy adjustment of high frequency compensating networks used in video amplifiers — identify ringing in circuits — demonstrate transformer characteristics, etc.

The circuitry consists of a multivibrator stage, a clipping and squaring stage, and a cathode follower output stage. The power supply is transformer operated and utilizes a full wave rectifier tube with 2 sections of LC filtering.

As a multivibrator cannot be accurately calibrated, a provision is provided to allow the instrument to be accurately synchronized with an accurate external source when extreme accuracy is required.

The low impedance output is continuously variable between 0 and 25 volts and operation is simple. You'll really appreciate the wide range of this instrument, 10 cycles to 100 kilocycles — continuously variable. Kit is complete with all parts and instruction manual, and is easy to build.



MODEL SQ-1
Shipping wt. 14 lbs.

\$29⁵⁰

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

REPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARLAB-N.Y.

The **HEATH COMPANY**

... BENTON HARBOR 20, MICHIGAN

Heathkit IMPEDANCE BRIDGE KIT



Model 1B-1B
Shipping Wt. 15 lbs.

\$69⁵⁰

This Impedance Bridge Kit is really a favorite with schools, industrial laboratories, and serious experimenters. An invaluable instrument for those doing electrical measurements work. Reads resistance from .01 Ohms to 10 meg., capacitance from .00001 to 100 MFD, inductance from 10 microhenries to 100 henries, dissipation factor from .002 to 1, and storage factor from 1 to 1000. And you don't have to worry about selecting the proper bridge circuit for the various measurements—the instrument automatically makes the correct circuit when you set up for taking the measurement you want. Bridge utilizes Wheatstone, Hay, Maxwell, and capacitance comparison circuits for the wide range and types of measurements possible. And it's self powered—has internal battery and 1000 cycle hummer. No external generator required—has provisions for external generator if measurements at other than 1000 cycles are desired. Kit utilizes only highest quality parts, General Radio main calibrated control.

Mallory ceramic switches, excellent 200 microamp zero center galvanometer, laboratory type binding posts with standard 3/4 inch centers, 1% precision ceramic-body type multiplier resistors, beautiful birch cabinet and ready calibrated panel. (Headphones not included.)

Take the guesswork out of electrical measurements—order your Heathkit Impedance Bridge kit today—you'll like it.

Heathkit LABORATORY RESISTANCE DECADE KIT



\$19⁵⁰

Shipping Wt. 4 lbs.

An indispensable piece of laboratory equipment—the Heathkit Resistance Decade Kit gives you resistance settings from 1 to 99,999 ohms IN ONE OHM STEPS. For greatest accuracy, 1% precision ceramic-body type resistors and highest quality ceramic wafer switches are used.

Designed to match the Impedance Bridge above, the Resistance Decade Kit has a beautiful birch cabinet and attractive panel. It's easy to build, and comes complete with all parts and construction manual.

Heathkit LABORATORY POWER SUPPLY KITS

Limits:

No load	Variable 150-400V DC
25 MA	Variable 30-310V DC
50 MA	Variable 25-250V DC

Higher loads: Voltage drops off proportionally

Every experimenter needs a good power supply for electronic setups of all kinds. This unit has been expressly designed to act as a source. Voltage control allows selection of HV output desired (continuously variable within limits outlined), and a Volts-Ma switch provides choice of output metering. A large plainly marked and direct reading meter scale indicates either DC voltage output (Range of meter 0-500V D.C., 0-200 Ma. D.C.). Instrument has convenient stand-by position and pilot light.



\$29⁵⁰

Model PS-1.....Ship. Wt. 20 lbs.

Comes with power transformer, filament transformer, meter, 5Y3 rectifier, two 1619 control tubes, completely punched and formed chassis, panel, cabinet, detailed construction manual, and all other parts to make the kit complete.

Heathkit ECONOMY . . . 6 WATT AMPLIFIER KIT



Model A-4
Ship. Wt. 8 lbs.

\$12⁵⁰

No. 304 12 inch speaker . . . \$6.95

This fine Heathkit Amplifier was designed to give quality reproduction and yet remain low in price. Has two preamp stages, phase inverter stage, and push-pull beam power output. Comes complete with six tubes, quality output transformer (to 3-4 ohm voice coil), husky cased power transformer and all other parts. Has tone and volume controls. Instruction manual has pictorial for easy assembly. Six watts output with response flat $\pm 1\frac{1}{2}$ db from 50 to 15,000 cycles. A quality amplifier kit at a low price. Better build one.

Heathkit HIGH FIDELITY . . . 20 WATT AMPLIFIER KIT

Our latest and finest amplifier—the model A-6 (or A-6A) is capable of a full 20 Watts of high fidelity output—good faithful reproduction made possible through careful circuit design and the use of only highest quality components. Frequency response within ± 1 db from 20-20,000 cycles. Distortion at 3 db below maximum power output (at 1000 cycles) is only .8%. The power transformer is rugged and conservatively rated and will deliver full plate and filament supply with ease. The output transformer was selected because of its exceptionally good frequency response and wide range of output impedances (4-8-16-150-600 ohms). Both are Chicago Transformers in drawn steel case for shielding and maximum protection to windings. The unit has dual tone controls to set the output for the tonal quality desired—treble control attenuates up to 15 db at 10,000 cycles—bass control gives bass boost up to 10 db at 50 cycles.



\$33⁵⁰

Shipping Wt. 18 lbs.

Tube complement consists of 5U4G rectifier, 6SJ7 voltage amplifier, 6SN7 amplifier and phase splitter, and two 6L6's in push-pull output. Comes complete with all parts and detailed construction manual. (Speaker not included.)
MODEL A-6: For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired.

MODEL A-6A: Features an added 6SJ7 stage (preamplifier) for operating from variable reluctance cartridge phono pickup, mike input, and either tuner or standard crystal phono pickup. A three position selector switch provides flexible switching.
Shipping Wt. 18 lbs. **\$35.50**

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
12 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARIRAP-NY

The **HEATH COMPANY**

. . . BENTON HARBOR 20, MICHIGAN



NEW 1952 *Heathkit*
**BATTERY ELIMINATOR
 KIT**

- Can be used as battery charger.
- Continuously variable output 0 - 8 Volts — not switch type.
- Heavy duty Mallory 17 disk type magnesium copper sulfide rectifier.
- Automatic overload relay for maximum protection. Self-resetting type.
- Ideal for battery, aircraft and marine radios.
- Dual Volt and Ammeters read both voltage and amperage continually — no switching.

The new Heathkit Model BE-2 incorporates the best. Continuously variable output control is of the variable transformer type with smooth wiper type contacts.

There are no switches or steps and voltage between 0 and 8 Volts is available at 10 Amperes continuous and 15 Amperes intermittent. Maximum safety from overloads and shorts provided by automatic overload relay which resets itself when overload is removed.

The new rectifier is a 17 plate Mallory magnesium copper sulfide type. This is the most rugged type available for long trouble-free use.

Output is continuously metered by both a 0 - 10 Volt Voltmeter and a 0 - 15 Amp Ammeter. Shorted vibrators indicated instantly by ammeter.

Equip now for all types of service — aircraft — marine — auto and battery radios — this inexpensive instrument vastly increases service possibilities — better be ready when the customer walks in.

\$24.50

Model BE-3
 Shipping Wt. 17 lbs.

NEW *Heathkit*
**SINE AND SQUARE WAVE
 AUDIO GENERATOR KIT**

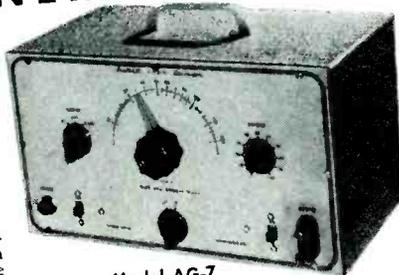
Designed with versatility, usefulness, and dependability in mind, the AG-7 gives you the two most needed wave shapes right at your fingertips — the sine wave and the square wave.

The range switch and plainly calibrated frequency scale give rapid and easy frequency selection, and the output control permits setting the output to any desired level.

A high-low impedance switch sets the instrument for either high or low impedance output — on high to connect a high impedance load, and on low to work into a low impedance transformer with negligible DC resistance.

Coverage is from 20 to 20,000 cycles, and distortion is at a minimum — you can really trust the output wave shape.

Six tubes, quality 4 gang tuning condenser, power transformer, metal cased filter condenser, 1% precision resistors in the frequency determining circuit, and all other parts come with the kit — plus, a complete construction manual — A tremendous kit, and the price is truly low.



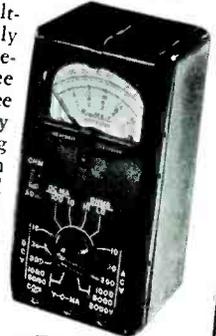
Model AG-7
 Shipping Wt. 15 lbs.

\$34.50

THE NEW *Heathkit*
HANDITESTER KIT

A precision portable volt-ohm milliammeter. Uses only high quality parts — All precision 1% resistors, three deck switch for trouble-free mounting of parts, specially designed battery mounting bracket, smooth acting ohm adjust control, beautiful molded bakelite case, 400 micro-amp meter movement, etc.

DC and AC voltage ranges 10 - 30 - 300 - 1000 - 5000V. Ohms range 0 - 3000 and 0 - 300,000. Range Milliamperes 0 - 10 Ma, 0 - 100 Ma. Easily assembled from complete instructions and pictorial diagrams.



\$13.50

Model M-1
 Shipping Wt. 3 lbs.

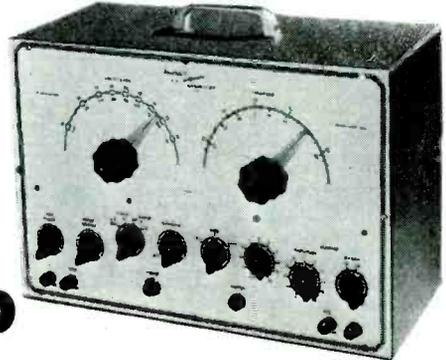
NEW *Heathkit*
T.V. ALIGNMENT GENERATOR KIT

A few auto radio repair jobs will pay for the Heathkit Battery Eliminator Kit. It's fast for service. The voltage can be lowered to find sticky vibrators or raised to ferret out intermittents. Provides variable DC voltage 5 to 7½ Volts at 10 Amps. continuous or 15 Amps. intermittent.

Also serves as storage battery charger. A well filtered, rugged power supply uses heavy duty selenium rectifier, a husky choke, and a 4000 MFD electrolytic condenser for clean DC. 0 - 15V voltmeter indicates output which is variable in eight steps. Better be equipped for all types of service — it means more income.

Model TS-2
 Shipping Wt. 20 lbs.

\$39.50



YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
 13 E. 40th ST.
 NEW YORK CITY (16)
 CABLE: ARLAB-N.Y.

The **HEATH COMPANY**

... BENTON HARBOR 20, MICHIGAN

Heathkit RECEIVER & TUNER KITS for AM and FM



Model BR-1 Broadcast Model Kit covers 550 to 1600 Kc. Shipping Wt. 10 lbs.

\$19⁵⁰



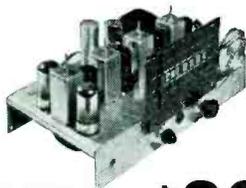
Model AR-1 3 Band Receiver Kit covers 550 Kc. to over 20 Mc. continuous. Extremely high sensitivity. Shipping Wt. 10 lbs.

\$23⁵⁰

TWO HIGH QUALITY *Heathkit* SUPERHETRODYNE RECEIVER KITS

Two excellent Heathkits. Ideal for schools, replacement of worn out receivers, amateur and custom installations.

Both are transformer operated quality units. The best of materials used throughout — six inch calibrated slide rule dial — quality power output transformers — dual iron core shielded. I.F. coils — metal cased filter condenser. The chassis has phono input jacks, 110 Volt output for phono motor and there is a phono-radio switch on panel. A large metal panel simplifying installation in used console cabinets is included. Comes complete with tubes and instruction manual incorporating pictorials and step-by-step instructions (less speaker and cabinet). The three band model has simple coil turret which is assembled separately for ease of construction.



Model FM-2
Ship. Wt. 9 lbs.

\$22⁵⁰

TRUE FM FROM

Heathkit

FM TUNER KIT

The Heathkit FM Tuner Model FM-2 was designed for best tonal reproduction. The circuit incorporates the most desirable FM features — true FM.

Utilizes 8 tubes: 7E5 Oscillator, 6SH7 mixer, two 6SH7 IF amplifiers, 6SH7 limiter, two 7C4 diodes as discriminator, and 6X5 rectifier.

The instrument is transformer operated making it safe for connection to any type receiver or amplifier. Has ready wound and adjusted RF coils, and 2 stages of 10.7 Mc IF (including limiter). A calibrated six inch slide rule dial has vernier drive for easy tuning. All parts and complete construction manual furnished.



MAIL TO THE
HEATH COMPANY
BENTON HARBOR 20,
MICHIGAN

ORDER BLANK

From _____

SHIP VIA

- Parcel Post
- Express
- Freight
- Best Way

Quantity	Item	Price	Quantity	Item	Price
	Heathkit Oscilloscope Kit — Model O-7			Heathkit H.V. Probe Kit — No. 336	
	Heathkit VTVM Kit — Model V-5			Heathkit R.F. Signal Gen. Kit — Model SG-6	
	Heathkit FM Tuner Kit — FM-2			Heathkit Condenser Checker Kit — Model C-2	
	Heathkit Broadcast Receiver Kit — Model BR-1			Heathkit Handitester Kit — Model M-1	
	Heathkit Three Band Receiver Kit—Model AR-1			Heathkit Power Supply Kit — Model PS-1	
	Heathkit Amplifier Kit — Model A-4			Heathkit Resistance Decade Kit — Model RD-1	
	Heathkit Amplifier Kit — Model A-6 (or A-6A)			Heathkit Impedance Bridge Kit — Model IB-1B	
	Heathkit Tube Checker Kit — Model TC-1			Heathkit A.C. VTVM-KIT — Model AV-1	
	Heathkit Audio Generator Kit — Model AG-7			Heathkit Intermodul. Analyzer Kit—Model IM-1	
	Heathkit Battery Eliminator Kit — Model BE-2			Heathkit Audio Freq. Meter Kit — Model AF-1	
	Heathkit Electronic Switch Kit — Model S-2			Heathkit Square Wave Gen. Kit — Model SQ-1	
	Heathkit T.V. Alignment Gen. Kit — TS-2				
	Heathkit Signal Tracer Kit — Model T-2				
	Heathkit R.F. Probe Kit — No. 309				

On Parcel Post Orders, include postage for weight shown and insurance. (We insure all shipments.)

On Express Orders, do not include transportation charges — they will be collected by the Express Agency at time of delivery.

Enclosed find Check Money Order for _____

Please ship C.O.D. Postage enclosed for _____ lbs.

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE ARAB.N.Y.

The HEATH COMPANY

... BENTON HARBOR 20, MICHIGAN

SIDEBAND GENERATOR

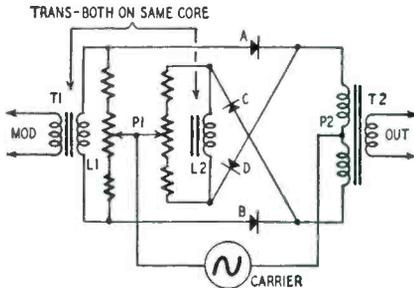
Patent No. 2,545,250

Kurt E. Appert, San Francisco, Calif.
(Assigned to Lenkurt Electric Co., Inc.)

This circuit mixes two signals, for example a.f. modulation with an r.f. carrier. Both signals are balanced out and do not appear, only the sidebands remain. No tubes are needed in this circuit.

The carrier is connected between P1 and P2. It divides equally and flows in opposite directions through the windings of the T2 primary. Thus the carrier is balanced out. Modulation is fed to T1 which has 2 secondaries, L1 and L2. Each is shunted by a center-tapped resistor.

The carrier voltage is made much larger than the modulation. Therefore the conductivity of the four rectifiers is determined solely by the carrier. During one-half cycle of the carrier, while P1



is positive and P2 negative, A and B are biased for full conduction while C and D are blocked. During this period L1 delivers its voltage to T2 but L2 is effectively isolated. During the next half-cycle, L2 delivers its voltage to T2 while A and B are blocked by the large negative voltage on their anodes.

Modulation voltage is thus transmitted to T2 but it is reversed rapidly (at the carrier rate). Therefore the audio envelope has simultaneous positive and negative components, and the modulation (like the carrier) is cancelled out.

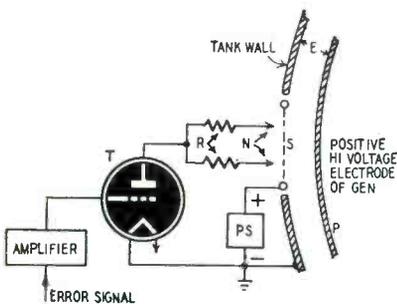
Sidebands are generated because of the non-linearity of the rectifiers. These are available at the output terminals.

HIGH-VOLTAGE REGULATOR

Patent No. 2,548,452

Clarence M. Turner, Stony Brook, N. Y.
(Assigned to United States of America as represented by U. S. Atomic Energy Committee)

It is difficult to regulate the output of an electrostatic generator like the Van de Graaff because of the high voltages involved. This invention permits control without a direct connection to the hot terminal. There are no moving parts.

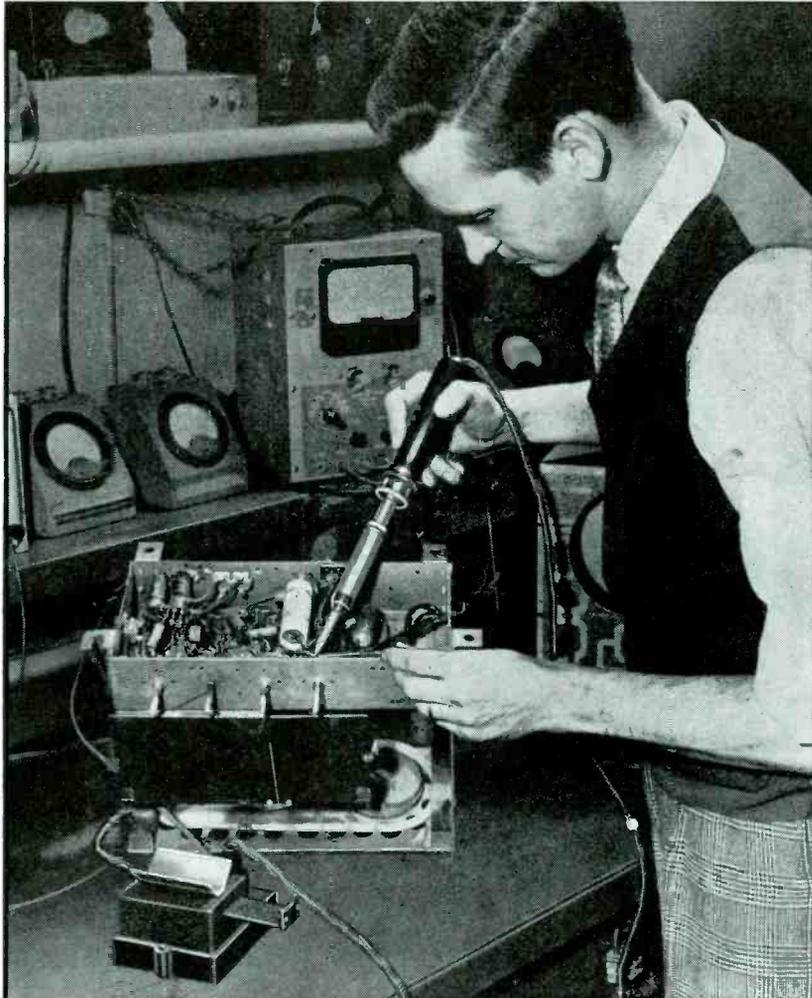


Resistors R act as load resistors and stabilize corona discharge from the end of needles N.

Metal needles N are fixed near a screen S. The screen substitutes for part of the tank wall of the generator. As usual, the wall is the grounded negative terminal. The power supply PS is sufficient to generate a corona discharge between N and S. This discharge is formed when electrons are drawn from the points N under influence of the positive screen.

The elements N, S, and P act as a triode. Some electrons pass through S and continue on to P. This flow loads the generator and lowers its output voltage E.

An amplified error-signal controls tube T and therefore determines the emission from N. This signal may be a small fraction of the generator output. If E rises for any reason, there is a greater error-signal and a more intense corona discharge. The increased flow between S and P reduces the generator output to normal.



SERVICEMEN, AMATEURS, TECHNICIANS SELECT-

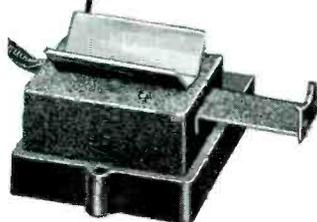
American Beauty

SOLDERING IRONS

for

TOP SOLDERING PERFORMANCE!

Outstanding performance coupled with durability of construction make American Beauty electric soldering irons the choice of discriminating users in all fields



TEMPERATURE REGULATING STAND

Providing heat-regulation for all sizes of electric soldering irons, this stand is adjustable for all heats up to full working-temperature. Assures longer life of iron and tip.

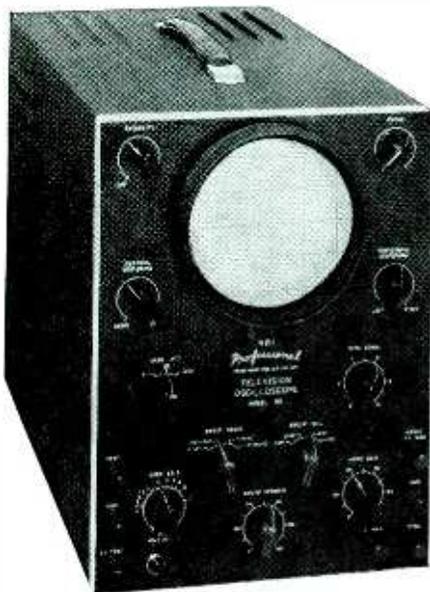
122

For descriptive catalog pages write Dept. S-23

AMERICAN ELECTRICAL HEATER CO.
DETROIT 2, MICH.

New 5 Inch Oscilloscope

FOR TELEVISION, AM & FM SERVICING



only \$127⁵⁰ Available on monthly terms

PERFORMANCE EQUALS SCOPES MUCH HIGHER PRICED

WIDE-BAND VERTICAL AMPLIFIER ± 3 db from 10 cps to 4.5 mc on any attenuator setting; useful to 7 mc.

VERTICAL SENSITIVITY—.014 volt (RMS) per inch.

CALIBRATED THREE STEP VERTICAL ATTENUATOR (Frequency Compensated)—gives peak-to-peak voltages direct.

BALANCED PUSH-PULL DEFLECTION AMPLIFIERS—used for both horizontal and vertical deflection.

WIDE-RANGE HORIZONTAL SWEEP—10 cps to 100 kc in four overlapping ranges; will sync with 3 mc sine wave.

THIRTEEN TUBES including 5U1 CR Tube.

VOLTAGE REGULATED FUSED POWER SUPPLY.

DESCRIPTIVE CIRCULAR FREE

Servicemen, investigate this scope before you buy another. Save yourself money, keep down your investment in equipment. Mail coupon or postcard for free descriptive circular giving details regarding its operation, specifications, and terms. You'll agree that this scope is just what you want for TV, AM, and FM servicing jobs—that it is an exceptional value. Send coupon in envelope or paste on penny postal.

MAIL NOW

NATIONAL RADIO INSTITUTE, DEPT. SD2
16th & U STS., N.W., WASHINGTON 9, D. C.
Send me, without obligation, descriptive circular regarding the NRI 5" Professional TV Scope.

NAME.....
ADDRESS.....
CITY.....ZONE.....STATE.....

GAS FLAME PROTECTION

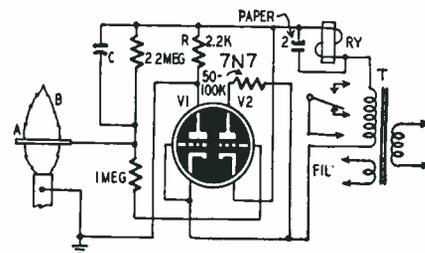
Patent No. 2,528,589
George P. Frick, Wayne, Pa.
(Assigned to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.)

This invention automatically shuts off a gas supply if the flame goes out. Its operation is based on the conductivity of a flame.

Winding T of the power transformer feeds rectifier V1. Rectified voltage appears across R, and half-waves of current flow downward through relay RY. Load resistor R is shunted by a 2.2-megohm resistor and a flame B in series. When the flame is on, its conductivity completes a voltage divider across R and C becomes charged. When the flame goes out, there is infinite resistance between electrode A and ground. There is no voltage division in this case and C loses its charge.

Grid and cathode of triode V2 are across C (through a grid resistor). When the flame is on, the voltage from C biases the triode beyond cutoff, and the only relay current is due to the half-waves flowing downward. When the flame goes out, there is no charge on C, and V2 conducts to send half-waves of current upward through RY. Since both alternations of the a.c. pass through

the relay there is no average d.c. component to energize it. The a.c. is bypassed by a 2- μ f capacitor across RY. The relay contacts control the gas



feed to the flame so that gas flows only in the energized position. This external control circuit is not illustrated here.

CONDUCTANCE METER

Patent No. 2,547,650
William A. McCool, Hyattsville, Md.
(assigned to Boonton Radio Corp.)

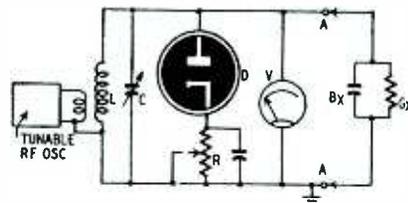
Measuring conductance and susceptance at any desired r.f. this device is applicable to coils, transmission lines, transformers and similar equipment.

With terminals A left open, the oscillator is set to the desired frequency. Then the secondary circuit is resonated by means of C. Meter V shows

when resonance occurs and measures the voltage across the secondary. D is a diode rectifier of the 6H6 type.

When the unknown network (shown here as Gx, Bx) is added, the secondary is detuned and shunted. Resonance may be re-established by varying C. The difference in scale reading of C shows the value of Bx. If the first reading is the higher one, then Bx is a capacitor. Otherwise it is an inductor. C may be calibrated in terms of capacitance (or inductance) across A so Bx can be read directly.

Gx shunts the secondary so the second maximum of V is lower than the first. The original maximum can be restored by increasing R. This control may be calibrated in terms of resistance across A. Then Gx is found directly by reading the dial.

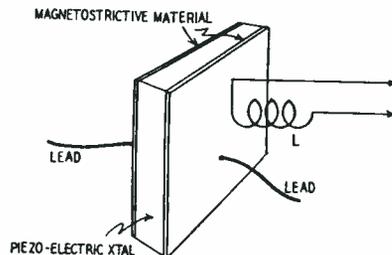


FREQUENCY CONTROL

Patent No. 2,551,848
Billy E. Parker, Quincy, Ill.

This control varies the physical dimensions of a quartz plate. The opposite surfaces of the quartz are coated with a thin layer of nickel or other magnetostrictive material. External connections are made by leads soldered to the metal surfaces.

A crystal may be used to control the frequency of an oscillator or as a filter element. However, if a coil L is added near the nickel layers, current through L sets up a magnetic field which expands or contracts the nickel. As a result the dimensions of the quartz plate also vary to alter the resonant frequency.



LINEAR SINGLE-SWEEP

Patent No. 2,539,007
Lourens Blok and George Philip Roszbach,
Eindhoven, Netherlands.
(assigned to Hartford Nat'l Bank)

A single-sweep time base such as needed to display a transient signal on a scope is provided by this circuit. It is not easy to attain linearity when such a sweep is very rapid. Compensation is added here to obtain a sweep which is rapid and linear.

A single-sweep is often generated by discharging a capacitor through a pentode. Normally the tube is blocked, and when the bias is removed the discharge current flows through it. Although a pentode tends to pass constant current, it is found that the current actually rises gradually from

zero to its final value. This is due to the fact that when bias is removed, the grid does not reach cathode potential instantaneously.

The new circuit (see diagram) has a variable resistor R (about 120 ohms) in series with the usual capacitor C. Normally the tube is blocked (SW open). When SW is closed, the bias is removed and the sweep starts. SW may be closed manually as shown, or electronically by the transient to be observed. In either case C discharges through R and the tube.

The discharge current (I) increases gradually

TRANSVISION

Sensational Offer!

2 Yr. GUARANTEE on PICTURE TUBES

Pro-Rated

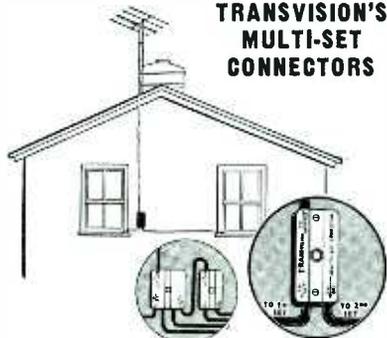


Transvision is the first and only manufacturer to offer you this amazing 2 yr. guarantee. Top quality rectangular and round tubes; all sizes.

Write for NEW LOW PRICES

FEED up to 5 TV SETS from 1 Antenna with

TRANSVISION'S MULTI-SET CONNECTORS



Increase Sales with Multi-Set Connectors. Ideal for homes, garden apartments, TV dealers, bars, etc. Big savings in time and labor.

PRICES: Multi-Set Conn. for 2 sets \$4.95 list*
" " " for 3 or 4 sets \$7.95 list*

FULLY GUARANTEED

*Dealers, write for discounts

CR Tube REACTIVATOR REVIVES DIM TV CR TUBES



It's profitable—first use often pays for instrument. Reactivates may dim CR Tubes, or tubes with low light output, if there's no mechanical defect. 110V-60 cycles; weighs 3 lbs.

\$14.95 NET

FIELD STRENGTH METER

at NEW LOW PRICE:

only \$59 net

Improves TV installations; saves 1/2 the work. Model FSM-1, complete with tubes \$59 net



Write for details on amazing Transvision FACTORY AGENT PLAN!

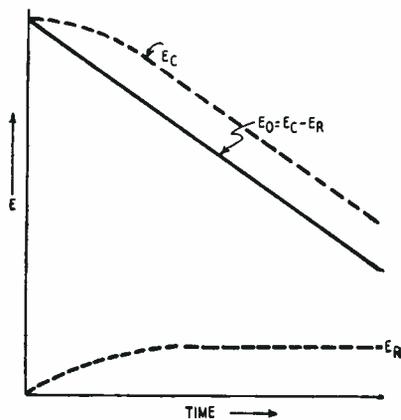
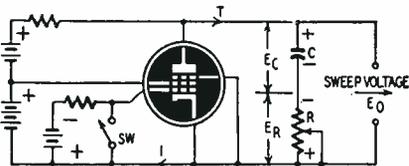
FREE:

Sample copy of "TV and Electronics Notes". Or send 50c to cover cost of addressograph plate and subscription. Monthly issues are gold mines of info on color, conversion, sales, service, etc. Write for it today!

TRANSVISION, INC.

DEPT. RE NEW ROCHELLE, N. Y.

before reaching its steady value. Therefore E_R (which is proportional to I) has the shape shown in the figure. Since I is the current withdrawn from the capacitor during discharge, E_C will



decay as shown by the curve. If R is correctly chosen, the rise in E_R will be similar to the decay of E_C .

The sweep voltage is the difference between E_C and E_R . It is shown by the straight line E_O which indicates a linear sweep.

POWER FACTOR METER

Patent No. 2,543,640

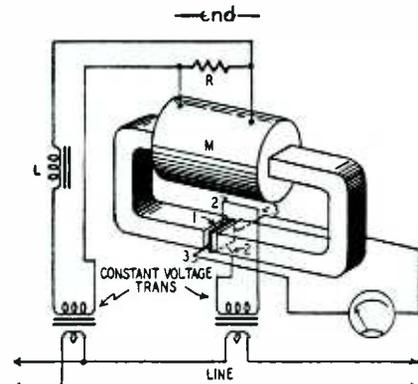
Noval P. Millar, Danvers, Mass. and Russell A. Warner, Schenectady, N. Y.

(assigned to General Electric Co.)

The Hall effect is utilized in this instrument to measure power factor in an a.c. line. If current flows through a plate of germanium while in a magnetic field, the germanium generates a potential difference. The voltage will be perpendicular to both the current and the field, and will be proportional to their product.

M is an electromagnet supplied with a.c. through a phase-shifter. L and R produce a 90° shift. The Hall plate (1) is fixed between the magnet pole pieces. Current flows through the plate by means of conductors (2). The generated voltage is available from leads (3) and is measured by the galvanometer.

Because of the phase shifter, the field is 90° out of phase with the current to the germanium, under conditions of unity power factor in the line. The product of two vectors with 90° phase difference is zero. Therefore the meter shows a reading of zero-center if the power factor is unity. As the factor lags or leads, the needle will deflect in one direction or the other. The meter may be calibrated in terms of power factor.



Learn Radio TELEVISION

through this UNIT CHASSIS SYSTEM

The exclusive "Unit Chassis System" of teaching television was developed at this 48-year-old College of Electrical Engineering. The TV set is divided into stages on separate chassis. You study one stage at a time, intimately learning the functions of every component of all types and makes of receivers. You are fully prepared to cope with future design changes, including the advent of color television. By enrolling NOW you will be ready for engineering employment opportunities predicted to reach a new high level in 1954.

You can become a Radio Technician in 12 months

The first third of the College of Electrical Engineering program trains you for such positions as Radio Shop Operator or Serviceman, Supervisor of Service Personnel. The Radio Technician's certificate is awarded. You may then advance immediately or at a future date into courses described below.

Radio-Television Certificate in 6 additional months

Be prepared for such work as Radio TV Service—Audio, Transmitter or Communication Technician—and Broadcast Operator (upon passing FCC examination).

Also Your Technician Courses are credited toward the B. S. Degree in ELECTRICAL ENGINEERING.

The Radio Technician course, while complete in itself, is one-third of the college program (major in electronics). Further, you may select as an elective: design, research, manufacturing and production, or engineering sales and management.



B.S. Degree in 36 months. Military, practical or prior academic, training evaluated for advanced credit. Terms open January, April, July, October.

MILWAUKEE SCHOOL of ENGINEERING

Technical Institute • College of Electrical Engineering

FREE—Write for "Occupational Guidance Manual" and 1951 Catalog.



MILWAUKEE SCHOOL OF ENGINEERING Dept. RE-1151, 1025 N. 8th Way, Milwaukee, Wisconsin

Without obligation, mail Your Career Bulletin, 1951 Catalog, Occupational Guidance Bulletin on Radio-TV, Electrical Engineering, B.S. Degree in Electronics, Electrical Power. Also bulletin on Electrical Service, Welding, Refrigeration, Heating, Air Conditioning.

Name..... Age.....
Address.....
City..... State.....
If Veteran, indicate date of discharge

KON-TIKI

Thousands read the best-seller! Millions have seen and will see the thrilling movie!

NATIONAL

SW-54
\$49⁹⁵

by the makers of professional radio
equipment for the

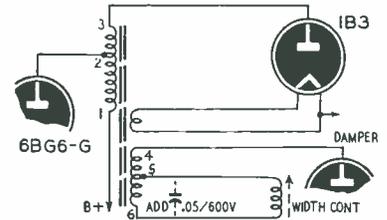
greatest adventure of our time!

Despite 101 days of salt spray and even total immersion, a National transmitter and receiver kept the world-famed Kon-Tiki Expedition in touch with the world! Now the same rugged dependability is yours in the amazing SW-54, the "Mighty Midget" broadcast and shortwave receiver (540 kcs. to 30 mcs.). Measures only 11" x 7" x 7". Write for details and name of nearest supplier!



INCREASING PICTURE WIDTH

If the width control of a TV set cannot be adjusted so the picture completely fills the screen, or if the set has no width control, the picture width can be extended to a satisfactory degree by



connecting a .05- μ f, 600-volt capacitor across terminals 5 and 6 of the horizontal output transformer.—L. H. Casto

ADMIRAL 24-TUBE CHASSIS

Strong 60-cycle hum in the 24D1, 24E1, 24F1, 24G1, and 24H1 chassis is generally caused by one of the following, and can be corrected easily:

- (1) The cold side of the volume control may be connected to the grounded heater lug of the first a.f. amplifier tube instead of to the grounded cathode lug on the same socket. Make sure that the volume control grounds to the cathode lug.
- (2) The a.c. leads to the switch on the volume control may be too close to the grid lead of the first a.f. tube. Dress the a.c. leads well away from the grid lead. Later production models have a retaining lug to keep the a.c. leads dressed against the chassis.
- (3) The coupling capacitor between the volume control and first a.f. grid may be reversed.—Admiral Radio & TV Service Bulletin

HALLICRAFTERS T-54

Failure of sound and video circuits is sometimes caused by a short in the .02- μ f capacitor between ground and the plate of the 25L6-GT audio output tube. The short circuit reduces the plate voltages to the point where the video circuits are inoperative. Replace this capacitor with a .02- μ f, 600-volt unit.

To improve the sensitivity of this set, remove the 10,000-ohm resistor between the plate and screen grid of the 6AG5 r.f. amplifier.—Wilbur J. Hantz

EMERSON 650D, 654DF, AND 654F

If the set does not work and several of the tubes do not light, check the filament-dropping resistors. These usually go bad after the set has been in service for about a year. After repairing the set, check the line voltage at the outlet supplying the receiver.

Do not confuse models 650D and 654D (chassis 120123-B) and 650F and 654F (chassis 120138-B)—transformerless types—with the 650 and 654 (chassis 120118-B) which have power transformers.—Wilbur J. Hantz

AIRLINE MODEL 62-901

If you find the 6A7 screen bypass capacitor C31 shorted, check the screen-dropping resistor R21 to make sure that its value has not changed from 30,000 ohms. This set will not track properly if the value has changed.—Clarence J. Tabor

COLOR TONE! TELEVISION!

Simply attach TELECOLOR FILTER to front of set and enjoy programs in glorious color tones instead of dull black and white. GUARANTEED to give genuine color tone. Can also be used with any other filter. Once tried, you will never go back to old black and white. Write for FREE information. ORDER BY MAIL. NEW REDUCED PRICES! Send check, M.O., cash, COD to Dept. RE-1

10 in.	\$1	16, 17 in.	\$3
12, 14 in.	\$2	19, 21 in.	\$5

HARVARD LAB. 459 FULTON ST. BROOKLYN, N.Y.

HAVE YOU A JOB FOR A TRAINED TECHNICIAN?

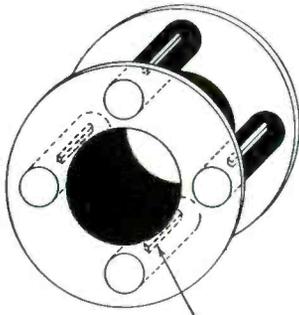
We have a number of alert young men who have completed intensive training in Radio and Television Repairing. They learned their trades thoroughly by working on actual equipment under personal, expert supervision. If you need a trained man, we invite you to write for an outline of our course, and for a prospectus of the graduate. No fees, of course. Address:

Placement Manager, Dept. P108-11
COMMERCIAL TRADES INSTITUTE
1400 Greenleaf Chicago 26

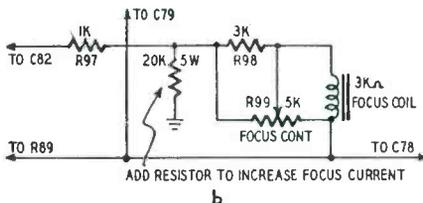
PIX TUBES FOR SENTINEL 420TV

The Sentinel model 420TV was originally shipped with a 16-inch rectangular picture tube bearing the manufacturer's part number 57E5 or 57E6. When exact replacements are not available, 16TP4 or 16RP4 tubes can be used as replacements.

After installing the 16TP4 or 16RP4, set the horizontal drive control as described on page 4 of the service manual for this model. If neck-shadow is present, remove it by adjusting the four mounting screws on the focus-coil mounting assembly. Adjust the focus control for proper focus.



STEEL SHUNTS HERE (ON EACH) TO REDUCE STRENGTH ON FOCUS MAGNET



ADD RESISTOR TO INCREASE FOCUS CURRENT

If focus improves but is not perfect when the control is in the full counter clockwise position, the focus magnet is too strong. Correct this by placing four $\frac{3}{4} \times \frac{1}{8} \times \frac{1}{16}$ -inch steel strips around the focus magnet as shown in the drawing at a. If these shunts do not bring proper focus within the range of the control, use additional shunts.

If you must turn the focus control clockwise for improved focus but perfect focus is not attained before the control reaches the full clockwise position, the focus magnet is too weak. Connect a 20,000-ohm, 5-watt resistor between ground and the junction of resistors R97, R98, and R99 as shown in the partial schematic at b.—Sentinel Service Dept.

CARE OF FOCUSING MAGNETS

The PM and EM-PM type focus magnet assemblies used in many TV sets can be permanently damaged by improper handling or storage. A slight jar or striking with a metal tool may cause the unit to lose its magnetism and affect its ability to properly focus the electron beam on the screen of the picture tube.

Always use a brass or nonmetallic screwdriver when making adjustments on the unit. When storing, do not leave them in contact with each other or with any metal material such as tools, other components, or shelving. Do not store them where they will be subjected to severe mechanical shock or vibration.—Stromberg-Carlson Service Dept.

—end—

"CONICAL-V-BEAMS"

*REGISTERED TRADE MARK

NOT JUST A WISE CHOICE —
BUT THE ONLY CHOICE
for
SUPERIOR PERFORMANCE
Telrex "CONICAL-V-BEAMS"
FOR THE ULTIMATE IN
TV RECEPTION

- Full Audio and Video Bandpass
- High Gain and High Signal to Noise Ratio
- Telrex designs and manufactures antennas for all requirements. See your Telrex distributor.

DELUXE SERIES—World's most famous, most powerful, most sturdily constructed antenna. Superior to any for TV-FM and UHF reception. WRITE today for your Telrex catalog.

"CONICAL-V-BEAMS" are produced under Re-issue Patent No. 23,346.

CANADIAN AND FOREIGN PATENTS PENDING

telrex INC. AMERICA'S STANDARD OF COMPARISON

CONICAL-V-BEAMS ASBURY PARK 9, NEW JERSEY

Immediate Delivery of **SCARCE RADIO TV TUBES**

TUBES BOUGHT, SOLD and TRADED. Send Your Want and Trade List!

Complete Line of TELEVISION PICTURE TUBES
Radio and TV service men, experimenters, amateurs... we have many types of scarce tubes ready for immediate shipment. Don't use make-shifts or spend valuable time looking for tube sources. Try Electro FIRST... and get the tubes you need without delay. Get complete list and Electro's low prices. It's FREE... write today!

ELECTRO-SALES 425 W. Randolph St., Chicago 6, Ill.

EASY TO LEARN CODE

It is easy to learn or increase speed with an Instructograph Code Teacher. Affords the quickest and most practical method yet developed. For beginners or advanced students. Available tapes for beginner's alphabet to typical messages on all subjects. Speed range 5 to 60 WPM. Always ready—no QRM.



ENDORSED BY THOUSANDS!

The Instructograph Code Teacher literally takes the place of an operator-instructor and enables anyone to learn and master code without further assistance. Thousands of successful operators have "acquired the code" with the Instructograph System. Write today for convenient rental and purchase plans.

INSTRUCTOGRAPH COMPANY

4701 Sheridan Rd., Dept. RC, Chicago 40, Ill.

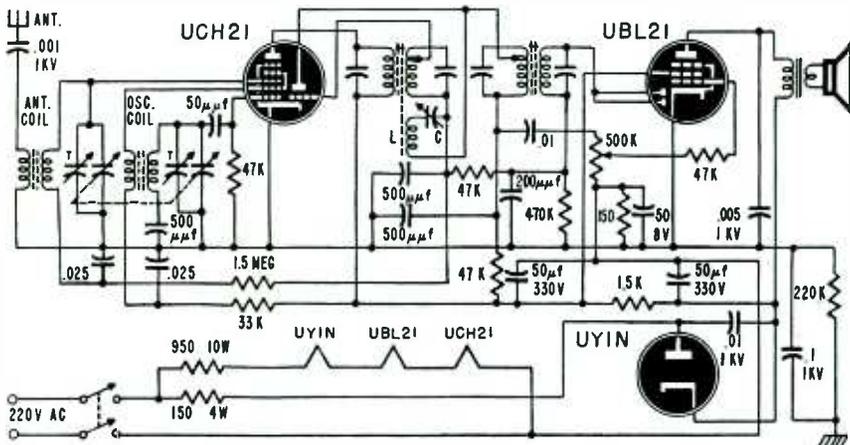
NOVEL 3-TUBE SUPERHETERODYNE FROM AUSTRIA

A glance at the circuit of this 3-tube superhet receiver will show that it is rather unusual when compared to typical American circuits. This set was described in *Radiotechnik* (Vienna, Austria).

The receiver uses a UCH21 triode-heptode, UBL21 duodiode-power amplifier, and a UY1N half-wave rectifier. In most European circuits, the

grid. The trimmer capacitor C serves as a blocking capacitor as well as a means of tuning the trap (neutralizing) circuit.

The UBL21 is the second detector and power amplifier tube. The output section is a beam power amplifier having comparatively high sensitivity. With 100, 180, or 200 volts on plate and screen, grid bias is 5.3, 10, or 13 volts



UCH21 is connected with the heptode section working as a mixer and the triode as the high-frequency oscillator in a converter circuit similar to that which we commonly use with a 6K8. In this circuit, the heptode section is used as a pentagrid converter and the triode section as a *neutralized i.f. amplifier*.

The triode section of the UCH21 is neutralized to prevent oscillation. Inductive neutralization is used. The inductance of L is paralleled by the grid-plate capacitance of the triode to form a parallel-resonant circuit tuned to the intermediate frequency. The high impedance of the tuned circuit prevents the flow of current from plate back to

respectively.

The UY1N is a half-wave rectifier tube having a 20-volt heater. In other respects, it is very much like the 35Z3 and similar American types.

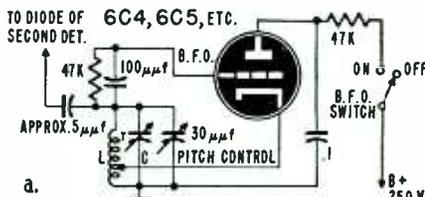
This circuit can be used as the basis for a number of interesting experimental circuits. For example, you may try a 6X8 as the converter and i.f. amplifier, a germanium diode as the second detector, a sensitive power amplifier tube as the output stage, and a selenium rectifier in the power supply circuit. Note that this set operates from a 220-volt line. It might be advisable to use a voltage doubler type power supply to obtain comparable plate and screen voltages.

SIMPLE SHORTWAVE RECEIVER CONVERSIONS

There are a number of home-type all-wave receivers which compare favorably with communications sets in selectivity and sensitivity. Such sets can be converted for amateur use by adding a b.f.o. and S-meter. The b.f.o. circuit shown at *a* and the S-meter at *b* can be added to most receivers without making any changes in the original wiring. These circuits were described in an article on an 11-tube communications receiver in *La Radio Professionnelle* (Paris, France).

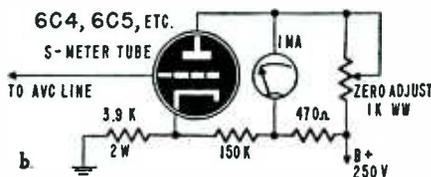
Both circuits are designed to use a medium-mu triode such as a 6C4 or 6C5. You can conserve space by using the separate triodes of a 6SN7-GT or a 12AU7.

The b.f.o. is an oscillator which tunes



over a range of 10 or 15 kc on each side of the receiver's intermediate frequency. The coil L may be one winding of an i.f. transformer designed for a frequency equal to the receiver's i.f. with a 30-turn cathode winding close to the ground end of the i.f. coil. No. 28 or 30 wire may be used for the cathode winding. Reverse the connections to this winding if the circuit does not oscillate. C is the usual i.f. tuning capacitor. Its value should be adjusted so the circuit oscillates at the receiver's i.f. when the pitch control is set at midrange. Shield the entire b.f.o. circuit and use minimum coupling to the second detector.

The S-meter circuit is a triode v.t.v.m. which measures the a.v.c. voltage and uses this as a measure of



THE RIGHT ANTENNA

can do wonders for any TV set

Television & FM Antenna Guide

Shows you how to get the most out of the antenna system at any location.

Remember the TV broadcasts from the San Francisco conference in August? *Special antennas made them possible.* To get the most out of any TV receiver at any location, a thorough knowledge of the best type of antenna to use and how to install it is essential. This book gives you that knowledge. It tells you how to determine, quickly and accurately, the best spot and direction for the antenna and what type to use; how to minimize noise from the transmission line; when and why to use booster amplifiers.

Includes UHF

It explains antennas for the new UHF band and shows how to attach a UHF antenna to a VHF model. Everything you want to know about antennas is here, in the most convenient handbook form for quick on-the-job reference. Get a copy without cost and see for yourself. Use the coupon below.

FOR THE RIGHT SOLUTIONS TO YOUR PROBLEMS

use these most helpful books

Radio and TV Mathematics

A Handbook of Problems & Solutions

721 sample problems and solutions show you what formulas to use, what numerical values to substitute, and each step in working out any problem you may encounter in radio, television or industrial electronics, conveniently arranged and thoroughly indexed by radio topics so you can quickly find the solution to YOUR problem.

Television for Radiomen

Clear, non-mathematical explanations of the operating principles and function of every part and circuit in today's TV receivers, with full instruction on installation, alignment, testing, adjusting and trouble shooting.

SEE THEM ON APPROVAL

The Macmillan Co., 60 Fifth Ave., N. Y. 11

Please send me copies of the books checked below. I will either remit in full or return the books in 10 days.

- Television & FM Antenna Guide \$5.50
- Radio & TV Mathematics \$6.00
- Television for Radiomen \$7.00

Signed

Address



NEW GOODLINE AIRLEAD has everything you want!

- Sharp, clean, "snow-free" pictures.
- Correct impedance for "ghost-free" reception. Nominal 300 ohms.
- Lower in cost than other leadlines purported to accomplish same results.
- Correct spacing for minimum radiation loss—Less than 1% of operating wave length.
- Fully insulated—approved by safety experts.
- Pure, unadulterated polyethylene insulation—specially treated by our chemists for extreme weather.
- High-efficiency conductors: Flexible, stranded—to insure long life.
- Easily installed—with standard insulators.
- Packaged in convenient lengths: 100', 250', 500', 1,000', 2,500'.
- AT YOUR DEALERS, or Write For Free Samples and Literature.

*Patent Pending *Trade Mark U.S. and Foreign Patents Pending
EXCLUSIVE LICENSEE AND SOLE MANUFACTURER

Don Good, INC.

1014 FAIR OAKS AVENUE
SOUTH PASADENA, CALIFORNIA

OTHER OUTSTANDING GOODLINE PRODUCTS:

VARIABLE TELETRAPS -2: Highly effective for *eliminating interference* from FM STATIONS, and DIATHERMY and AMATEUR SIGNALS within its tuning range.

HI-PASS FILTER: *Eliminates or greatly reduces interference* picked up by I. F. AMPLIFIER or TV RECEIVER—interference arising from strong, local low-frequency fields: X-Ray, Diathermy Equipment, Neon Lights, Etc., Etc.

WANTED TO BUY

Large and small quantities of new or used electronic government or manufacturers' surplus tubes and equipment. Highest prices paid. State quantity, condition and best price in first letter.

Box No. F-2 c/o Radio-Electronics
25 West Broadway
New York 7, N. Y.

TELEVISION RECEIVER—\$1.00

Complete instructions for building your own television receiver. 16 pages—11"x17" of pictures, pictorial diagrams, clarified schematics. 17"x22" complete schematic diagram & chassis layout. Also booklet of alignment instructions, voltage & resistance tables and troubleshooting hints.—All for \$1.00. Write for free catalogue.

CERTIFIED TELEVISION LABORATORIES
Dept. C, 5507-13th Ave., Brooklyn 19, N. Y.

SURPLUS
BOUGHT & SOLD
GOULD GREEN
252 Greenwich St.
Worth 4-8044—NYC 7

signal strength. The meter should be adjusted to zero with the antenna posts grounded and the sensitivity control turned to maximum.

The conversion can be completed by installing a switch which grounds the a.v.c. line when the b.f.o. is turned on to receive c.w. This switch is connected between ground and the grid returns on the grid side of the a.v.c. isolating resistor.

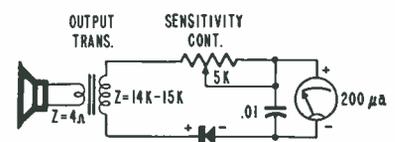
A bandsread capacitor is another desirable feature. A good approximation is a 15- or 20- μ mf variable connected across the high-frequency oscillator trimmer in the receiver. Fitted with a knob, it will act as the bandsread tuner. The set should be aligned with it in the half-in position, which should be clearly marked, so that stations will come in at the same point on the main tuning dial.

A noise limiter is often used in communications receivers. One may be added, using the circuits shown in the June, 1951, issue of RADIO-ELECTRONICS.

A.F. OUTPUT METER

An output meter like that shown in the diagram is a handy piece of equipment to have on the aligning bench of a busy radio service shop. The average service technician uses the a.c. volts or output range of a multimeter, thus tying up the instrument so it cannot be used for more essential work.

This instrument, described in *Popular Radio* (Stockholm, Sweden) works without being connected to the set. Sound is picked up by a microphone—a small loudspeaker—and fed through a rectifier to a 200- μ a d.c. meter. An output transformer having a turns ratio of 60 to 1 provides a high output voltage. A transformer designed to match a 4-ohm voice coil to a 14,000- or 15,000-ohm plate should work nicely. The rectifier may be a germanium diode or an instrument rectifier.



When aligning sets, the output meter is placed in front of the speaker on the set. The volume control and the 5,000-ohm sensitivity control are adjusted for a low reading on the meter. Receiver circuits are then aligned for maximum swing on the meter.

When working with audio circuits and filters, the volume control or input to the circuit and the sensitivity control on the output meter are adjusted so the meter reads zero db. Changes in volume level can then be read directly from the meter which is calibrated in decibels.

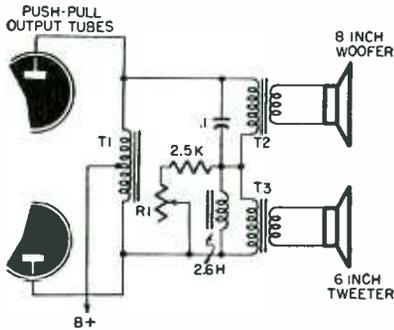
The meter is calibrated with zero db at the 80- μ a point. Above zero db, +2, +4, +6, and +8 db are at 100, 126, 159, and 200 μ a respectively, on the meter. Below zero db, 63, 50, 35, and 25 μ a are marked -2, -4, -7, and -10 db respectively.

—end—

RADIO-ELECTRONICS for

NOVEL CROSSOVER NETWORK

I find that the circuit shown is an acceptable substitute for the more expensive dividing or crossover networks used with most high-fidelity reproducing systems. It is particularly useful in small receivers which do not have sufficient baffling to warrant the ex-

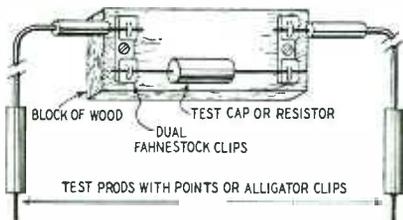


pense of a more elaborate system. The crossover frequency is approximately 400 cycles.

T1 is the regular output transformer of the receiver or amplifier. Its secondary is not used. T2 and T3 are small output transformers. The primary impedance of each is equal to the plate-to-plate load impedance of the output tubes. R1 serves as a tone control by cutting the highs fed to the tweeter. I use a 500,000-ohm unit, but probably a lower value will work better.—G. Borchert

SUBSTITUTION BLOCK

This little gadget is as handy as it is simple to construct. I find it lots easier to use than a decade box. The component leads are clamped firmly to Fahnestock clips on a heavy wooden block, so



there is little danger of short-circuits or an accidental shock. If test leads are fitted with alligator clips, the setup can be used when trying different components in experimental circuits. Any capacitor, resistor, or other two-terminal device can then be inserted for test or substitution.—M. J. Kolo

TOM THUMB 3-WAY SET

The customer reported that severe distortion appeared in the set after he had installed five new 1.5-volt A-cells. The distortion sounded like that produced by improper bias or a bad coupling capacitor. Examination showed that the new cells had been inserted incorrectly. The trouble cleared up when the cells were properly installed.

Bias for the various stages is obtained by returning the grids to points on the series-connected filament string. Reversing the polarity of one or more cells will cause severe distortion as will one or two bad or low cells.—David Gnessin

NOVEMBER, 1951

GET YOUR BIG, NEW 1952 CONCORD Catalog FREE!

Send for it NOW!

ALL-NEW COMPLETE BUYING GUIDE for Every Need!

FAMOUS PRODUCTS—VAST STOCKS—LOWEST PRICES

TV • RADIO • ELECTRONICS

You save time and money—with this bigger, better 1952 Buying Guide! Here is page-after-page full of the latest and greatest values in Television, Radio and Electronics. It brings right to your finger tips one of the world's largest stocks of nationally known guaranteed quality parts and equipment. You find it quick and easy to get whatever you need—at the very lowest prices! Send for your FREE *Concord* Catalog today! Have it handy for quick reference!

Supplies for Industry, TV and Broadcast Stations, Schools, Servicemen, Hams, Government, Experimenters and Builders

CONCORD RADIO

901 W. JACKSON BLVD. • CHICAGO
Over 30 Years of Service to the Radio World

CONCORD RADIO CORP., Dept. JL-51
901 W. Jackson Blvd., Chicago 7, Illinois

Rush FREE Big, New 1952 CONCORD Catalog No. 951

Name _____

Address _____

City _____ Zone _____ State _____

FREE SEND FOR IT TODAY!

- HIGH FIDELITY TV & RADIOS
- PHONOS & RECORDERS
- SOUND SYSTEMS
- HAM GEAR
- TEST EQUIPMENT
- ELECTRONIC TUBES
- PARTS, BOOKS, KITS

FAST DELIVERY
Large and varied stocks insure quick shipment on thousands of items.

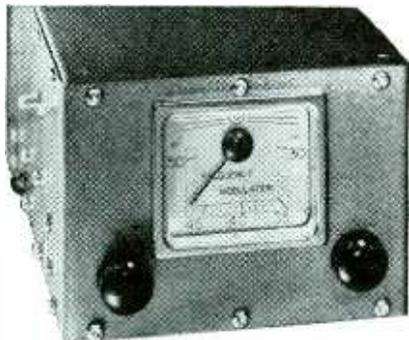
HELPFUL SERVICE
Our technical experts give personal attention to your problems!

INDUSTRIAL DIVISION
Experienced staff and centralized efficiency speed service on supplies to Industry!

HIGH FIDELITY
Complete systems and custom components for finest reproduction!

EXPORT DIVISION
Special Export Division gives prompt service on orders and inquiries.

POSITIVE SATISFACTION
CONCORD'S policy of quality and value assures you of complete satisfaction!



**Model
M-51
\$72.50**

for emergency communications

USED BY HUNDREDS OF MUNICIPALITIES FROM BOSTON, MASS., TO ALHAMBRA, CAL.

POLIC-ALARM MONITOR-RADIO

5 Models For All Systems

6 VOLT MOBILE

M-51

Tuneable 30-50 MC

M-101

Tuneable 152-163 MC

RCC-1

Fixed Frequency

in both bands

115 VOLT AC-DC

PR-31

Tuneable 30-50 MC

PR-8

Tuneable 152-163 MC

AIRCRAFT

AR-1

AM Tuneable 108-132 MC

115 Volt AC-DC

Says S. L. Grant, City Manager, Winchester, Virginia . . .

"I think you have a receiver that is well built, and I see no reason why it should not be in demand by all public works departments that have a transmitter available."



Users of FM 2-Way Radio Communications equipment throughout the entire nation, find Polic-Alarm and Monitor-Radio a welcome innovation to low-cost mobile communications radio .

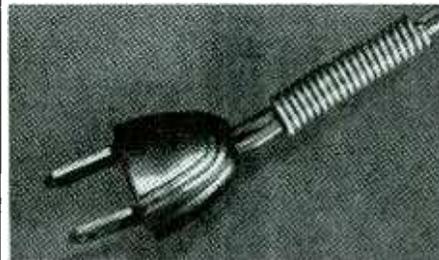
For Complete Information: See Your Jobber—Or Write Us Today

RADIO APPARATUS CORPORATION

55 N. NEW JERSEY ST., INDIANAPOLIS 4, IND., PHONE: ATLANTIC 1624

HANDY SOLDER SUPPLY

Forgetting to take along a supply of solder when going on a service call or running out of solder just when you need it most, can be prevented by wrap-



ping a foot or two of wire solder around one end of the soldering-iron cord as shown in the photo. Here, it is out of the way, yet always available when needed. —Louis H. Yates

DEFECTIVE TUBES ARE USEFUL

Frequently amateurs and radio experimenters are called on to repair a small a.c.-d.c. set for a friend or relative. Usually, the trouble is a burned-out tube as indicated by the complaint, "the set won't light".

To quickly locate the tube with the open filament, make a collection of different types of tubes which have good filaments but are otherwise defective. Snip off all the pins except those for the heater. Now, when you get a set to repair, you can quickly find the defective tube by substituting a dummy.

I have also found the dummy tubes handy substitutes for line-dropping resistors in experimental a.c.-d.c. circuits. For example, I built a code oscillator using a 35Z5-GT and 50L6-GT. I didn't have a resistor which could be used in series with the heaters so I wired in an extra socket and inserted a dummy 35Z5-GT. —C. Tierney

LINE FILTERS IN A.C. SETS

Many a.c. receivers have filter capacitors—usually about 0.1 μ f—connected from the chassis to one or both sides of the a.c. power line. Although these capacitors are effective in removing stray line noises, they have the disadvantage of reducing the line-isolating capabilities of the power transformer. The current passed by these capacitors is not sufficient to damage any of the set's components but it can give you a healthy jolt if you happen to get between the chassis and a good ground. You can avoid it by removing one capacitor and connecting the other across the line. —Charles Erwin Cohn

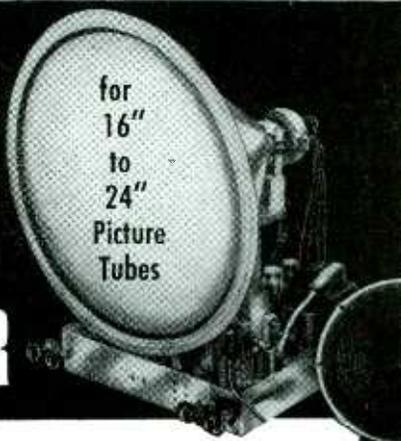
CARRIER-CURRENT NOTES

Recently, I constructed the carrier-current relay described in the September, 1950 issue. While experimenting with it, I found that it will not work if a receiver or other device having a bypass capacitor across its line cord is plugged into the power line. The capacitor short-circuits the line for r.f. so the relay will not work. The same applies to most carrier-current or wired-wireless devices. —Walter R. Sherman

—end—

3 New
Custom-Built
Deluxe
TV Chassis

by **TECH-MASTER**



MODEL 2430—Designed specifically for all picture tubes requiring from 65 to 70 degrees horizontal deflection, (such as 24AP4, 20CP4, 19AP4, etc.) Supplied with 5X7 speaker and Universal Picture Tube Mounting Brackets. . . . \$189.50

MODEL 2431P—Similar to model 2430, but with Push-Pull Audio, Phono Jack, 12" PM Speaker and Universal Picture Tube Mounting Brackets. . . . \$199.95

MODEL 2431C—Basically same as Model 2430 but with Continuous Tuner, Push-Pull Audio, Phono Jack, 12" PM Speaker and Universal Picture Tube Mounting Brackets. Allows complete coverage of both TV and FM bands. . . . \$199.95

The new **Gold Medal Series** incorporates all the latest Tech-Master features which have made this improved 630 type chassis the standard by which custom-built TV is measured . . . performance and service are assured because Tech-Master design and construction are as fine as human hands and brains can produce. All chassis are supplied completely wired, aligned and tested with all tubes (less picture tube).

LOOK for your Tech-Master registration and guarantee card attached to each chassis . . . it is your assurance that you are buying a genuine Tech-Master receiver.



See the Gold Medal Series and other quality Tech-Master products at your favorite Radio Parts Jobber or write direct to Tech-Master Products Co. Dept. RE-11 for complete descriptive literature.

TECH-MASTER PRODUCTS CO.

443-445 Broadway • New York 13, N. Y.

RADIO-ELECTRONICS for

WORLD'S FASTEST SELLING VOLT-OHM MILLIAMMETER



Sensitivity
1000 ohms per volt

- ★ Uses latest design 2% accurate 1 Mil. D'Arsonval type meter.
- ★ Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range.
- ★ Housed in round-cornered, molded case.
- ★ Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

The Model 770 comes complete with self-contained batteries, test leads and all operating instructions.

\$14.90
NET

- Specifications:**
- 6 A.C. VOLTAGE RANGES:
0-15/30/150/300/1500/3000 Volts.
 - 6 D.C. VOLTAGE RANGES:
0-7.5/15/75/150/750/1500 Volts.
 - 4 D.C. CURRENT RANGES:
0-1.5/15/150 MA. 0-1.5 Amps.
 - 2 RESISTANCE RANGES:
0-500 Ohms 0-1 Megohm.

Model 770
is an accurate pocket-size V.O.M.
Measures only 3 1/8" x 5 7/8" x 2 1/4"

Write Dept. RC-11 for catalog of complete line.

SICO Manufactured and Guaranteed by
SUPERIOR INSTRUMENTS CO.
227 Fulton Street • New York 7, N. Y.

AT YOUR RADIO PARTS JOBBER

centers. The quarter-wavelength matching stubs may be No. 12 wire spaced 1 1/2 inches, or 1/4-inch tubing or rod spaced 4 1/2 inches.

The length of the matching stubs is calculated from the formula:

$$L = 246 \times V/f,$$

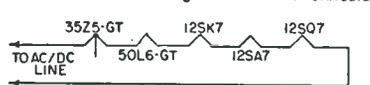
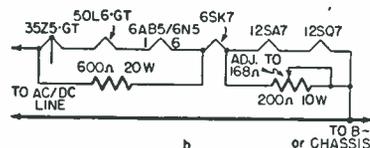
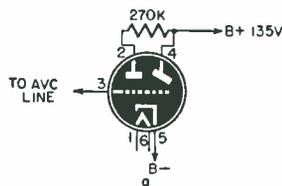
where L is the length of the stub in feet, V is the velocity factor (approximately 0.975 for open-wire lines), and f is frequency in megacycles. If the antenna is cut for a single channel, substitute for f the center frequency of that channel. For an all-channel antenna, use the average of the frequencies of the highest and lowest local channels or use the center frequency of the weakest local channel.

ADDING A TUNING INDICATOR

? Please show me how to connect an electron-ray tuning indicator tube to an a.c.-d.c. receiver which uses a 35Z5-GT, 50L6-GT, 12SQ7, 12SA7, and 12SK7. I would like to use either a 6AF6-G or a 6AB5/6N5.—C. M., Maracaibo, Venezuela

A. Your set requires approximately 120 volts across the series-connected heater string for proper operation. If you use the set on a.c. only, then you can connect the indicator tube as shown at a and supply its heater voltage from

6AB5/6N5



a small 6.3-volt, 1-ampere filament transformer. If the set is used on d.c., you may substitute a 6SK7 for the 12SK7 and connect the heater of the 6AB5/6N5 in the filament string as shown at b. The 6SK7 draws 300 ma, so resistors must be shunted around the sections of the string which contain the 150-ma tubes. The drawing at c shows the heater circuit of the average 5-tube receiver using the tubes you have listed or their equivalents. If a 35L6 can be used for the 50L6, the 6AB5 can be inserted without other changes.

Some receivers develop considerably more a.v.c. voltage than others for a given signal input to the antenna, therefore allowance must be made for individual receiver peculiarities.

In this circuit, -10 volts must be applied to the grid of the 6AB5 for zero shadow angle. Therefore, it may be necessary to add a cathode biasing resistor. A resistor of approximately 2,000 ohms will be about right.

—end—

FREE! Just For Examining
COYNE'S
New 5-Volume Set
APPLIED PRACTICAL RADIO-TELEVISION

Get this Book of TV PICTURE PATTERNS FREE. Gives you dozens of actual TV Test Patterns and wave forms—tells how to use them to shoot trouble and repair TV sets quicker easier. Money-making short cuts that help you get ahead in Television. It's yours FREE!

Complete Up-to-Date!
This book is our gift to you for examining Coyne's brand new 5-volume set APPLIED PRACTICAL RADIO-TELEVISION. Here is the most completely up-to-date set of reference books in America! 1500 easy-to-understand pages; 1000 illustrations. Covers all phases of radio and television. Tells you how to install, service, trouble shoot, align all types of radio and television sets. "Break-down" photos help you understand quicker.

Sensational Free Book Offer Send No Money!
Mail coupon now to get this great new 5 volume set and the FREE Book of Picture Patterns. Use the set 7 days. If you keep the set, pay just \$3.00 after 7 days and \$3.00 a month until \$16.50 plus postage is paid. (Cash price \$15.00.) If not 100% satisfied with set send it back and owe us nothing. EITHER WAY THE BOOK ON TV PICTURE PATTERNS IS YOURS FREE. Coupon is just a request to see set and get Free book of picture Patterns. This offer is limited. ACT NOW!

FREE ON 7 DAYS TRIAL

MAIL COUPON NOW!

COYNE ELECTRICAL & TELEVISION-RADIO SCHOOL
500 S. Paulina St., Dept. B1-T1, Chicago 12, Ill.
Rush "APPLIED PRACTICAL RADIO-TELEVISION" on 7 days' FREE TRIAL, per offer above.

NAME..... Age.....
Address.....
City..... Zone..... State.....
Where Employed.....
 Check here if you want set sent C.O.D. You pay postman \$15.00 plus C.O.D. postage. Same money-back guarantee of satisfaction.

DID YOU GET IT? IF NOT
SEND NOW FOR B-A'S
136 BIG PAGE
FREE CATALOG

RADIO TELEVISION ELECTRONICS
1952

B-A

INCLUDING 21 PAGES OF DOLLAR-SAVING BARGAINS!

BURSTEIN-APPLEBEE CO.
1012-14 McGee St.
Kansas City 6, Mo.

Send your 1952 catalog to:

Name.....
Address.....
City..... State.....

FREE

BURSTEIN-APPLEBEE CO.

RTMA ANSWERS TECHNICIANS

The Radio-Television Manufacturers Association's Service Committee met September 18 at New York. Delegates of several radio-TV service technicians' and TV contractors' associations were also present. The committee made a formal reply to the proposals made by the service technicians' representatives at the committee's Chicago meeting (RADIO-ELECTRONICS, Aug. 1951, page 87 and Sept. 1951, page 119).

On the question of design the RTMA committee stated that the majority of member manufacturers were in favor of, and had already complied with, requests such as stamping model and serial numbers on the chassis, providing tube layouts in each set, providing protective covers on metal picture tubes, engineering sets with servicing in view, and that practically all their other members had "set wheels in motion" in that direction. The committee did not quite see its way clear, however, to promise that such problems as tubes and fuses placed under the chassis would be settled immediately.

Even after it was pointed out by service delegates present that large manufacturers had marketed receivers with removable safety glass, so that the face of the picture tube could be cleaned, the committee insisted that the underwriters have not approved the practice.

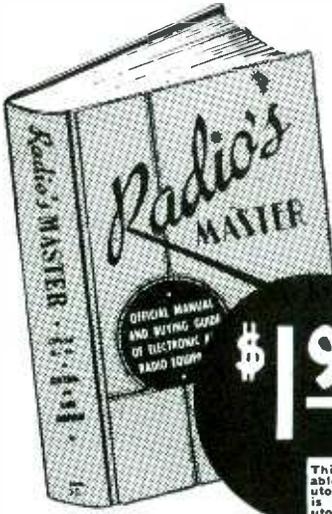
The "more liberal program" in supplying service notes was "economically unfeasible" the committee stated. Krantz of Philadelphia, representing NETSDA, pointed out that much of the present distribution of service data is wasted, going into the hands of dealers and distributors who neither understood nor used the data, and that if such data were in the hands of the active service technician it would result in an increase in components sales probably sufficient to cover the cost of distributing the service data. The service technician, it was pointed out, would naturally prefer to use the correct replacement part, which could be installed without difficulty, if he had the information which would permit him to order it. This point evoked considerable interest, and it is felt that future policies of RTMA members may favor wider data distribution than envisaged by the committee's statement.

It appeared that the manufacturers had not been able to make progress on the proposal for an effective training program on u.h.f. and color, for technicians to whom these fields are new, as requested at the June meeting. Instead, some progress had been made in a plan to have a television technician's training course included in the curriculum of 2,500 vocational schools.

Service technician representatives attending the meeting expressed the feeling that while much asked for at the Chicago meeting had not materialized, considerable progress had been made. The very fact that manufacturers and service technicians are at last working together for their mutual benefit is a great step forward, they pointed out.

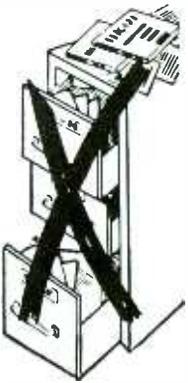
NOVEMBER, 1951

**You'll find it
FASTER
in the
MASTER**



\$1.95

This special offer available ONLY thru Distributors (Publisher's price is \$6.50). The Distributors absorb the bulk of the cost for the privilege of printing their ad on the front cover.



No More
Files of
Small
Catalogs and
Loose
Literature

**When you BUY--SELL--SPECIFY
you must have the MASTER**

This single volume replaces all other small catalogs

Over 90% of the products manufactured in the Radio-Electronic-Television Parts and Equipment Industry are catalogued in this BIG 1100 page MASTER Buying Guide. Complete descriptions, with specifications and illustrations are written and compiled by each manufacturer covering such products as: tubes, instruments, TV parts, transformers, capacitors, resistors, test equipment, relays, coils and antenna equipment. Also, recording and PA systems, intercoms, tools, hardware, switches and thousands of associated products. IT'S YOUR "RADIO BIBLE"—SAVES YOU TIME AND MONEY.

**BE MASTER-Minded—GET your copy NOW
from local Distributor**

UNITED CATALOG PUBLISHERS, INC.
110 Lafayette St., New York 13, N. Y.

ONLY available thru Distributors at this special \$1.95 price

SHOOT TV TROUBLE
FAST!

With H. G. CISIN'S
Copyrighted Rapid
"TV TROUBLE SHOOTING METHOD"

EARN more money! Locate television troubles by this quick, entirely new method. Rapid checks applied in simple, logical steps enable you to classify, sub-classify, diagnose and locate all faults in record-breaking time regardless of make or model!

H. G. CISIN is well-known to radio and television men as a recognized electronic engineer, inventor, technical author and educator. He has trained thousands of television technicians, many of them now owning their own prosperous TV service organizations or holding important positions in television. The results of his years of experience are embodied in this remarkable TV TROUBLE SHOOTING METHOD.

HERE'S PROOF! J. B. Seiler, Chicago, writes: "Rush another copy. Am tickled to death with results. Your book hasn't failed me yet." G. E. Hirsch, Jamaica, N. Y. "Congratulations! Your book extremely underpriced. Very ingenious in its logical use of cause and effect, should be in every TV tool kit."

INCREASE your earning power with the most valuable aid to TV servicing ever written!

Guaranteed, Money Back in 5 Days If Not Satisfied!

Send Your Name & Address Today. \$1
POSTPAID ---

↓ RUSH COUPON NOW! ↓

H. G. CISIN—CONSULTING ENGINEER
Dept. E-7, 200 Clinton St., Brooklyn 2, N. Y.

Enclosed is \$..... for which please rush copies (postpaid) of your TV TROUBLE SHOOTING METHOD.

Name.....

Address.....

City..... Zone..... State.....

AMPERITE

Studio Microphones
at P.A. Prices

Ideal for
BROADCASTING
RECORDING
PUBLIC ADDRESS

"The ultimate in microphone quality," says Evan Rushing, sound engineer of the Hotel New Yorker.

- Shout right into the new Amperite Microphone—or stand 2 feet away—reproduction is always perfect.
- Not affected by any climatic conditions.
- Guaranteed to withstand severe "knocking around."



Models
RBLG—200 ohms
RBHG—Hi-imp.
List \$42.00



"Kontak" Mikes
Model SKH, list \$12.00
Model KKH, list \$18.00

Special Offer:

Write for Special Introductory Offer. and 4-page illustrated folder.

AMPERITE Company, Inc.

561 BROADWAY • NEW YORK 12, N. Y.

Canada: Atlas Radio Corp., Ltd., 560 King St. W., Toronto



Special Offer On This Complete **RADIO ENGINEERING LIBRARY**

New, Up-To-Date Edition of Famous Library Covers Whole Field of Radio Engineering. Places Latest Facts, Standards, Data, Practice, and Theory At Your Fingertips

The five big volumes of the new edition of the Radio Engineering Library now include the very latest facts, standards, data, and practice. This Library will help solve hundreds of problems for designers, researchers, engineers, and students in any field based on radio.

Written by leading radio engineers, these books cover circuit phenomena, networks, tube theory, vacuum tubes, amplification, measurements, etc.—give specialized treatment of all fields of practical design and application. They provide you with a complete and dependable encyclopedia of facts.

- 5 Volumes, 3872 Pages, 2770 Illustrations
- Eastman's **FUNDAMENTALS OF VACUUM TUBES**, 3rd Edition.
- Terman's **RADIO ENGINEERING**, 3rd Edition.
- Everitt's **COMMUNICATION ENGINEERING**, 2nd Edition.
- Hund's **HIGH FREQUENCY MEASUREMENTS**, 2nd Edition.
- Henney's **RADIO ENGINEERING HANDBOOK**, 4th Edition.

SEND NO MONEY

Special Low Price—Easy Terms

On this special offer you get this Library for \$34.50, instead of \$39.00. You save \$4.50 and may pay on easy terms. Mail coupon below to examine the Library FREE for 10 days. No obligation. These books are recognized as standard works; you are bound to need them. So take advantage of this special money-saving offer. *Mail coupon at once!*

McGraw-Hill Book Co., Dept. RE-11-51
327 West 41st St., New York 18, N. Y.

Send for 10 days' FREE trial, the **RADIO ENGINEERING LIBRARY**. If not satisfied I will return books. Otherwise I will send \$4.50, plus delivery charges, then; and \$5 a month for 6 months. (Reg. price \$39.00; you save \$4.50).

Name

Home Address

City & State RE-11-51

We'll Pay Delivery Charges if you enclose \$4.50 first payment WITH coupon. Same return privilege for full refund.

NETSDA MEETS IN PHILLY

The first fall meeting of the National Electronic Technicians and Service Dealers Associations (NETSDA) was held September 9, in Philadelphia. Delegates from fifteen member Chapters were present. Delegations from the Radio and Television Servicemen's Association of Pittsburgh, Inc. and the Television Contractors Association of Philadelphia were also present as guests.

The delegation headed by David Van Nest of Trenton presented application for membership to NETSDA, which was voted on and accepted, making the Trenton Radio and Television Servicemen's Association the sixteenth Chapter in NETSDA.

Dave Krantz then reported on the Chicago June meeting of the RTMA service committee, which he had attended as representative of NETSDA, and informed the delegates of the coming meeting in New York, to which a representative was also invited. Krantz and Max Liebowitz were elected to attend that meeting. (See P. 113.)

Delegates then voted to add to NETSDA's Industry Relations Committee Max Liebowitz of New York and Dave Krantz of Philadelphia to assist Norman Selinger, vice-president of NETSDA, in Washington, D. C. in making a representation to the Federal Trade Commission on September 26th. NETSDA will join with other service groups in making this representation.

NETSDA voted unanimously approving Sylvania's action regarding its advertising policy in regard to *Look* Magazine and suggested that other members of the electronic manufacturing industry follow Sylvania in the protest to *Look* Magazine, thus assisting the electronic Servicing profession. (See R. 116.)

A committee was appointed under the chairmanship of Mr. James Daly of the Philadelphia Radio Servicemen's Association to formulate a national code of ethics for NETSDA.

The next meeting was set for October 7, at New York City.

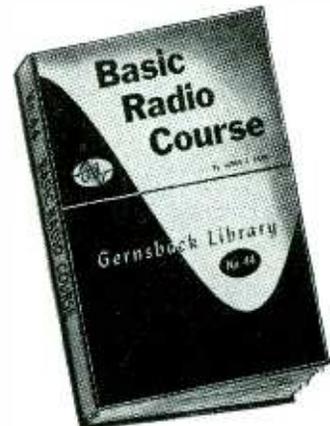
MARYLAND'S TECHNICIANS FACE LICENSING PROBLEM

Some Maryland believers in the value of licensing to the service industry have recently been inclined to admit that even a good thing can be carried to absurdity. Cause of the opinion was a "Notice to the Public" recently issued by the Electrical Administrative Board of Baltimore County, Maryland (Baltimore County surrounds the city on three sides, but Baltimore proper is not part of it).

The notice read:

It is illegal to perform or have performed any electrical repairs, installations, or electrically operated apparatus including television and radio, except by a person holding an electrician's license as set forth in the 1949 Acts of the General Assembly of Maryland. Persons violating this law will be prosecuted. . . . Shortly thereafter, a meeting was held by the board, before a surprisingly

TECHNICIANS
—YOU CAN PROFIT
FROM THIS BOOK!



Only \$2.25

176 Pages

130 Illustrations

First Gernsback Library Book with Durable hard-cloth cover

One of the finest books on fundamentals ever written for the practical service technician. **BASIC RADIO COURSE** starts with Ohm's law, then takes you through the circuits of a modern radio set and tells you how and why they work. It's actually a pleasure to read because the author believes learning should be fun. He talks the service technician's language and isn't afraid to make you smile once in a while. But **BASIC RADIO COURSE** doesn't skimp on facts. It gives you all the technical information you'll find in a higher priced book. But, you'll enjoy reading it and you'll save money.

PUBLISHED BY REQUEST

BASIC RADIO COURSE was published at the request of many radio men who read, enjoyed and learned from John Frye's series on the fundamentals of radio servicing which concluded only recently in **RADIO-ELECTRONICS**. It can help the experienced technician as well as the beginner. Order your copy today.

TWENTY-SIX CHAPTERS

The Electron Theory • Ohm's Law and the Resistor • What is Induction? • Capacitance • How Capacitors are Made • Reactance, Impedance and Phase • Resonant Circuits • Transformers—How They Work • The Diode Vacuum Tube • Triode and Tetrode Tubes • The Pentode Vacuum Tube • Vacuum Tube Characteristics • The Power Supply • Power Supply Types • Sound and Loudspeakers • The Power Output Stage • The Voltage Amplifier • Demodulating the R. F. • Receiver Selectivity • The Converter Stage • Some Oscillator Circuits • How To Trap a Signal • Signals in Space • Receiver Refinements • Instruments and Tools • Service Techniques.

Order your copy from your distributor or MAIL THIS COUPON TODAY

Radercraft Publications, Inc., Dept. 111
25 West Broadway
New York 7, N. Y.

My remittance for \$2.25 is enclosed. Please send me a copy of Book No. 44, **BASIC RADIO COURSE** postpaid.

NAME

STREET

CITY ZONE STATE

RADIO-ELECTRONICS for

large body (more than 200) of interested radio-TV service technicians, radio amateurs, and experimenters. The board's chairman, Louis E. Susemihl, a local electrical contractor, declared that his business had improved 25 per cent since these new rulings had gone into effect. He continued by urging radio and TV service technicians to obtain their licenses.

To obtain one of these licenses, however, it is necessary to have worked for a master electrician for a period of at least two years, and to pay various fees and pass an examination. This would limit licensing to a very small group of the persons now working in the field of electronics as it is generally accepted.

High points of the meeting included several questions as to the fitness of the board members to pass on the qualifications of electronics technicians whose skills are quite different from those of electricians.

As a result of the meeting, a second meeting was held between the board and representatives of a combine of radio amateur clubs. James F. Gordon and Willis Jones, of Bendix Radio Division of Bendix Aviation Corporation, Towson, Maryland, announced after the meeting that the board had agreed to interpret the rulings in such a way as to eliminate the requirement for radio amateurs and radio broadcasting station operators to hold County Electrician's Licenses. This was not exactly a victory, since these classes of operators are protected in their rights by the Federal Government, and no doubt the board had learned that fact.

At the present time, according to Paul D. Rockwell, principal engineer at Bendix Radio Division and president of the Chesapeake Amateur Radio Club, there are some indications that the entire set of rules and regulations may be changed, but the ruling continues to require electrician's licenses for radio and television repairmen.

PITTSBURGH'S CREDIT UNION

The Radio and Television Servicemen's Association of Pittsburgh, Inc., applied for membership in the Federation of Radio Servicemen's Association of Pennsylvania.

Pittsburgh is believed to be the first association in the country to set up a Federal Credit Union. This was done to help the small shop owners and the independent service technicians to obtain additional financing for their business and the purchasing of test equipment.

NETSDA ADOPTS EMBLEM



Above is the new emblem of the National Electronic Technicians and Service Dealers Associations, adopted in Washington last spring. It will be supplied to all chapters in the form of mats and decals.

Don't You Agree With These Men?

Yes... YOU NEED PRACTICAL TRAINING TO DO THE KIND OF TV SERVICING!

That Means BIG PAY!

"It takes actual practice on real equipment to learn any job well!"

"I want practical facts, not long-winded lectures and complicated mathematics."

"I learn faster, easier and remember longer when my hands help me think."

"If I want to learn a trade I'll go to someone in that business for practical help. They know from experience."

LEARN BY DOING WITH MILTON S. KIVER!

- * Active president of T. C. I., registered professional engineer, Television Consultant, internationally known author of TV books and magazine articles.
- * You build and train on modern large screen TV set.
- * You can get 2 weeks experience with leading service organization.
- * You learn testing, trouble shooting, repair of all types of TV sets.
- * You learn COLOR TV, including conversion and UHF. We guarantee to supply you with latest facts on these phases of television.

Prepare Now for Color TV and UHF!

You can't learn Television Servicing from books alone. The right way... the only way to learn to test, trouble shoot, repair and adjust television sets is by actually doing this work. That's how you learn with T.C.I. PRACTICAL TELEVISION TRAINING! This easy-to-follow training is based on practical experience.

Look How Practical This Course Is!

You train on a large screen modern television receiver, furnished as part of the course. You build this set... service it... trouble shoot it... adjust it... keep it! As an optional feature you can get two weeks of actual field experience with Chicago's largest independent TV servicing organization. You learn set conversion, master antenna installation, COLOR TV, COLOR CONVERSION, money-saving short cuts practiced by expert TV servicemen.

SEE FOR YOURSELF how this practical training can help you get ahead faster in the big-money TV field. Write for FREE Catalog and SAMPLE LESSONS. Age is no barrier. Many T.C.I. students are over 40. ACT NOW!

MAIL COUPON FOR BOOKLET

Milton S. Kiver, President
TELEVISION COMMUNICATIONS INSTITUTE
205 W. Wacker Dr., Dept. RE-6, Chicago 6, Ill.

YES, MR. KIVER: Rush FREE Catalog and Sample Lesson on your practical course in TV Servicing. I am not obligated. Salesman will not call.

Name Age

Address

City Zone State

(BEGINNERS: Check here for facts on Pre-TV radio course.)

New! Up-to-date!

TELEVISION SERVICING

by Walter H. Buchsbaum

Get this brand new, complete handbook for sure-fire working knowledge of TV installation, maintenance and troubleshooting. Tells you step-by-step procedures for audio IF alignment, video IF alignment, aligning RF amplifiers, mixers, oscillators, etc. All possible defects classified for ready reference, thoroughly analyzed to show what is wrong and why... and what to do to correct the defect. No mathematical knowledge needed! Practical, authoritative, up-to-the minute, the perfect handbook for set owners, trainees, and repairmen.

USE IT 10 DAYS FREE

Coupon below brings you "Television Servicing" on FREE trial for 10 days, without obligation. Mail it NOW.

PRENTICE-HALL, Inc., Dept. M-RE-1151
70 Fifth Ave., New York 11, N. Y.

Send me, for 10 DAYS' FREE TRIAL, "Television Servicing." I will return it in ten days and pay nothing—or keep it and send \$1.35 down (plus postage) and \$2 monthly for 2 months.

NAME.....

ADDRESS.....

CITY.....STATE.....

SAVE! Send \$5.35 with this coupon, and we'll pay postage and packing.

DYNAMOTORS

Type	Input Volts	Input Amps	Output Volts	Output Amps	Ratio Set
PER6	28	1.25	250	.080	RC 36
DM416	14	6.2	330	.170	RJ 19
DM33A	28	7	540	.250	BC 456
DM42	14	46	515	.110	SCR 506
			1030	.050	
PE101C	13/26	12.6	2/8	.135	SCR 515
BD AR 93	28	3.25	800	.020	
23350	27	1.75	375	.150	APN-1
ZA0515	12/24	4/2	500	.050	MARK II
B-19 pack	12	9.4	275	.110	
D-104	12		225	.100	
			440	.200	
DA-3A	28	10	300	.085	SCR 522
			150	.010	
			14.5	.060	APN-1
5053	28	1.4	1000	.350	BC 375
PE73CM	28	19	400	.135	
CW21AAX	13	12.6	800	.020	
			26	6.3	
PE94	28	10	300	.112	SCR 522
			150	.010	
			14.5	.5	

DY2/ARR-2 DY22/ARC

INVERTERS

PE 218-E: Input: 25 28 vdc. O2 amp. Output: 115 v. 350-500 cy 1500 volt-amperes. Dim: 17"x8 1/2"x10". New \$49.50

PE 218-H: Same as above except size: 16 1/2"x8"x10". New \$49.50

POWER TRANSFORMERS

ALL PRIMARIES 115V, 60 CYCLES

STOCK #	RATINGS	PRICE
CT-456	390VCT/30 MA, 6.3V/1.3A, 5V/3A	\$3.45
CT-160	800VCT/100 MA, 6.3V/1.2A, 5V/3A	4.95
CT-319	460VCT/.085A, 5V/2A, 6.3/7.5A, 6.3/3A	3.25
CT-931	585VCT/86 MA, 5V/3A, 6.3V/6A	4.95
CT-441	50-48V/200 MA, 10VCT/2A	2.75
CT-442	325VCT/75 MA, 3V/2A, 10VCT/2A, 50V/200 MA	3.85
CT-626	1350V .160	2.5/12.30/100
CT-15A	350VCT .070	6.3/6.3/1.8/3 lbs.
CT-071	110V .200	33/200, 5V/10, 2.5/10
CT-378	2300V 4 MA	2.5/2
CT-367	580VCT .050	5VCT/3A
CT-441	350VCT .100	6.3/1.2.5VCT/2
CT-99A	2x110VCT .010	6.3/1A.2.5VCT/7A
CT-403	350VCT .026 MA	5V/3A
CT-931	585VCT .036	3V/3A, 6.3V/6A
CT-610	1250 .002 MA	2.5V/2.1A, 2.5V/1.75A
CT-137	350VCT .026 MA	1V/3A
CT-866	330V .065	6.3V/1.2, 6.3V/1.75

Rated Concerns Send P.O.

Send M.O. or CHK. Mdse. Guartd. Shpg. Charges Sent C.O.D. Price F.O.B. N.Y.C. Phone Di. 9-4124

COMMUNICATIONS EQUIPMENT CO.
131 Liberty St., Dept. C-11 New York City 7, N. Y.

Miller
 BUILDERS OF QUALITY RADIO INDUCTANCES SINCE 1924

NOW AVAILABLE TO THE SERVICEMAN AND EXPERIMENTER THE FAMOUS K-TRAN



- THE FINEST MINIATURE I. F. TRANSFORMER EVER MANUFACTURED!
- ONLY 2 1/4" HIGH BY 3/4" SQUARE

• SHELL CORE PERMEABILITY TUNED. STABLE SILVER MICA FIXED CONDENSERS — NOT MICA COMPRESSION TUNED.
 • UNIQUE SNAP CLIP MOUNTING FOR ROUNO HOLES IN CHASSIS.

455 KC input transformer gain 50. Band width at 2 times 16 KC; at 10 times 40 KC.
 455 KC output transformer gain 110. Band width at 2 times 18 KC; at 10 times 50 KC.
 262 KC input transformer gain 65. Band width at 2 times 9 KC; at 10 times 23 KC.
 262 KC output transformer gain 130. Band width at 2 times 10 KC; at 10 times 27 KC.

CAT. No	ITEM	NET PRICE
12-H1	262 KC Input I. F. Trans.	
12-H2	262 KC Output I. F. Trans.	
12-C1	455 KC Input I. F. Trans.	
12-C2	455 KC Output I. F. Trans.	



The "K-TRAN" is distributed nationally to the jobber only by J. W. Miller Company.

*Manufactured under "K-TRAN" Patent Numbers 2435630 and 2429468 of Automatic Manufacturing Corp.

J. W. MILLER COMPANY
 5917 S. MAIN ST. LOS ANGELES, CALIF.

LEARN

Television - Radio - Electricity

OR

Electricity

IN THE GREAT SHOPS OF **COYNE**



TRAIN QUICKLY!
OLDEST, BEST EQUIPPED SCHOOL OF ITS KIND IN U.S.
Young and Older Men

Come to the Great Shops of Coyne in Chicago. Get practical training in TELEVISION-RADIO or ELECTRICITY — vital in Defense Program. Prepare now for a better job or better service rating.

START NOW — PAY LATER

You can finance most of your tuition, pay for it later in easy monthly payments. Special plan for men of Draft Age. Part time employment service available. **GI APPROVED**

FREE BOOK Clip coupon for Big Free Illustrated Book. Indicate below, course that interests you. No salesman will call. Act NOW.

An Institution not for Profit

B. W. COOKE, Pres.
 COYNE Electrical & Television-Radio School,
 500 S. Paulina St., Chicago 12, Ill. Dept. 81-81H

Send FREE BOOK and full details on:

TELEVISION-RADIO ELECTRICITY

NAME.....

ADDRESS.....

CITY..... STATE.....

RADIO-TV EMPLOYMENT PROSPECTS ARE GOOD

The U.S. Labor Department predicts strong demand for skilled electronic technicians throughout the early 1950's. Chief demand will be in the fields of home radio and television servicing and in manufacturing and servicing military, industrial, and household electronic equipment. The prediction, which appears in an "Occupational Outlook Handbook" issued by the Department in co-operation with the Veterans Administration, continues to state that service work will increase with the increase of automatic control and automatically operated appliances and equipment. Such control is predominantly electronic.

One note of warning was sounded: The radio service shop owners who do not intend to go into television may have to prepare to go out of business, according to the report.

ETHICS AND WARRANTIES DISCUSSED IN JERSEY

The Television Contractors Association of New Jersey made business ethics and parts warranties the subjects of discussion at an August meeting at the American Legion Home in East Orange.

President Gus Friedman pointed out that the problem of parts warranties is becoming a serious matter, and that in some cases warranties on some components were on the point of expiration when the equipment containing them reached the customer, thus creating a difficult situation for contractor, dealer, and distributor.

The Association advertises in two Newark Sunday newspapers, asking TV service contract holders to make any legitimate complaints to the association's grievance committee, so that any instances of dishonesty or incompetence may be investigated and rectified.

SYLVANIA CANCELS LOOK

Among the indignant responses to the *Look* article, "Pop Is a Moral Slacker," was one that came from Sylvania Electric Products, Inc. Sylvania had been running its well-known series of ads promoting the skill and reliability of the radio service technician in that magazine, and by coincidence part of the article describing "radio repair experts" as crooks and cheats appeared on the same page.

Although no part of the television industry would deny that the servicing field includes some dishonest individuals, this article stated that "America's radio repair experts and garage mechanics, almost to a man, have cheated the set owners and car drivers. In nearly every case, though they did diagnose and repair the trouble, they gave it a fancy name and charged a fancy price."

Sylvania felt that such an article did not fairly represent the service technician and that *Look* in publishing it had acted in a manner harmful to the service industry. To make the protest more impressive, all future Sylvania advertising in *Look* was cancelled. (Italics ours.—Editor)

ANOTHER NEW GERNSBACK LIBRARY BOOK

Get right to the heart of Radio!



RADIO TUBE FUNDAMENTALS

by George J. Christ

Instructor, Div. of General Education, New York University

Only \$1.00 96 pages 74 illustrations

What! You never went to college? You don't understand calculus backwards (and forwards)? You can't outperform an electronic computer? Really deep down you don't understand radio tubes?

Don't worry about it, for here's a brand new book whose sole object is to make you understand just what radio tubes are, how they work, and just how you can expect them to behave in a radio circuit. The author, with years of radio tube teaching experience for a background, takes the complicated subject of radio tubes and makes it so simple and easy to understand that you'll just naturally wonder why you didn't understand it all by yourself.

If you're a beginner, then this book is a definite must, and if you've been in the business more years than you can (or care to) remember, then this book will give you a fresh new approach to the subject.

RADIO TUBE FUNDAMENTALS goes all the way from diodes on through multi-purpose tubes, and then into circuits. Don't worry about getting lost—the author is with you all the way. Get it today. It's the biggest dollar's worth of radio info you can possibly buy.

USED AS A REFERENCE TEXT

Radio Course, Div. of General Education, New York University

Partial list of Contents

- Electrons in motion. Thermionic emission • The cathode • Plate current • Space charge • Diode load voltage • Ionization • Voltage regulators • The triode • Plate resistance • Amplification factor • Oscillation • Gas triodes • Tetrodes • Pentode characteristics • Multipurpose tubes • Vacuum and gas photo-tubes • Vacuum-tube grid bias • Radio Tube applications • Voltage doublers • Detectors • Automatic volume control • FM detection • Oscillators • Converters • Conversion gain.

See Your Distributor—or use coupon

RADCRAFT PUBLICATIONS, INC.

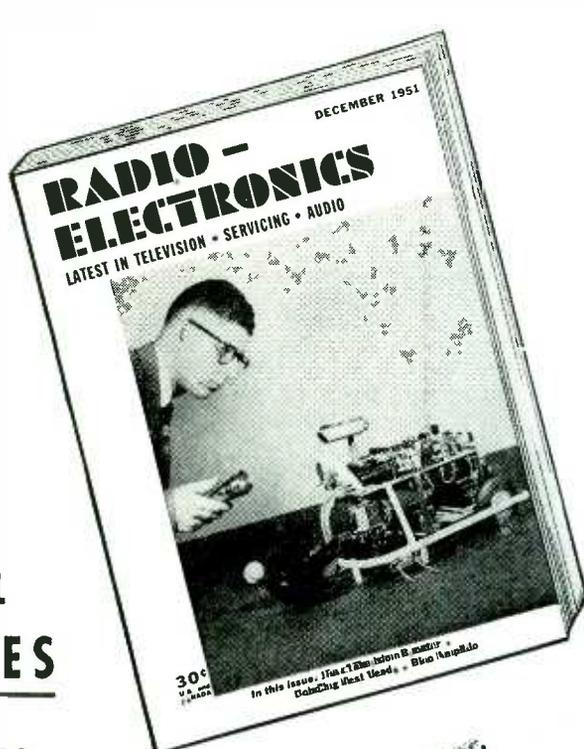
Radcrafft Publications, Inc., Dept. 111
 25 West Broadway, New York 7, N. Y.
 My remittance of \$1.00 is enclosed. Please send me postpaid a copy of RADIO TUBE FUNDAMENTALS, Gernsback Library Book No. 45.

Name.....
 Street.....
 City..... Zone..... State.....

RADIO-ELECTRONICS for

SPECIAL OFFER!

Save up to \$2.50 over regular rates.



SPECIAL LOW RATES

3 YEARS \$5.50

2 YEARS \$4.00

1 YEAR \$2.50

REGULAR RATES

3 Years \$8.00

2 Years \$6.00

1 Year \$3.50

*Save up to 15¢ a copy
over the newsstand price!*

RADIO • TELEVISION • AUDIO

*Don't miss these features scheduled
for publication in the near future!*

- CONVERTERS FOR UHF TV
- DESIGNING CROSSOVER NETWORKS
- NEW LIFE FOR OLD RADIOS
- ESSENTIAL FACTORS FOR HIGH QUALITY AUDIO
- TIPS ON INDOOR TV ANTENNAS
- MORE ON COLOR AND UHF TV

By such top flight technical writers as Mandl, Frye, Berkeley, Turner, Langham, Ledbetter, Dorf and others.

A SUBSCRIPTION NOW WILL INCLUDE THE BIG 50¢ JANUARY SPECIAL TELEVISION ISSUE!

RADIO - ELECTRONICS

Compare!
PROVE
EMC
SUPERIORITY!

Model 201
mutual conductance tube tester
• Checks mutual conductance on calibrated micro scale • Checks tubes for gas content • Detects both shorted and open elements • Tests all tubes from .75V to 117 Filament volts • Tests all octal, octal, and miniature tubes • Checks individual sections of multi-purpose tubes • Built-in roll chart
Model R201BC — 4½" meter-sloping counter case..... **\$69.50**
Model R201BP — 4½" meter-hand rubbed oak carrying case..... **\$73.50**

Model 204
tube-battery-ohm capacity tester
• Tests all tubes including Noval & sub-miniature • Tests all batteries under rated load • Emission testing method gives easy, direct readings • Tests resistance to 4 megohms • Tests condensers from .01 to 1 mfd • Uses four-position lever type switches • Checks condenser leakage
Model 204 — portable oak case, removable cover..... **\$55.90**

Model 120
(20,000 ohms per) (volt meter)
• 4 Resistance ranges from .2 ohm to 300 Megs. • 5 Current ranges to 6 Amps. • Uses 1% precision resistors • 6 AC & DC voltage ranges to 6,000 volts • AC volts at 10,000 ohms/volt.
Model 120 — open face..... **\$31.95**
Model 120P — portable oak case..... **\$36.95**

Write Dept. RE-11 for Free Complete Catalog of these and other Instruments.

—See them at your Jobbers—

Electronic Measurements Corp.
280 Lafayette St., New York 12, N. Y.
Export Dept., 303 W. 42nd St., N. Y. C.

Consecrated to Quality Output and Golden Rule Service

ASTRON Fixed Capacitors and RF Interference Filters

Write for catalogue
ASTRON CORPORATION — 255 Grant Ave., East Newark, N. J.

PEN-OSCIL-LITE

Extremely convenient test oscillator for all radio servicing; alignment • Small as a pen • Self powered • Range from 700 cycles audio to over 600 megacycles u.h.f. • Output from zero to 125 v. • Low in cost • Used by Signal Corps • Write for information.

GENERAL TEST EQUIPMENT
38 Argyle Ave. Buffalo 9, N. Y.

BAR WESTERN UNION?
A "good possibility" that Western Union might be prevented from continuing in the television service field was stated to exist by Frank Moch of Chicago, president of the National Alliance of Television and Electronic Service Associations, in a bulletin issued to the association's membership in late summer.

The bulletin refers to the FTC (Federal Trade Commission) investigation into radio-television industry practices, and says that the FTC is especially interested in:

1. Forced sales of parts warranties.
2. Failure to stock replacements.
3. Use by distributors and manufacturers of off-brand tubes and parts.
4. Charge by distributors and manufacturers of shipping costs in cases where parts are back-ordered.
5. Misrepresentation in advertising.
6. Failure of distributors and manufacturers to co-operate in the supplying of service data.
7. Copies of written parts warranties issued by distributors and manufacturers.

The bulletin then goes on to state: "You will undoubtedly be interested to know that the Western Union attempt to enter the service field is also being investigated, and we believe a very good possibility exists that Western Union will eventually be barred from the service field."

NEW STATE ASSOCIATION
A new State federation came into being with the formation of the Texas Electronic Association June 3, 1951. It was founded at a meeting at Austin, at which delegates from the Dallas Radio Sales and Service Association, the Texas Electronic Technicians Association of Houston, the San Antonio Radio and Television Association, and the Texas Radio Service Association of Austin were present. Representatives from Fort Worth, Galveston, and Lockhart also attended the meeting.

Two earlier meetings, at which the proposed setup was thoroughly discussed, had been held.

The charter permanent officers are: president, Frank J. Humpola, Houston; vice-president, Forrest Baker, San Antonio; secretary, Luther Bradley, Dallas; and treasurer, J. D. Huff. T. P. Robinson of Dallas was appointed public relations representative.

Object of the association is to unify and bring together the programs of the local groups into a co-operative effort, to advance the cause of the radio and television technicians of Texas, and to provide a means for watching for any proposed legislation that would affect the welfare of these technical men.

In a communication after the date of the meeting, the Fort Worth group notified the secretary of the completion of their own local organization and their intention to apply for membership in the Texas Electronic Association at the next meeting, which was to be held in September. It was anticipated that other associations would join then.

STAN-BURN
E-D-A-R-K-E

CONDENSER SPECIALS
BY PASS—ALL GUARANTEED

.001-400 Stan Burn .04	.002-600 Stan Burn .08
.01-600 Stan Burn .07	.005-600 Stan Burn .12
.02-600 Stan Burn .09	.005-600 Stan Burn .59
.05-600 Stan Burn .10	.1-600 Stan Burn .19
.01-600 Stan Burn .07	20x20-150 Stan Burn .41
.25-600 Stan Burn .15	50x30-150 Stan Burn .49
.005-200 Stan Burn .07	20-150 Stan Burn .32
.004-200 Stan Burn .07	

CHASSIS—630—K2—Famous make **139.50**

CATHODE RAY TUBE SPECIALS

10BP4 \$14.95	16RP4A 26.00
12LP4 19.95	17B4A 27.00
12L4A 19.95	20CP4 39.95
14B4 19.95	19AP4 47.95
16DP4A 26.00	19DP4A 47.95
16GP4 33.00	24AP4A 83.20
16AP4 39.00	Single ion traps99
	Double ion traps59

RAM TRANSFORMERS

RCA type for 16" to 24" X032 \$3.85	70° DEFLECTION YOKES
G. E. Type for 16" to 24" X045 \$3.85	Todd wired replacement
These are very special prices. While they last	Special for RCA, GE, etc. Special \$3.85

ANTENNAS

Conicals, less mast, 10 element \$ 2.98
Circle X, less mast 2.98
Double V, less mast 2.98
Chimney Mounts—1-12, 95 12 or more89
100 ft. roll strapping 2.98
Mast standoffs03
10 ft. masts, each 1.59
12 or more, each 1.49
53 mil. 300 ohm wire white or black, 1000 ft. 19.97

We carry a complete line of popular makes of Radio and TV tubes, at 50% discount. Also many other special purpose and transmitting types, and all electronic parts and equipment at lowest prices. Send us a list of your requests for quantities and prices. Terms: 20% with order. Balance COD. All prices FOB. New York Warehouse. Minimum order \$5.00. Write for our latest price list to Dept. RE-11

STAN-BURN RADIO and ELECTRONICS CO.
(S.B.S. THEATRE BLDG.)
1697 BROADWAY • NEW YORK 19, N.Y.

Replace Your Old TV Aerial With The NEW Snyder

360° MOTORLESS TV AERIAL

SAME CLEAR PIX AS MOTOR ROTATING AERIAL SYSTEMS COSTING TRIPLE THIS PRICE

Only \$18.95

Complete with 3 1½" mast sections, 75 ft. of 3 cond. cable. Electronic beam selector switch. Connecting stubs, guy ring mounting base, "U" clamps.

For Ultra Fringe Electronically beams in complete 360° rotation to give clear picture on all channels. You choose direction with Directronic selector switch. Mounted on or near TV set. 18 hi-tensil 5/8" aluminum alloy elements. Complete ready to install.

AX-599 DIRECTRONIC ARRAY FOR FRINGE Same as TX-599 less mast 16.95
AX-56 DIRECTRONIC ARRAY FOR CITY AREA 6 element array with switch, lead-in less mast \$9.50

STEEL MAST SECTIONS weather treated.
10 Ft. 1½" di. \$2.19
5 Ft. 1½" di. crimped end 1.35
Chimney Mount Brackets CM-100 1.59
Wall Mount Brackets WB-2, Adj. to 18" Heavy Duty 3.75

Order from Dept. RE-11 or call Mulberry 2134
WRITE FOR FREE F.Y.I. BULLETIN

WHOLESALE RADIO PARTS CO., Inc.
311 W. Baltimore St.
BALTIMORE 1, MD.

RADIO-ELECTRONICS for

SOUTH JERSEY SEEKS MEMBERS

Membership Committee of the Allied Television Technicians Association of South Jersey has designed a program to extend its membership drive to all of South Jersey.

Present officers are Rodger Haines, president; Paul Matlack, vice-president; Bob Blazer, secretary; and Gordon Laney, treasurer. At the last meeting a nominating committee was appointed to select the list of candidates for election of officers for the October meeting.

Paul Matlack, vice-president of the Association, has just received the contract for the Inter-Communication System on the New Jersey Super Highway.

TRENTON, N. J. NOMINATES

At its recent election the following officers were chosen: George Owens, president; Francis Wolf, vice-president; Charles Redman, secretary; while David Van Nest was elected delegate to the NETSDA. Trenton's delegates were requested to present application for membership to NETSDA. The Trenton association will also co-operate with other groups in New Jersey State in meeting and discussing State problems.

WASHINGTON, D. C., REPORT

Under supervision of J. T. Burns, president, and Norman Selinger, vice-president, we are preparing a new and complete series of technical lectures and business forms. Membership Committee is contemplating a drive to obtain membership from all service organizations in Washington, D. C. A committee will investigate all licensing bills that are being presented in the various municipalities and states as an aid in formulating a licensing bill for Washington, D. C.

Joe Burns, president of the Television Associates, is also Chairman of the Membership Committee for NETSDA and is kept busy meeting delegates from numerous associations and answering mail from others who are interested either in forming an association or obtaining membership in NETSDA.

ARTSNY GETS CLUBROOM

ARTSNY has obtained a new club room consisting of 3,000 square feet. In addition to being a club room, it will have a complete Service Clinic and offices at 5 Rutgers Street, New York City.

A large group of ARTSNY members, with the Association's backing, now have a large ad in the classified telephone directory.

ITHACA AIDS CAUSE

Ben De Young of the Ithaca RSA has all the members helping him on a fund raising campaign for a cause close to his heart—The Cerebral Palsy Fund. The Program Committee has developed new educational and business training lectures that will be presented to the membership at its meetings.

—end—

NIAGARA IS RADIO PARADISE!

EVERYTHING FOR THE RADIO-MINDED MAN

DOES YOUR TV DROOP FROM TVI* BLOOP?

BANISH INTERFERENCE WITH NIAGARA'S FAMOUS HIGH PASS FILTER

Positive protection against interference from amateur transmitters, diathermy, and all other devices generating radio frequency interference below 40 MCS. Designed for 300 ohm leadin. No loss in brightness or clarity.

ORIGINAL 630 TYPE

80 MTR TRANSMITTING STATION FOR THE NOVICE

1-TRANSMITTER KIT \$15.95
(as described in May QST)

2-POWER SUPPLY KIT (for above) 9.95
(see June QST)

3-ANTENNA KIT (80 mtrs) 2.95

\$28.85

COMBINATION SPECIAL

All THREE KITS **\$25.95**

All kits are available separately at prices indicated beside each kit. Complete instructions with each kit.

REMOTE CONTROL FOR THE THING!

(PLUS \$1.00 BOOK FREE)

The answer to the "Remote Control" experimenter's dream! A completely wired, 3 tube remote control unit, originally used as Electronic Brain for remote thermo-static control of electric blankets. Can be used, with slight modification, to control model trains, planes, trucks, remote on-off for radios, open and close garage doors from your car, or to remotely control any device in accordance with your own ingenuity.

And that's not all! With each unit we will give you absolutely free, one copy of Gernsback Library's popular new book "Model Control by Radio," 112 pages, containing more than 125 illustrations, diagrams, tables and formulas, for Electronic Remote Control.

Remote Control Unit, including Fil. Xfmr., 300 ohm plate circuit "trigger" relay, completely wired, circuit diagram and above described book—less tubes..... **\$5.50**

ALL FOR ONLY.....

Shipping Wgt. 3 Lbs.

WESTERN ELECTRIC 25 WATT AUDIO REPRODUCER

AMAZING FREQUENCY RESPONSE! 25 WATT RECEIVER

Made by W. E., no D-173246, for the famous BEECHMASTER 250 watt P. A. systems used for guiding blind aircraft in for landings and for P. A. from flying aircraft. These P. M. dynamic receivers have an impedance load of 8 ohms to the output of any amplifier. DUAL CO-AXIAL MAGNETS weigh 23 ounces. Perfect for use as horn type drive speaker or co-axial high power tweeters. Shipping wgt. 7 lbs. **\$12.50** Each

ONE OF AMERICA'S GREAT RADIO STORES

Niagara

RADIO SUPPLY CORP. Dept. 11-E1

160 Greenwich Street, New York 6, N. Y.

Digby 9-1132-3-4



Wired and tested... **\$2.95**
Postpaid if entire amount is included with order.
* Television interference



\$129.00

Manufacturer's Closeout—Brand New 16"-20" TV RECEIVER

Completely Wired, Aligned and Tested—Ready to Install With Big 12" High Quality PM Speaker.

- 30 TUBES (including 3 Rectifiers)!
- High Efficiency High Voltage Circuit!
- Advanced Model 12 Channel Tuner!
- AGC for Fringe Area Reception!
- Magnificent TV Performance!

WEBSTER CHICAGO AUTOMATIC RECORD CHANGER

3 SPEED

TYPE 100—16 SERIES

A fortunate purchase makes it possible for us to offer these fine, new record changers at less than regular manufacturer's cost. Made by Webster-Chicago and only introduced on the market a few months ago as one of their latest models. Plays 12, 10 or 7 inch records at 33 1/3, 45, or 78 R. P. M. New spindle inside-out records played without any adjustment. Assures light needle pressure and long wear. Needle tip (included) for standard or micro-groove records. Pickup arm comes to rest position after last record has played. Complete factory packed and sealed record changers, normally listing at \$47.50—While they last. **\$24.85**

Shipping Wgt. 15 lbs.



125 illustrations, diagrams, tables and formulas, for Electronic Remote Control.



Shipping Wgt. 7 lbs. **\$12.50** Each

Radio Thirty - Five Years Ago

In Gernsback Publications

HUGO GERNSBACK
Founder

Modern Electrics	1908
Wireless Association of America	1908
Electrical Experimenter	1913
Radio News	1919
Science & Invention	1920
Television	1927
Radio-Craft	1929
Short-Wave Craft	1930
Television News	1931

Some of the larger libraries still have copies of **ELECTRICAL EXPERIMENTER** on file for interested readers.

IN NOVEMBER, 1917
ELECTRICAL EXPERIMENTER

Seeing Wireless Signals

Microphones in Trench Warfare, by H. Gernsback

Something New in Microphones

New Radio Submarine to Foil U-Boats

Construction of a Laboratory Vacuum Pump by Raymond Francis Yates

First Woman Radio Operator

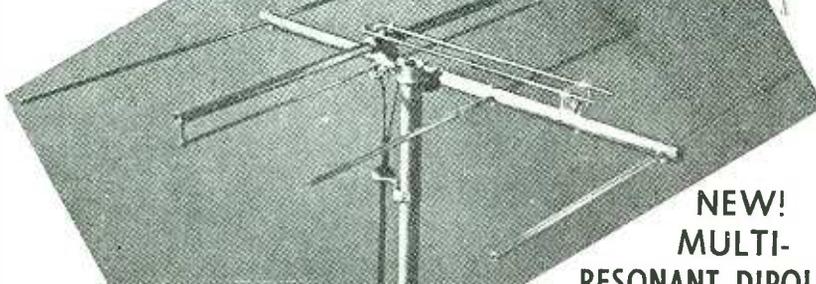
Development of Aircraft Radio in the Navy by Benjamin F. Miessner

Efficiency in Radio Transmitting Circuits by Bayard Shumate

Locating Underground Ores by Electricity

—end—

SENSATIONAL RESULTS!



NEW!
MULTI-RESONANT DIPOLE
PAT. PENDING

THE ONLY TRUE

COMBINATION YAGI ANTENNA

NOW! for the first time—a TV antenna with all these powerful advantages! Unequaled in relation to gain and size! Just a few Yagi antennas cover the entire high and low bands! All elements work in their true fashion! When incorporated in the Yagi Antenna as a driven element, the multi-resonant dipole assumes the aspects of two or more separate Yagi Antennas in one! Eliminates troublesome and frequency sensitive phasing lines! Flexible to channel changes, and especially adaptable to any locality! Light, rigid, easy to install!

The Multi Resonant Dipole Combination Yagi Antenna is the only true answer to difficult reception problems. Order today from your jobber or write for prices and descriptive folder.

WELLS & WINEGARD TELEVISION ACCESSORY MFGS.
BURLINGTON, IOWA

You can't beat **RADIO-ELECTRONICS**

for complete coverage of

RADIO, TELEVISION and AUDIO

SAVE HERE! TUBES VERY LOWEST PRICES
Receiving-Transmitting-TV

RMA GUARANTEED—ALL STANDARD BRANDS

024	\$.59	6AK5	\$1.89	6BN6	\$.139	12AX7	\$.119	35A5	\$.98
1A5	\$.69	6AK6	1.19	6BQ6	1.59	12BH7	1.19	35L6	.89
1A7	1.09	6AL5	.79	6C4	.79	12SA7	.79	35W4	.69
1B3	1.19	6AQ5	.89	6CB6	.89	12SK7	.79	35Y4	.98
1R5	.79	6AT6	.69	6CD6	2.79	12SQ7	.69	35Z5	.59
1X2A	1.19	6AU6	.79	6H6	.79	19BG6	2.89	39/44	.49
5U4	.79	6AV6	.69	6J6	1.19	19T8	1.39	50A5	1.19
5V4	1.39	6BA6	.79	6K6	.69	25BQ6	1.29	50B5	.75
5Y3	.49	6BC5	.89	6K7	.59	35/51	.89	50L6	.75
6AB4	.99	6BD6	1.09	6L6	1.79				
6AC7	1.29	6BG6	1.89	6S4	.79				
6AG5	1.29	6BH6	.89	6SA7	.69				
6AH6	1.89	6BJ6	.89	6SK7	.79				

GENUINE MOLDED CONDENSERS

Fresh Stock—All Mineral Oil Filled—100° Centigrade—Meets Jan. C91 Tests.

All 600 Volts

Cap.	per 10	per 100
.001	\$.079	\$6.90
.002	.79	6.90
.005	.79	6.90
.01	.89	7.90
.02	.99	8.90
.05	1.09	9.90
.1	1.25	11.50

TRANSMITTING TUBES

0B2	\$1.69	803	\$2.49
0C3/VR105	805	2.99	
	1.29	807	1.79
0D3/VR150	809	1.79	
	1.19	813	7.49
2X2	.59	872A	2.39
3CP1	5.39	885	1.29
3HP7	3.49	905	2.29
5FP14	16.99	954	.29
7BP7	7.89	1616	1.19
7CP1	12.49	1624	1.49
211	.59	1629	.39
304TH	12.49	2051	1.19
GL471A	2.75	7193	.29
12A6	.69	8020	1.25
717A	1.19	9006	.29

TV PICTURE TUBES

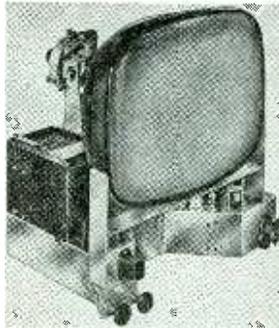
Full Year's Guarantee Black Face

Brand New, Standard Brands, Sealed Cartons

10BP4	\$22.95	16GP4	\$29.95	19AP4A	\$29.95
12LP4	22.95	20CP4	31.95	20CP4	33.95
14BP4	22.95	17BP4	24.95	24AP4	69.95

Terrific Value! Order Now & Save! **New 630 Super Chassis**

30-Tubes—RCA lic.—For 16" to 24" Picture Tubes



- High efficiency high voltage circuit
- Keyed AGC
- Automatic brightness control
- Special extra high gain standard coil tuner
- Directly adaptable for color
- 12" Speaker
- Factory wired, aligned & tested
- Complete, ready to play
- Including all hardware & knobs

\$133.95 (Less CRT)

630 DX CHASSIS! 3 times normal reception—designed expressly for fringe areas. Needs no complicated booster or antenna. FREE OFFER! Schematic diagram free with any chassis ordered! (less CRT)



THE ROSE COMPANY

FREE! Write for new catalog including complete listing of tubes, parts and accessories for radio and TV! Also special electronic instruments catalog.

Minimum Order: \$5.00. 25% deposit with order, balance C.O.D. Include postage with order. All merchandise subject to prior sale, F.O.B., New York City.

100 Park Place

Dept. E-11, New York 7, N. Y.

Cortland 7-6195

RADIO-ELECTRONICS for

THE FUND TOPS \$8,700.



HELP-FREDDIE-WALK FUND

We are happy to inform our readers that the Freddie Fund last month reached a grand total of \$8,672.62.

As a number of our readers know by this time, little Freddie was born completely legless and armless. There are not even any vestiges of limbs on his body. He is the three-year-old son of Herschel Thomason, well-known Arkansas radio technician.

We were exceptionally pleased to receive a letter from Mr. Herbert F. Dengler, Radio Engineer, Voice of America, Munich, Germany. He not only enclosed his own check for \$5.00 as a contribution, but also forwarded a check for \$10.00 as well from the members of the German technical staff of the Voice of America Receiving Station at Munich, Germany. Ten dollars may not seem like a large sum of money to Americans, but coming from Germany it means a very fine contribution. We take this opportunity to thank the staff of the Voice of America.

We are also pleased to report a special contribution of \$3.80 from the Beginners' Class (5-6-year-olds) of the 9th Street Methodist Church, Decatur, Alabama, collected by Mrs. J. D. Sims. Our readers will also be interested in a very important four-page article in *Look* magazine, issue of October 9th. It contains many excellent photographs of Freddie. Do not miss it.

Please send your further contributions from time to time—even the smallest amount will be highly welcome. Make all checks, money orders, etc., payable to Herschel Thomason, and please address all letters to

HELP-FREDDIE-WALK FUND
c/o RADIO-ELECTRONICS

25 WEST BROADWAY
New York 7, New York

FAMILY CIRCLE CONTRIBUTIONS

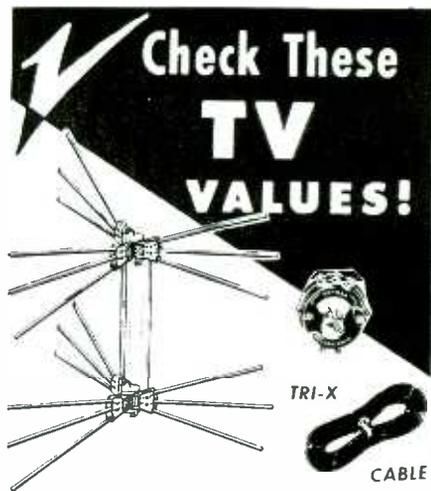
Balance as of August 20, 1951	\$434.70
Mrs. I. U. Ballard, Wilmington, Calif.	1.00
Miss Norma Cole, Orange, Mass.	5.00
Mrs. Donald Newton, El Cajon, Calif.	1.00
Mary Anne & Tom Rooney, Baltimore, Md.	2.00
Mrs. J. D. Sims and the Beginners' Class of the 9th Street Methodist Church, Decatur, Alabama	3.80
Mrs. Dail C. West, Miami, Oklahoma	10.00

FAMILY CIRCLE contributions received up to September 18, 1951. \$457.50
RADIO-ELECTRONICS CONTRIBUTIONS

Balance as of August 20, 1951	\$8,118.93
Anonymous, Glendale, Calif.	1.00
Anonymous, Stratford, Conn.	5.00
Anonymous, Atlanta, Ga.	5.00
Anonymous, Oak Lawn, Ill.	1.00
Anonymous, Short Hills, N. J.	1.00
Anonymous, New York, N. Y.	2.00
Anonymous, East Pittsburgh, Pa.	1.00
Anonymous, Seattle, Washington	10.00
Joe Anso, Seaside, Calif.	1.00
Bradway Locker Plant, New Castle, Ind.	5.00
James J. Cassidy, So. Boston, Mass.	3.00
Charles Cerami, Newark, N. J.	1.00
Richard A. Davis, Collingswood, N. J.	10.00
H. F. Dengler, Munich, Germany	5.00
Harold Eagen, Philadelphia, Pa.	10.00
W. A. Gilmartin, San Francisco, Calif.	5.00
Herbert Goldstein, New York, N. Y.	5.00
Hurst Radio Service, Trenton, Neb.	10.00
E. G. Kohl, Richmond Hill, N. Y.	3.00
Aurora Mares, Seaside, Calif.	1.00
Ray Mares, Seaside, Calif.	1.00
Pfc. John Martindale, c/o P.M., N.Y.C.	10.00
Members of the German technical staff of "Voice of America" Receiving Station, Munich, Germany	10.00
Stephen Nester, Keyport, N. J.	5.00
Charles Pritchard, Gerard, Ill.	5.00
H. B. Scroogis, Baltimore, Md.	1.00
Robert B. Sheehan, Williamstown, Mass.	5.00
W4RTI, Birmingham, Ala.	10.00

RADIO-ELECTRONICS	
Contributions	\$8,250.93
FAMILY CIRCLE Contributions	457.50
TOTAL RECEIPTS TO September 18, 1951	\$8,708.43

—end—



DIRECTRONIC MOTORLESS

360° Electronically Switched Beam
 • No Motors • No Roof Orientation • No Electric Power
 • No Roof Orientation • No Electric Power
 The Directronic 18 element, 360° antenna is the finest for ultratrangle or metropolitan reception. The HI-PAC molded insulator is a material of extreme tensile strength not affected by weather or temperature, either mechanically or electrically. Included in the AX-599 Servicemen's Array are:
 18 Hi-tensile aluminum alloy elements
 1 set of connecting stubs (3)
 Universal U Clamps for masts to 1 1/2"
 Directronic Beam Selector
 75 feet of Tri-X Cable
 1 stacked array per carton

AX-599 Directronic	Weight 8 lbs.	\$16.95
AX-56 Directronic	6 element Single	9.95
AX-566 Directronic	12 element Stacked	14.95
AX-59 Directronic	9 element Single	11.95

All above antenna prices include Tri-X Cable and Switch.

5 ELEMENT TV ANTENNA

Excellent Pictures in Fringe Areas
 Here is a highly directive antenna that is the real solution to perfect pictures in fringe areas because it is closely tuned to each channel and cuts interference and noise to the minimum. Five elements include one folded dipole, three directors and one reflector. Supplied less mast. Specify number of channel desired. Channels 2 to 6—\$6.95 Channels 7 to 13—\$3.95
 Shipping Weight—5 1/2 lbs. Low Band.
 Shipping Weight—3 lbs. Hi-Band.

ALL CHANNEL CONICALS

This conical TV is designed for broad-band reception on all TV channels plus FM. The conical has proved high signal-to-noise ratio and excellent front-to-back ratio matches 72, 150 or 300 ohm input impedance. This metropolitan area, high quality TV antenna is engineered for superior performance. The all-aluminum construction provides maximum strength and eliminates rust and weight problems. The AX-4 is built solid and cannot slip or twist on the mast.
 Single Bay \$3.75 each Stacked Array with 7 1/2 lbs. Shipping Weight 1 1/2 lbs. \$8.20 each
 Lots of 6, single Shipping Weight 7 1/2 lbs. carton \$21.00 per carton Lots of 6, single \$23.10
 Shipping Weight 18 lbs. Shipping Weight 19 lbs.

1 1/4" O.D.	5 Crimped	\$ 1.05
Mast Steel (Dualcoated)	10'	1.95
Mast Steel (Zinc Plated)	10'	1.59
Mast Connectors for 1 1/4" O.D. Mast—10" Long		.39
Motors—Alliance ATR		20.53
—Alliance DIR		26.43
—Radiart TR2		9.70
—Walco WRO-4		28.50
Motor Wire		
3-Conductor (Walco)		.03 ft.
1-Conductor (Alliance)		.04 ft.
—Conductor (Radiart)		.06 ft.
Peak Roof Saddles (will take up to 1 1/2" I.D.)		1.49
Twin Lead 300 Ohm—2 70 Mil—Solid		.02 ft.
Twin Lead 300 Ohm—2 60 Mil—7/28 Stranded		.02 1/2 ft.
Side Wall Mounts—3" Extension		1.25
Side Wall Mounts—6" Extension		1.25
Side Wall Mounts—12" Extension		1.75
Side Wall Mounts—18" Adj.		3.20
Tie Rods for Stacking Antennas		7¢ Dr.
Double Stacking Assembly—for stacking 2-XX arrays		1.70 set
Aluminum Guy Line 7/18—Stranded—300' coil		4.95
Arrestors (TV—Lightning)		.55
Auto Radio (6 tube Universal Underdash)		34.97
Chimney Mount—Complete with Straps		1.19
Coax—72 Ohm		.06 ft.
Elements 1/2" x 44" or 48"		.90
Elements 1/2" x 45" or 48"		1.20 p.
Guy Wire—Galvanized—4 Strand #20		.04 1/2 ft.
Guy Wire—Galvanized—6 Strand #20		.07 1/2 ft.
Guy Wire—Galvanized—1 Strand #20		.01 1/2 ft.
Indoor Antennas (Popular Brands) Rabbit Ears		1.75
Boosters—Anchor—101-75		22.50
—Astatic—BT-1		19.50
—Tec—S-505		26.97
Stand-off Screw Insulators—3" for 300 Ohm		2.75 C
Stand-off Screw Insulators—7" for 300 Ohm		5.50 C
Trap Clamp Stand-off Insulators—3"		8.50 C

PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
 ALL PRICES F.O.B. CLEVELAND, OHIO



Three-year-old Freddie gazes admiringly at the addition to the Thomason family.

Chas. Freshman & Co.
 4019 PROSPECT AVENUE
 Cleveland 3, Ohio • Phone EX 1-8723

SURPLUS
NOVEMBER SPECIALS
BARGAIN! NEW!
CRAMER TIMER

ADJUSTABLE TIME DELAY RELAY. RE-LAY adjustable from 1/30 sec. S.P.D.T. with starting relay for remote control motor and contacts separate. Stock No. R-246. Operating voltage 115V. AC. Coil resistance. Contacts SPST \$9.95 (NO) or (NC) 10 Amps. EACH



VERTICAL ANTENNA MAST KITS

Fully Adjustable 5 to 35 Feet
Easy to Set Up

FOR FM, TELEVISION AND ROTARY BEAM Doublet Antenna Kit used with the famous Hallcrafters BC-610, consisting of 7 steel-alloy mast sections in a handy canvas bag. Each section is 5'6" long, 1 1/2" OD with the last 6" rolled to a smaller OD to telescope into the end of the preceding section. No taper. Assemble into mast up to 35' high or shorter by any multiple of 3'. Finished in weatherproof olive drab. Ideal for erection of FM and Television Beams! Drop your coaxial cable right through the center! Brand new. EACH \$12.95

TUBE SPECIALS

1626	.49	1616	.69	12SL7GT	.99
1629	.39	81	.49	41	.49
FG104/5561	29.95	2X2	.99	837	.99
				2051	1.29
RK73	.99	843	.39	G.E. 2ii	.98
15R	.79	803	2.95	12A6	.69
801	.79	9001	.99	6S17	.69
6AK5	1.49	58P4	1.95	307ARK75	4.95
250R	3.95	1825	.39	1E70	.69
HV615	.49	10Y	.39	EF50	.69

MANY OTHER ITEMS NOT LISTED

FUSES 3c each, \$1.95 per C 3AG—1 amp, 4 amp, 15 amp
4AG—35 amp, 40 amp 5AG—20 amp, 40, 50, 70 amp

GP-7 TRANSMITTER

TUNING UNITS



Ideal Basis for E.C.O. Rig
Tuning units for TCE & GP7 in the following frequencies: Kcs A—350 to 800 kcs; B—800 to 1500 kcs; C—1500 to 3000 kcs; E—4525 to 8500 kcs; F—8200 to 9050 kcs. Contains all coils, etc., for these frequencies. Used units are in A-1 condition. Units C.F. each \$3.95

Write for our Bargain Bulletin

DOW RADIO, INC.

1759 E. Colorado St. Pasadena 4, Calif.
Phone: Sycamore 3-1196
\$2.00 min. order 25% deposit with orders
Send full remittance to save C.O.D. charges
All merchandise fully guaranteed. Subject to prior sale.

Dr. Charles B. Jolliffe was elected to the newly created position of vice-president and technical director of RCA. Dr. E. W. Engstrom was elected vice-president in charge of RCA Labo-



Dr. C. B. Jolliffe



Dr. E. W. Engstrom

ratories Division. Dr. Jolliffe previously was executive vice-president of the RCA Laboratories Division. Dr. Engstrom was previously vice-president in charge of research of the RCA Laboratories Division.

Julius Fine was appointed commercial products sales manager of both WARD PRODUCTS and WORKSHOP ASSOCIATES, Electronic Divisions of the Gabriel Co. He will direct all distributor



J. Fine



K. S. Brock

sales. The company also announced the appointment of Kenneth S. Brock as advertising and sales promotion manager for the two divisions. Mr. Fine is currently sales manager of Ward Products. Mr. Brock was previously commercial sales manager for Workshop Associates. Both Mr. Fine and Mr. Brock will maintain their headquarters at the general offices of the Gabriel Company in Cleveland, O. There will be no change in the policies of either division as a result of these promotions.

Charles A. Hansen of the JENSEN MANUFACTURING Co., Chicago, was elected president of the Board of Directors of the Radio Parts & Electronic Equipment Shows, Inc. Sam L. Baraf, United Transformer Co., was elected vice-president; W. D. Jenkins, Radio Supply Co., Richmond Va., secretary, and Lew W. Howard, Triad Transformer Manufacturing Co., Los Angeles, treasurer.

John W. Craig of the CROSLY DIVISION, AVCO MANUFACTURING CORP., was reappointed chairman of the RTMA FM Policy Committee. Other RTMA Committee appointments include: Leslie E. Woods, Raytheon Manufacturing Co., as chairman of the RTMA Industrial Relations Committee; Harvey Stephens, International Resistance Co., vice-chairman; John B. Swan, Philco Corp., as chairman of the Traffic Com-

PREVIEW FOR '52

Just out! Our new 1952 catalog, featuring the most advanced-design and widest variety of tape recorders ever offered. More than 20 popular recorders, including models for the broadcaster, technician, experimenter, and high-fidelity enthusiast.

TWIN-TRAX* TAPE RECORDERS Trade Mark Reg. U.S. Pat. Off.

Write today for your free copy of Catalog #5272.

AMPLIFIER CORP. OF AMERICA
398 BROADWAY • NEW YORK 13, N. Y.

LOVE THAT QUICK-WEDGE!
I use it instead of a conventional screwdriver!

Quick-Wedge **SCREW-HOLDING SCREWDRIVER**
unconditionally guaranteed

ASK FOR IT AT YOUR DEALER
KEDMAN CO. • 233 S. 5th WEST • SALT LAKE CITY, UTAH

OPPORTUNITY AD-LETS

Advertisements in this section cost 35c a word for each insertion. Name, address and initials must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than ten words accepted. Ten percent discount six issues, twenty percent for twelve issues. Objectionable or misleading advertisements not accepted. Advertisements for Jan. issue must reach us not later than November 31, 1951. Radio-Electronics, 25 W. Broadway, New York 7, N. Y.

SPEAKERS REPAIRED at wholesale prices. Guaranteed workmanship. Fast service. Amprite Speaker Service, 70 Vesey St., New York 7, N. Y.

MAGAZINES (BACK DATED)—FOREIGN, DOMESTIC—Arts, Books, booklets, subscriptions, etc. Catalog 10c (refunded). Ciccone's, 86-23 Northern Blvd. Jackson Heights, N. Y.

WE REPAIR, EXCHANGE, SELL, ALL TYPES electrical instruments, tube checkers and analyzers. Hazleton Instrument Co. (Electric Meter Laboratory), 140 Liberty Street, New York, N. Y. Telephone—BARclay 7-4239.

WANTED: AN/APR-4, other "APR-", "ARR-", "TS-", "IE-" ARC-1, ARC-3, ART-13, everything Surplus! Special tubes, Tech Manuals, Lab quality Test Equipment, etc. Describe, price in first letter, Littell, Fairhills Box 25, Dayton 9, Ohio.

Five Element TV, Yaxl Beams, Aluminum Tubing Etc. Write for prices. Willard Radcliff, Postoria, Ohio.

SPEAKERS RECONED: FIELD COILS manufactured to specifications. Guaranteed workmanship. Wholesale only. S & S Mfg. Co., Rt.-1, Box 594, Riverside Drive, Mobile, Alabama.

AMATEUR—RADIAL AND ELECTRICAL RESEARCH Engineering. Hy Twillmann, R.R.#1, Chesterfield, Mo.

LONG DISTANCE TV AND FM ANTENNAS. Yaxl beams, stacks, etc. Wholesale Supply Co., Lunenburg, Mass.

The New CREST MODEL 50
Multi-Frequency Crystal Oscillator

A Must for I.F. Alignment, for Factory or Service Lab.

SPECIFICATIONS

- HIGH OUTPUT—1 volt
- OUTPUTS—5 xtal freqs.
- RANGE—4 to 50 MC
- ACCURACY—±.01%
- MODULATION—400 Cycles

Price net with terminated output cable, less crystals **\$68.50**

Write for illustrated brochure
CREST LABORATORIES INC.
Whitehall Building
Far Rockaway, L. I., N. Y.

SOUNDTRONICS SPECIALS

STANDARD BRAND RESISTORS

1/3 W to 2 W — 5% — 10% — 20%
Jobbers Quantities

Labs—We will make up small assortments for your stock at lowest prices.

14 PIN TV SOCKETS for 3BP1, 7JP4, etc.
Black Bakelite15¢ Mica Filled28¢

TOP BRAND TUBULAR CONDENSERS
.1 MFD 1000 Working Volts6¢
.05 MFD 400V7¢ .25 MFD 400V7¢
.035 MFD 600V6¢ .035 MFD 1000V8¢

MUTER CERAMIC CONDENSERS, 600 VOLT
15, 22, 33, 56, 75, 82, 180, 220 MMFD
5¢ each \$4.50 per C

U.T.C. CHOKES P.A. CASES
10 HY @ 66 MA. \$.97 10 HY @ 110 MA. \$1.40
5 HY @ 150 MA. 1.85 10 HY @ 150 MA. 2.25

SPECIAL ASSORTMENTS
50 new pop. type coded res. 50 small YOUR CHOICE
pop. ceramic cond., all voltages \$1.49 each asst.
& cap. 50 postage stamp mica cond.

F. W. SEL. BRIDGE RECTIFIERS
18 V. IN. 14 V. OUT 40 V. IN. 34 V. OUT
1.3 Amps\$ 2.90 .6 amps\$ 3.30
.2.4 Amps 3.85 1.2 Amps 4.40
6.6 Amps 5.45 3.2 Amps 6.55
13.0 Amps 9.80 6.0 Amps 11.70
17.5 Amps 12.50 9.0 Amps 13.75

ARC 5 RECEIVER

I. F. Strip—6.9 MEG. I.F.

Contains the following circuits: Mixer, 1st I.F. Amp.,
2nd I.F. Amp. Detector AVC and Squelch Rectifier.
1st A.F. and Squelch Amp and 2nd A.F. ONLY!
Complete I.F. STRIP, less tubes and output
transformer \$2.49

WIRE KIT—OVER 100 FT.

Contains over 100 ft. of #12, #14, #16 H.D. wire for
Pri & Fil. Wiring ONLY 69¢

POWER TRANSFORMER SPECIALS

700 V. CT @ 70 MA, 6.3 V @ 2.5 A. 5 @ 2 Amp. \$2.29
700 V. CT @ 150 MA, 6.3 V. @ 3.5 A. 5 @ 2 Amp. \$4.95

TV OR SCOPE TRANSFORMERS

1800 V @ 5 MA, 2.5 V @ 2 Amps\$3.95
435/870/1625 @ 35 MA. 6.3 V @ 600 MA, 6.3 V @ 1.3
A, 2 V @ 2.5 Amps, 5 V @ 2 A\$4.95
3600 V @ 2 MA, 1.25 V @ 300 MA, 750 V CT @ 200
MA, 6.3 V @ 8.7 Amps, 5 V @ 3 Amps\$7.95
8 HY @ 75 MA CHOKE—500 OHM D.C.R.49¢

TRANSFORMER POWER SUPPLY

115 V. 60 CY., 300 V. @ 55 MA.,
6.3 V. @ 2 Amps. Has 5Y3, 2-8HY,
Chokes, 2-30 MFD Filters, Pilot
Term. Strip, Meas. 5"x5"x8".
Completely wired\$6.85



TERMS—25% w/order, balance C.O.D.

SOUNDTRONICS LABS.

632 Arch St., Phila. 6, Pa.—MA 7-2775

BE YOUR OWN BOSS!

MAKE MORE MONEY



\$1.00 VALUE
25¢
40,000 WORDS
IN
TEXT
NO ADS
ALL
"MEAT!"

In "CASH IN" you now get THE real money-makers — dozens of profitable tested mail order plans, confidential business secrets, dozens of practical tested formulas, successful tested schemes — actual experiences of men who have started on a shoestring—with less than \$10 capital. 25¢ a copy postpaid. Send U. S. stamps, money order, or coin.

Money Back Guarantee

NATIONAL PLANS COMPANY
1966R BROADWAY, NEW YORK 23, N. Y.

NOVEMBER, 1951

mittee; W. L. Fogelson, P. R. Mallory & Co., Inc., vice-chairman; A. M. Freeman, RCA Victor Division, as chairman of the Tax Committee; J. B. Elliot, RCA Victor Division, as chairman of the Sports Broadcasting Committee; and Frank W. Mansfield, Sylvania Electric Products Inc., as chairman of the Industry Statistics Committee.

George Wedemeyer, WEDEMEYER ELECTRONIC SUPPLY CO., Ann Arbor, Mich., was elected president of the National Electronic Distributors Association. Other officers are: Harry D. Stark, Stark Radio Supply Co., Minneapolis, secretary; H. E. Ruble, SREPCO, Inc., Dayton, treasurer; W. D. Jenkins, Radio Supply Co., Richmond, Va., first vice-president; and Byron C. Deadman, Northern Radio & Television Co., Green Bay, Wisc., second vice-president.

Barton K. Wickstrum was elected to the post of vice-president and director of sales of SYLVANIA ELECTRIC PRODUCTS, INC. Mr. Wickstrum, who had been general sales manager of Sylvania's Lighting Division since 1946, succeeds Robert H. Bishop, who resigned from the company.



B. K. Wickstrum

Dr. Edward U. Condon was appointed director of research and development of CORNING GLASS WORKS. Dr. Condon, one of the country's outstanding physicists, was previously director of the National Bureau of Standards.

George C. Mercer, former purchasing agent of P. R. MALLORY & Co., INC, Indianapolis, Ind., was promoted to the position of director of purchasing. W. J. Topmiller, Jr., former assistant purchasing agent, succeeds Mr. Mercer as purchasing agent.

E. W. Olson was appointed to the newly created position of sales promotion manager for component products of WEBSTER-CHICAGO CORP. He was previously field promotional representative for the company. H. R. Letzter continues as the company's sales promotion manager for all products.

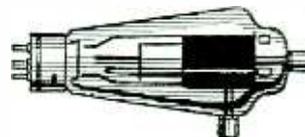
Howard Rowland was named chief research engineer of The WORKSHOP ASSOCIATES, division of The Gabriel Co., Needham Heights, Mass. He was the division's chief electrical engineer.

George Siegel was promoted to the position of sales promotion manager of JOHN F. RIDER, Publisher, Inc., New York City. Mr. Siegel has been with the Rider Advertising and Sales Departments for the past five years.

Max Cohn, president of SOUTH RIVER METAL PRODUCTS Co., INC., South River, N. J., will supervise the company's Sales Department in addition to his duties as general manager.

—end—

GE THYRATRON FG-105



Brand New MERCURY RECTIFIER

Individually boxed in factory sealed cartons. List Price \$80.00. Your cost... \$18.95

White They Last! Each
For continuous rectifier and welder control service. Tetrode type. Indirectly heated cathode; 10000 V peak, 10000 V peak inverse. Av. Max. current 6.4 amps continuous, 2.4 to 4 amps welder control service.

1B3	1.25	6K8	1.25	12SK7	.88
1H5GT	.99	6L6G	1.75	12SL7	.95
1LA4	1.12	6L6M	2.65	12SN7	1.25
1LA6	1.20	6O7	.65	12SQ7	1.10
1LB4	1.22	6SA7	1.10	12SR7	.90
1LC5	1.05	6SC7	1.10	12Z3	.85
1LC6	1.15	6SF5GT	.90	14A7	1.05
1LD5	1.22	6SF7	.95	14B6	1.05
1LE3	1.15	6SG7	.85	14F8	1.10
1LG5	1.10	6SJ7	1.00	14F7	1.05
1LH4	1.45	6SK7	.85	14J7	1.10
1LN5	1.22	6SL7GT	1.15	14H7	1.05
1N5GT	1.20	6SN7GT	1.45	14N7	1.10
1Q5GT	1.15	6SQ7	.80	14Q7	1.00
1R5	.95	6SS7	.85	14R7	1.05
1S4	.95	6T8	1.25	19	.85
1S5	.95	6V6GT	1.05	24A	.79
1T4	.95	6W4	1.05	25L6	.90
1T5GT	1.15	6X5	.75	25Z5	.85
1U4	.95	6Y6G	1.10	25Z6GT	1.00
1V	.75	7A4/XXL	1.05	26	.59
2A3	1.45	7A5	1.05	27	.59
2A5	.95	7A6	1.05	28D7	.90
2A6	.75	7A7	1.05	30	.75
2A7	.75	7A8	1.05	31	.65
2B7	.95	7B4	1.05	32	.75
2X2A	.88	7B5	1.05	34	.89
3Q5GT	1.15	7B6	1.05	35/51	.75
3S4	.90	7B7	1.05	35A5	.90
3V4	.90	7B8	1.05	35C5	1.00
5T4	1.45	7C4	1.05	35B5	1.05
5U4G	.75	7C5	1.05	35C5C	1.10
5V4G	1.65	7C6	1.10	35L6	1.00
5W4	.95	7C7	1.00	35W4	.95
5X4G	1.10	7E8	1.00	35Y4	.88
5Y3GT	.75	7E7	1.00	35Z3	.88
5Y4G	.75	7F7	1.00	35V4	.95
5Z3	.95	7F8	1.75	35Z5	.65
5Z4	1.15	7H7	1.40	36	.65
6A3	1.25	7K7	1.10	37	.65
6A6	1.15	7L7	1.10	38	.65
6A7	1.05	7N7	1.25	39/44	.65
6A8	1.10	7Q7	1.00	41	.65
6AC5GT	1.15	7V7	1.10	42	.75
6AC7	1.35	7Y4	.89	43	.82
6AG5	1.25	11L7L	1.45	45	.75
6AH6	1.65	11N7	1.45	46	.85
6AJ5	1.65	11P7	1.45	47	.95
6AK5	1.65	11Z3	.85	48	2.25
6AK6	1.25	11Z6	1.05	49	.95
6AL5	.90	12A	.85	50A5	1.00
6AL7	1.60	12A6	.70	50B5	1.15
6AQ5	1.15	12A8GT	.95	50C5	1.10
6AT6	.99	12AH7GT	1.25	50L6	1.00
6AU6	.90	12AT6	1.00	50Y6	1.25
6AV6	1.00	12AT7	1.45	53	1.05
6BA6	1.00	12AU6	1.20	56	.70
6BE6	1.00	12AU7	1.20	57	.85
6BC6G	2.20	12AV6	1.05	58	.85
6BH6	1.05	12AW6	1.75	59	1.05
6C4	.95	12BA6	.95	70L7	1.10
6C6	.85	12BE6	.95	71A	.90
6D6	.85	12J7	.95	75	.85
6E5	.95	12K7	.95	76	.85
6F5	.70	12K8	1.00	77	.85
6F6	1.05	12Q7	.75	78	.85
6F6G7	.95	12SA7	.95	80	1.05
6J5	.70	12SC7	1.25	82	1.10
6J6	1.25	12SF7	.85	83	1.25
6J7	1.05	12SG7	.90	83V	1.15
6K6	.85	12SH7	.95	84/LJ4	.90
6K7	.80	12SJ7	.95	85	.95

WILLARD 2-VOLT STORAGE BATTERY
Exact replacement for GE portables for
LB-500—
BRAND NEW. Each. \$2.69

WILLARD MIDGET 6-V STORAGE BATTERY
3 amp hour rating. Transparent plastic case. Brand
new. 3 3/4" x 1 13/16" x 2 3/8" high. Uses
standard electrolyte.
Each \$2.65

ONE-QUART BOTTLE BATTERY ELECTROLYTE
Made by Willard, for above storage batteries. 1 quart
sufficient for two 2-volt cells. Hermetically
sealed. SPECIAL \$1.45
per qt. bottle.

7-PRONG 2-VOLT RADIO VIBRATOR
for Portable and Farm Sets Replacement
for GE
LB 530 \$1.95

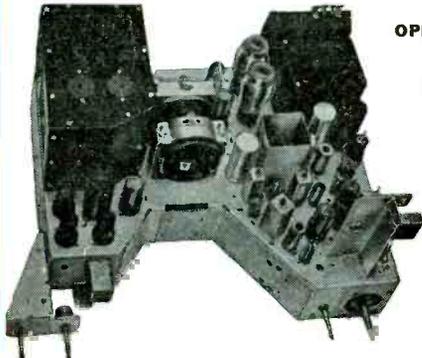
Please include 25% Deposit with order—Balance
C.O.D. MINIMUM ORDER \$3.00. All Shipments F.O.B.
Our Warehouse N.Y.C.

G & G GENUINE MAJESTIC
RADIO PARTS SERVICE
53 VESEY STREET - NEW YORK 7, N.Y.

DOLLAR FOR DOLLAR WE BRING YOU YOUR BEST BUYS IN TV!

WE ARE HEADQUARTERS FOR #630 TELEVISION CHASSIS, KITS & PARTS ●●● All Items are STANDARD BRANDS ●●● All Prices Are WHOLESALE (FEDERAL TAXES PAID) ●●● Do Not Be Misled By Any Lower Offers!

#630 SUPER DELUXE 31-TUBE TV CHASSIS



OPERATES ALL 16" TO 24" PICTURE TUBES

Engineered in strict adherence to the genuine RCA #630, plus added features ★★★★★

NOTHING BETTER AT ANY PRICE!

- Standard Turret Tuner
- Original 630 Synch. Chain for Stability
- 16.5 KV for Clarity and Brilliance
- Peak Sensitivity for Fringe Areas
- 4 Megacycle Bandwidth for Definition
- Larger Power Trans. & Voltage Doubler
- Fast Action Pulse Keyed AGC
- Large Concert-tone 12" PM Speaker

KNOWN MFR. . . . LICENSED BY RCA

Complete ready to play with all tubes, hardware, knobs, etc. (less CRT) **\$167.97**

#630 SUPER DE LUXE TV KIT

COMPLETE SET OF PARTS for the 31-TUBE 16" to 24" CHASSIS

Complete with all tubes, hardware and instructions. (less CRT & wire) **\$146.49**

#630 STANDARD TV KIT

COMPLETE SET OF PARTS for the FAMOUS ORIGINAL RCA #630 29-TUBE 10" TO 12 1/2" CHASSIS

Complete with all tubes, hardware and instructions. (less CRT & wire) **\$119.74**

STANDARD GUARANTEED PICTURE TUBES

- 24AP4 — (Round, Metal, Black) \$79.49
- 20CP4 — (Rectangular, Black) 49.74
- 19AP4A — (Round, Metal, Black) 49.74
- 17BP4A — (Rectangular, Black) 34.63
- 16TP4 — (Rectangular, Black) 32.97
- 16DP4A — (Round, Black) 32.97
- 16AP4A — (Round, Metal, Black) 32.97
- 16GP4A — (Short Round, Metal, Black) 32.97
- 14DP4A — (Rectangular, Black) 29.38
- 12LP4A — (Round, Black) 26.72
- 10BP4A — (Round, Black) 22.36

CUSTOM-BUILT CABINETS FOR #630 AND ALL TV SETS

4 leading styles in genuine mahogany or walnut (Blonde 10% extra). WINDSOR when open looks like STREAMLINER. Ready drilled for #630 chassis and any 16" to 20" picture tube at no extras in price. Also supplied with blank panel to fit any make TV set. Delivered complete as pictured including hardware, supports and safety glass. Information on cabinets for the 24" picture tube, on request.

The VOGUE
Most Popular Table Model.

The MANHATTAN
It Has Everything Style, Quality, Price

The STREAMLINER
Center Drop Panel Conceals Tuning Knobs.

The WINDSOR
Aristocrat of Cabinets Doors In Genuine Leather Hand Tooled In Gold

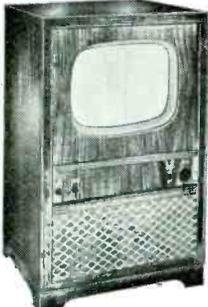


16" — H-24", W-24", D-24"

17" — H-24", W-24", D-24"

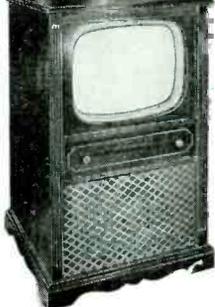
20" — H-27", W-24", D-24"

\$47.45



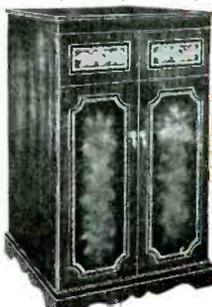
H-41", W-23", D-25"

\$59.37



H-42", W-26", D-25"

\$74.98



H-42", W-26", D-25"

\$117.46

#630 TV PARTS . . . TOP QUALITY . . . LOW PRICES

- RCA FRONT END TUNER, compl. w/tubes. \$22.49
- STANDARD TURRET TUNER, com. w/tubes. 22.49
- ESCAPTECHON PLATE, for either tuner.69
- DUMONT INPUT TUNER, complete w/tubes. 22.49
- COMPLETE SET OF KNOBS, incl. decals. . . . 1.34
- COMPLETE SET OF KNOBS, gold incl. decals 2.49
- POWER TRANSFORMER, 295ma. 201T6. . . . 9.97
- VERTICAL OUTPUT TRANS. 204T2. . . . 2.69
- VERTICAL BLOCKING TRANS. 208T2. . . . 1.32
- HORIZONTAL OUTPUT TRANS. 211T3. . . . 2.98
- HORIZONTAL OUTPUT TRANS. 211T5. . . . 3.98
- FOCUS COIL, 247 ohms, 202D1. . . . 2.29
- FOCUS COIL, 470 ohms, 202D2. . . . 3.42
- DEFLECTION YOKE, 60°, 201D1. . . . 2.97
- DEFLECTION YOKE, 70°, 206D1. . . . 3.98
- HORIZONTAL DISCRIM. TRANS. 208T8. . . . 1.49
- FILTER CHOKE, 62 ohms. 201R1. . . . 1.47
- WIDTH CONTROL COIL, 201R1.44
- WIDTH CONTROL COIL, keyed AGC.79
- HORIZONTAL LINEARITY COIL, 201R3.39
- ION TRAP BEAM BENDER, (single) 203D1.79
- ION TRAP BEAM BENDER, (double) 203D3.98
- AUDIO OUTPUT TRANSFORMER (6K6).69
- HV RECTIFIER, SOCKET ASSEMBLY, single.79
- HV RECTIFIER, SOCKET ASSEMBLY, double 1.37
- HV KINESCOPE LEAD, with clip.39

- PUNCHED CHASSIS PAN, cadmium plated \$4.87
- 630KIT, screws, nuts, rivets, washers. . . . 1.69
- TV 6' LINE CORD, with both plugs.29
- INTERLOCK SAFETY CONNECTOR, (input)17
- CATHODE RAY TUBE SOCKET, 18" leads.39
- AMPHENOL CONNECTOR PLUGS, set.48
- OVAL PM SPEAKER, 5"x7" 2.49
- 8" PM SPEAKER, heavy alnico #5 magnet. . . . 3.97
- 12" PM SPEAKER, heavy alnico #5 magnet. . . . 6.94

PARTS FOR #630 COMPLETE SETS

- VIDEO AND I.F. KIT, 19 items.7.84
- ELECTROLYTIC CONDENSER KIT, 6 Cond. 7.37
- TUBULAR CONDENSER KIT, 37 condensers. 4.28
- CERAMIC CONDENSER KIT, 28 condensers. 3.37
- MICA CONDENSER KIT, 11 condensers. 1.38
- CARBON RESISTOR KIT, 107 resistors. . . . 6.98
- WIREWOUND RESISTOR KIT, 4 resistors. . . . 2.31
- OCTAL WAFER SOCKET KIT, 13 sockets.72
- MIN. WAFER SOCKET KIT, 10 sockets.63
- MIN. MOLDED SOCKET KIT, 2 sockets.22
- BRACKET AND SHIELD KIT, 18 items. . . . 8.63
- TERMINAL STRIP KIT, 18 strips.59
- VARIABLE CONTROL KIT, 9 controls. . . . 5.83
- COMPLETE SET OF TUBES, 29 tubes. . . . 30.31

COLOR TELEVISION

Good practical COLOR TELEVISION is still a long way off The NEW YORK TIMES, June 24, 1951 reports . . . "CBS executives are no better equipped to sit at home and watch color broadcasts than is the general public . . ." Waiting for color TV only deprives you of the world's greatest pleasure . . . Hardly anyone hesitates to see a movie in black and white . . . For those who want to experiment with color TV, we have the following items:



COLOR ADAPTER

Brings in color programs in black and white from all stations. Easy to install to any TV set.

Complete with instructions **\$13.30**

Specify make of your TV set.



COLOR WHEEL

Solid one-piece product. Matched for true color. Balanced for smooth performance. CBS specifications.

- 7", 1 1/2" Diam. **\$13.36**
- 10", 2 1/2" Diam. **17.69**
- 12 1/2", 2 7/8" Diam. **29.47**

COLOR WHEEL HUB \$2.43



COLOR MOTOR

110V.-50/60 Cycle. Type pictured or type superseding it (whichever is better) will be delivered.

Including rheostat **\$19.16**

BROOKS RADIO & TV CORP., 84 Vesey St., Dept. A, New York 7, N. Y.

TELEPHONE
COntlandt 7-2359

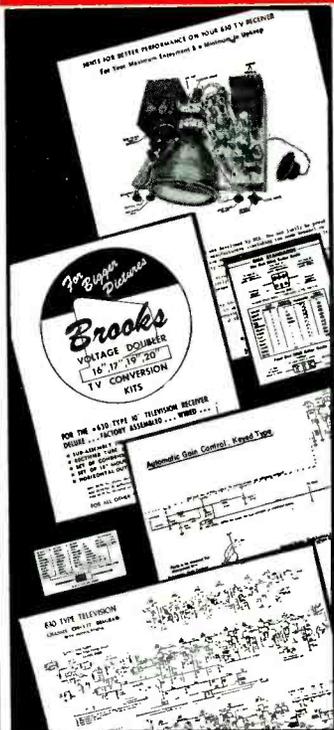
MOST POPULAR RADIO & TV TUBES

At Better Than 50% Off List Price!

STANDARD BRANDS—FULLY GUARANTEED

OZ4	\$.77	6SG7	.94
1A5G9	.94	6SH7	1.04
1A7GT	1.03	6SJ7GT	.77
1B3GT	1.27	6SK7GT	.84
1H5GT	.77	6SL7GT	1.14
1LA6	1.27	6SN7GT	1.04
1LB4	1.27	6SQ7GT	.69
1LC5	1.27	6SS7	.94
1LC6	1.27	6T8	1.39
1LD5	1.27	6U5	.94
1LE3	1.27	6V6GT	.94
1LH4	1.27	6W4GT	.84
1LN5	1.27	6X4	.69
1N5GT	.94	6X5GT	.69
1Q5GT	1.27	7A5	1.04
1R5	.94	7A8	.84
1S4	1.03	7B4	.84
1S5	.84	7B5	.84
1T4	.94	7B6	.84
1T5GT	1.27	7B7	.84
1U4	.94	7C5	.84
1U5	.84	7C6	.84
1X2	1.27	7F7	1.04
3Q4	1.04	7F8	1.54
3Q5GT	1.14	7Q7	.84
3S4	.94	7Y4	.84
3V4	.94	12AH7GT	1.27
5T4	1.16	12AL5	.94
5U4G	.69	12AT6	.69
5V4G	1.14	12AT7	1.39
5W4	.77	12AU7	1.14
5Y3GT	.52	12AX7	1.14
5Y4G	.69	12BA6	.84
6A7	1.04	12BE6	.84
6A8GT	1.04	12J5GT	.69
6AB4	.94	12K7GT	1.04
6AB7	1.56	12SA7GT	.84
6AC7	1.39	12SF5	.94
6AG5	1.27	12SF7	.94
6AG7	1.54	12SG7	.94
6AH6	1.89	12SJ7GT	.77
6AK5	1.89	12SK7GT	.84
6AL5	.94	12SL7GT	1.14
6AL7GT	1.27	12SN7GT	1.04
6AQ5	.94	12SQ7GT	.77
6AQ6	.84	12SR7	1.04
6AQ7GT	1.14	14A7	1.04
6AS7G	3.98	14B6	1.04
6AT6	.69	14Q7	1.04
6AU6	.84	19BG6G	2.94
6AV6	.69	19T8	1.39
6AX5GT	.77	25A6	1.27
6BA6	.84	25L6GT	.84
6BE6	.84	25W4GT	.94
6BG6G	2.32	25Z5	.77
6BC5	.94	25Z6GT	.69
6BH6	.94	35A5	.84
6BQ6GT	1.54	35L6GT	.84
6C4	.77	35W4	.62
6C5GT	.77	35Y4	.84
6C6	1.04	35Z3	.84
6CD6G	2.94	35Z5GT	.62
6D6	1.04	41	.94
6E5	1.04	42	.94
6F5GT	.77	43	.94
6F6GT	.77	45	.94
6H6GT	.84	47	1.39
6J5GT	.69	50A5	1.04
6J6	1.39	50B5	.94
6J7GT	.94	50L6GT	.77
6K6GT	.77	75	.77
6K7GT	1.04	76	.77
6L6G	1.72	77	.94
6N7GT	1.14	78	.94
6Q7GT	.84	80	.61
6SA7GT	.84	117L7GT	1.89
6SC7	.94	117N7GT	1.89
6SF5GT	.84	117Z3	.69
6SF7	.94	117Z6GT	1.14

HOTTEST TV PACKAGE for "ONE BUCK"!



EVERYONE INTERESTED IN TELEVISION should own this TV literature package... The information will be found useful on any make TV set. It's different and right to the point! It carries instructions that are up to the minute and not yet found in expensive text books. Indispensable to the TV technician yet easy enough for anyone with even a limited knowledge of TV to understand and follow.

Just think of being able to convert any 10" TV set into a life-size 20" receiver in as little as one hour... The ILLUSTRATED TV CONVERSION MANUAL makes that possible.

SAVE MONEY ON REPAIRS—Important common occurrences are carefully analyzed and corrective procedures are suggested. You are told what to do—WHEN THE RECEIVER FAILS TO OPERATE, WHEN THERE ARE GHOSTS, INTERFERENCE, NO PICTURE, PICTURE FOLD-OVER, NO RASTER, PICTURE BLOOMS, DISTORTED PICTURE, PICTURE ROLLS, NO SOUND, DISTORTED SOUND, CORONA EFFECTS, ETC. PICTURE TUBE ASSEMBLY and PATTERN ADJUSTMENTS are outlined in detail (the ion trap adjustment caution may save you the price of a new picture tube). The HORIZONTAL SYNC, RCA TUNER and STANDARD TUNER step by step adjustments alone are worth many times the cost of this package.

TUNING GUIDANCE and ANTENNA ADVICE will enable you to enjoy peak performance at its best. The HIGH VOLTAGE CAUTION will give you that free and easy feeling of safety while handling the chassis or any of its parts.

The #630 CIRCUIT DIAGRAM, KEYED AGC DIAGRAM, RESISTOR & MICA CODE CHARTS need no emphasis as to their usefulness.

You will also receive our latest catalog and flyers with hundreds of special offers in Television, Chassis, Cabinets, Picture Tubes, Parts, Radios, Portables, Auto Radios, Radio Tubes, Test Equipment, Accessories, Latest in Color Equipment, Etc., at WHOLESALE PRICES.

USE HANDY COUPON

BROOKS RADIO & TELEVISION CORP.
84 Vesey St., New York 7, N. Y.

Send complete package of TV literature

Enclosed find \$1.00 Cash Check M.O.

NAME.....

ADDRESS.....

CITY..... STATE.....

1. HINTS FOR BETTER PICTURES ON 630 TV
2. 630 TV DIAGRAM WITH MODIFICATIONS
3. ILLUSTRATED TV CONVERSION MANUAL
4. PULSE KEYED AGC CIRCUIT DIAGRAM
5. RMA RESISTOR & MICA CODE CHARTS

\$1.00 POSTPAID

CUSTOM-BUILT AUTO RADIOS

Known Mfr. • • • Licensed By RCA

6-TUBE SUPER-HET. (8-tube performance)

FORD	1949-50-51	PLYMOUTH	1949-50-51
DODGE	49-50-51	CHEVROLET	49-50-51
STUDEBAKER	50-51	HUDSON	48-49-50-51
HENRY J.	51		All List at \$59.95

Your Price... (Any Model) Complete, ready to install including Easy Instructions... **\$41.97** Net

PM SPEAKERS (ALNICO #5)

1 oz. mag. on 3" to 6", heavier mag. on 8" & 12"

Brand New—Factory Guaranteed Stock

3"	\$.98	6"	1.98
4"	1.29	8"	3.97
5"	1.49	12"	6.94

TUBE CARTONS in LOTS of 100

SMALL PEANUT	1" x 1" x 2 1/8"	\$.89
LARGE PEANUT	1" x 1" x 2 3/4"	.98
GT TYPE	1 1/4" x 1 1/4" x 3 3/8"	1.06
SMALL G	1 1/2" x 1 1/2" x 4 1/2"	1.39
LARGE G	2" x 2" x 5"	1.59
EXTRA LARGE	2 1/4" x 2 1/4" x 6 1/2"	2.97

KEYED AGC KIT

Keyed pulse, fast action AUTOMATIC GAIN CONTROL KIT to modernize a #630 or any other TV receiver. Improves performance, giving a steady picture on all channels. Eliminates airplane flutter and picture jumping. Complete set of parts includes: CONDENSERS, RESISTORS, 6AU6 TUBE, SOCKET, WIDTH CONTROL COIL, HARDWARE, ETC.

Complete with easy to follow step-by-step assembly instructions and diagrams. **\$4.59** ONLY

CRYSTAL-LUCITE MASKS

Framed in Beautiful Rich Gold Leaf Finish

Overall Dimensions	Price
10" -Round 9 1/8" x 11 1/4"	\$ 3.47
12 1/2" -Round 11 1/8" x 13 7/8"	4.78
14" -Rectangular 11 1/8" x 14"	4.52
16" -Round 13-1/16" x 16 1/4"	5.97
16" -Rectangular 12 3/4" x 16 1/8"	5.84
17" -Rectangular 13-9/16" x 16 7/8"	5.97
19" -Round 15 3/8" x 19 3/8"	7.69
20" -Rectangular 15 3/4" x 19 3/8"	7.98
24" -Round 20 1/2" x 26 1/4"	14.65

(Including Set of Rosettes)

NO GLARE TV FILTERS

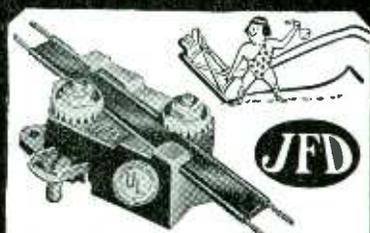
For better, More Clearly Defined Pictures. Improves Contrast. Eliminates TV Glare. Sharpens Picture Image. Sizes To Fit All Sets In Smoke Or Blue Colors.

10"	8" x 10 1/2"	\$.89
12 1/2"	9" x 12 1/2"	1.26
14"	10 1/2" x 15"	1.47
16"	12" x 16 3/8"	1.92
17"	13 3/8" x 17 3/8"	2.16
19" or 20"	15 1/2" x 19 1/2"	2.44
24"	20" x 24"	3.87

BROOKS RADIO & TV CORP., 84 Vesey St., Dept. A, New York 7, N. Y.

TELEPHONE
Cortlandt 7-2359

PERFORMANCE Not Size IS WHAT COUNTS



"LITTLE GIANT" LIGHTNING ARRESTER

PROTECTS Against Lightning Hazards

No. AT 105 \$1.25 LIST
For ribbon-type and oval jumbo twin lead.

ONLY JFD Lightning Arresters offer you these exclusive patented features...

1. Strain-relief Retaining Lip prevents pulling or straining of lead against contact points.
2. You actually see positive contact made with lead-in wire.
3. No wire stripping or cutting.

Write for Form No. 84 showing the damage lightning can do to a Television Installation.

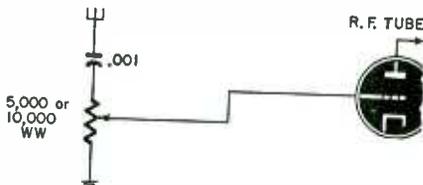
JFD MANUFACTURING CO., Inc.
6101-L 16th AVENUE, BROOKLYN 4, N. Y.
FIRST in Television Antennas and Accessories

HINTS ON SYNCHRODYNE

Dear Editor:

Thanks for forwarding me the correspondence from readers who have been having difficulties with the Synchrodyne. The most common appears to be squealing. Some possible causes are:

1. Due to insufficient shielding or common coupling in a power supply or in the tuning gang, the r.f. stage is included in a positive feedback loop and the whistles are caused by oscillation in the r.f. or r.f. plus demodulator circuit. To check this try the untuned input circuit shown below.



2. Some American 6J8-G tubes may be different in construction from the Australian ones. North American Philips should be able to supply an ECH35, or alternatively you could use more turns on the triode grid oscillator coil together with lower values for the anode and grid resistors between the r.f. and demodulator tubes.

3. Insufficient signal from the r.f. may not give enough sync signal. Is the r.f. stage defective? Check tube and a.v.c. voltages.

4. The potentiometer giving the synchronizing signal may have a high-resistance contact and this combined with excessive shielding may bypass too much of the sync voltage.

JOHN WM. STRAED

Victoria, Australia

MULTIPLE 405-LINE TV!

Dear Editor:

Recently while adjusting my television receiver, a 630 model by Philmore, CBS started to transmit color. By adjusting the synchrolock control at rear, I received the CBS color picture in black-and-white.

But, best of all, I received not one picture but four! One in each quarter of a 17-inch picture tube. Now each member of our family has an individual picture when Columbia transmits a color program!

JOHN CODY

Bronx, N. Y.

SOME NOTES ON THE YAGI

Dear Editor:

We have been reading with interest the answers to the many questions which appear in the Question Box each month. You are definitely providing a much-needed service to your readers.

The July, August, and September issues contained articles of particular interest to our company. Vee-D-X, as you are probably aware, has made certain contributions to the television antenna market.

In the July issue a question was asked relative to the matching of a channel 13 Yagi antenna with a conical. Vee-D-

TUBES at Mfr's. COST

Standard Brands—Unbranded—Guaranteed

*1B3	\$.135	6BF5	.60	6W4GT	.49
1L4	.60	6BG6	1.48	6X4	.36
1L6	.60	6BN7	.94	6Y5	.68
*1LN5	.85	6BQ6	.94	*12AG	.70
1R5	.60	6BQ7	.39	12AT6	.40
1U4	.60	6C4	.56	12AT7	.75
1U5	.50	6C86	.75	12AV7	.75
*2A3	1.25	6CD6	1.33	12AX7	.65
*2X2	.60	6H6GT	.48	*12AV7	4.95
3Q4	.66	6H6M	.75	12BA6	5.48
3V4	.62	6J5GT	.44	12BE6	.49
*5V4	1.20	6J6	.73	12SK7GT	.53
5Y3GT	.33	*6K6	1.09	12SN7GT	.58
*5Z3	.85	*6K7M	.85	12SW4	.90
*6AC7	1.25	6L6	1.05	19T8	.86
6AG5	.57	6L6A	1.05	25L6GT	.50
*6AG7	1.05	6L6GA	1.05	35W4	.37
*6AH6	1.75	6N7M	1.20	35L6GT	.53
6AK5	1.10	6R6	1.50	50L6GT	.53
6AL5	.44	6S5GT	.75	50B5	.53
6A05	.51	6T8	.86	*89Y	1.50
6AT6	.40	6V6GT	.51		
6AUG	.45				
6AV6	.40				
6B4G	1.35				
6BA6	1.48				
6BC5	.56				
6BE6	.49				

UNBRANDED—Lots of 50 only
*STANDARD BRANDS—Any Quantity

SPECIAL PURPOSE TUBES

1N23A	\$.275	211C/VT4C	1.75	1632	.65
1N23B	4.95	3508	5.50	1833	.65
2C51	5.95	394A	5.50	8025	5.75
2E25	5.95	715R	15.00	9001	1.75
2E30	4.00	721A	3.95	9002	1.50
2D21	1.65	723AB	14.50	9005	1.75
3AP1A	12.50	726A	6.50	CK70	4.95
3B24	5.50	807	1.39	CK105	.65
3BP1	56.93	809	2.25	RR73	1.50
3C24, 24E	1.50	829R	13.95	T20	2.25
46A	6.75	824A	11.95	T200	16.95
446A	2.25	837	1.95	TF20	3.95
455	.35	1603	5.95	TZ20	2.25
75TH	6.75	1620	6.50	TZ40	3.25

IMMEDIATE DELIVERY!

Write for quotations, many other types available. All prices subject to prior sale.

WRITE, WIRE, CALL—TODAY!

Nat Adelman

168 Washington St., New York 6, N. Y.
CO. 7-6091

AUTOMATIC M-90 AUTO RADIO



- Six Tube Superheterodyne • Three Gang Condenser • Powerful, Long-Distance Reception • Fits All Cars, Easy Installation

- Mounting Brackets Included
- 6 Tube model M90 *\$33.87
- 5 Tube Model A-15 *\$28.76

*Above price includes Federal Excise Tax

Approx. shipping weight either radio (11) eleven pounds

MAIL US YOUR ORDERS

All orders filled within 24 hours.
Standard Brand tubes 50% off list

Bill Sutton's Wholesale Electronics
Fifth at Commerce Fort Worth, Texas

BIG BOOK NEWS

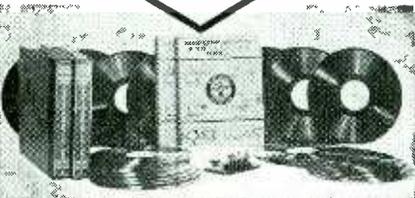
See page 116

TALK TO THE WORLD!
PREPARE FOR F.C.C. NOVICE

AMATEUR RADIO LICENSE **\$26.95** COMPLETE

Be a "Ham" in a Few Days—No Experience Needed! Operate Your Own Station—Enjoy the "Hobby with a Future"

YOU GET AND KEEP ALL THIS



- 36 4-min. code recordings (alphabet thru 6 wpm)
- 2 12-record albums
- Telegraph Key
- Tone Record for Sending Practice
- Instruction on Sending, Radio Theory, & F.C.C. Regulations.
- Pre-F.C.C. Exams graded FREE by E.T.I.
- MONEY-BACK GUARANTEE
- With PHOTOSOUND, you SEE the material & HEAR your instructor!

5-DAY TRIAL - SEND NO MONEY MAIL COUPON NOW!

ELECTRONIC TECHNICAL INSTITUTE Dept. RE 111
830 Venice Boulevard, Los Angeles 15, California

- Please send NOVICE LICENSE COURSE for 5-day No-Risk Examination. On arrival I will pay the postman \$26.95 plus C.O.D. charges.
- Check here if you enclose \$26.95—We pay delivery charges.

Send _____
Information on: Novice License Advanced Amateur License
Commercial License

Name _____ Age _____
Address _____
City _____ Zone _____ State _____

**7 HARD TO GET ITEMS
AT BIG SAVINGS TO YOU**

AMAZING BLACK LIGHT



250-watt ultra-violet light source. Makes fluorescent articles glow in the dark. Fits any lamp socket. For experimenting, entertaining, unusual lighting effects. Ship. wt. 2 lbs. ITEM NO. 87 **\$2.45**
A SAVING AT

POWERFUL ALL PURPOSE MOTOR



Sturdy shaded pole A.C. induction motor. 15 watts, 3000 rpm. 3"x2"x1 1/4". 4 mounting studs; 7/8" shaft, 3/16" diameter; 110-120 volts. 50-60 cycles. A.C. only. When geared down, this unit can operate an 18" turntable with a 200 lb. dead weight. Use it for fans, displays, timers and other purposes. Ship. wt. 2 lbs.

ITEM NO. 147 **\$2.45**
UNUSUAL BUY

WATTHOUR METER

Leading makes—completely overhauled, ready for service. 100-110 volts, 60 cycles, 2-wire A.C. 5 amp. Heavy metal case 8 1/2" x 6 1/4" x 5". Easy to install. Ship. wt. 14 lbs.



ITEM NO. 33 **\$4.50**
NOW ONLY

WESTERN ELECTRIC BREAST MIKE

Lightweight 1 lb. carbon microphone. Aircraft type. Breastplate mounting, adjustable 2-way swivel. Easily fastened straps. For home broadcasts, communications etc. Complete with 6 foot cord, hard rubber plug. Sheradized plate, non-rusting finish. Ship. wt. 2 lbs. ITEM NO. 152 **\$1.75**
NEW LOW PRICE



TELEPHONE TRANSMITTERS

Genuine transmitters made by Kellogg Western Electric, Stromberg Carlson. Work on two dry cells. For P.A. systems, intercoms, other practical uses. Shipping weight 1 lb.



ITEM 160 **\$2.45**
REAL VALUE

250 POWER TELESCOPE LENS KIT

Make your own high powered 6 ft. telescopic lens. Kit contains 3" diam., 75" focal length, ground and polished objective lens and necessary eye pieces. Magnifies 50x to 250x. Full instructions. Ship. wt. 1 lb. ITEM NO. 123 **\$2.95**
YOU SAVE AT



HUDSON SPECIALTIES CO.
40 West Broadway, Dept. RE-11-51
New York 7, N. Y.

I am enclosing full remittance for items circled below. (Be sure to include shipping charges.)

OR, my deposit of \$..... Ship balance C.O.D.
MINIMUM C.O.D. ORDER \$5.00.

C.O.D. ORDERS ACCEPTED ONLY WITH 20% DEPOSIT
INCLUDE SHIPPING CHARGES.

Circle Items Wanted

87 147 33 182 160 123

Name..... Please Print Clearly

Address.....

City..... Zone..... State.....

\$3.00 FOR CARTOON IDEAS

RADIO-ELECTRONICS prints several radio cartoons every month. Readers are invited to contribute humorous radio ideas which can be used in cartoon form. It is not necessary that you draw a sketch, unless you wish.

Address
RADIO CARTOONS, RADIO-ELECTRONICS
25 West Broadway, New York 7, N. Y.

X markets a divider network known as the MM-2 Mighty Match. This device will provide the desired isolation of the two antennas. When connected to a single transmission line with an MM-2 installed, the conical will not pass high-channel signals to the transmission line. The MM-2 will present no insertion loss and will prevent detuning effect of the two antennas. A minimum separation of 36 inches is recommended between the two antennas.

Your July and September issues answered questions relative to the stacking of four and eight Yagi antennas. Vee-D-X markets such harness kits for use with our antennas which will provide either vertical or horizontal stacking of four Yagis. We have constructed and experimented with the stacking of eight Yagi antennas. This array, as pointed out in your article, provided extremely sharp patterns and due to its massive size is not recommended. Such harness kits are not available.

It has been our experience that regardless of the number of antennas stacked, the band-width of the array will not change from that of a single Yagi. We have found that six-element Yagis with a band-width of 5 mc may be multistacked and still maintain their band-width.

We hope that this information is received in the spirit in which it was given; that is, to assist you in compiling information.

THE LA POINTE-PLASCOMOLD CORP.
F. A. Hess, Sales Manager
Windsor Locks, Conn.

UNPAID ETHICAL SERVICE

Dear Editor:

I have just read Walter R. Rogers' article, "Ethical Service Pays," in the September issue, and agree with his conclusions.

But what got me was the lad working after hours and at a rate of only \$1.50 for replacing a capacitor and alignment too. I guess that explains why he works at night—he couldn't make a living by day giving away work at that price. Standard rates here allow at least \$2.50 for capacitor installation, plus cost of the unit at list price. Alignment would be added to that.

I believe an item featuring low charges such as this example is as bad as too high charges, and only adds to the confusion of the repair man following the middle of the road and who is managing to keep his business on a paying basis at fair prices. What will the average technician think after reading of a man who can render repairs such as the article listed—for \$1.50?

J. W. ESSEX
Industrial Sound, Reg'd
Bridgewater, Nova Scotia

(Mr. Essex has an important point here. Many shops which operate till 10 every night could close at a decent hour if the owners would only charge what their work is worth. They'd probably increase their prestige thereby and so get more business, too!—Editor)

—end—

ALL IN ONE!
with RCP's new
MODEL 8773
SERVISHOP



EQUIVALENT TO A COMPLETE SERVICE SHOP!

- TUBE TESTER
- SET TESTER
- A.M. GENERATOR
- F.M. GENERATOR
- A.F. GENERATOR
- CONDENSER TESTER
- FUSE PROTECTED METER

\$ 99⁹⁵

Every square inch solid-packed with value! Look what you get in this phenomenally low priced tester: a complete latest model obsolescent proof tube tester with approximately 1000 listings on improved roll chart together with an elaborate multimeter for measuring all AC & DC voltage DC currents—resistance in ohms and megohms—output in decibels—condenser leakage—signal generators for audio—radio AM and radio FM signals.

- DC Voltmeter: 0-10-50-500-1000-2500
- AC Voltmeter: 0-10-50-500-1000-2500
- DC Milliammeter: 0-10-100-1000
- DC Ammeter: 0-10
- Decibel Meter: —8 to +15, 15 to 29, 29 to 49, 32 to 55
- Ohmmeter: 0-500-5000 ohms, 0-0.1-1-10 meg-ohms

Complete with tubes, batteries, test leads, output leads, etc. in beautiful natural finish oak case. BUY FROM YOUR JOBBER. INSIST ON RCP INSTRUMENTS • WRITE FOR CATALOG RE-11

RADIO CITY PRODUCTS CO., INC.

152 West 25th St.  New York 7, N. Y.

• VIDEO-VEND
COIN OPERATED TELEVISION

Get in on the ground floor of this SENSATIONAL PROFITABLE business. For small investment we can show you large returns. Requires only a few hours a week. Write—

Coin Radio & Television Corp.
190A Duane St. Dept. RE New York City

HELP THE DEFENSE EFFORT

by turning over old copies of RADIO-ELECTRONICS and all other waste paper to paper collecting agencies in your community.



RADIO COURSES

Preparatory Mathematics, Service, Broadcast, Television, Marine Operating, Aeronautical, Frequency Modulation, Radar.

Classes now forming for the
Fall term beginning Feb. 1st
Entrance exam. Jan. 15th
Veterans. Literature.

COMMERCIAL RADIO INSTITUTE
(Founded 1929)
38 West Biddle Street, Baltimore 1, Md.

ATTENTION...

A NEW department of the DON MARTIN SCHOOL OF RADIO AND TELEVISION ARTS AND SCIENCES . . . for instruction and training in—**TELEVISION**—incorporating:

Production: Writing, Directing, Producing, Acting, Staging, Lighting.

Engineering: Transmission, Receiving, Camera and Studio, Operation, Theory of Video, Pickup and Reproduction.

Approved for veterans.

THE DON MARTIN SCHOOL OF RADIO AND TELEVISION ARTS AND SCIENCES
1655 No. Cherokee, Hollywood 28, Calif. HU. 23281.

F.C.C. COMMERCIAL RADIO OPERATORS LICENSE

Critical Shortage of Licensed Operators Exists!!!
A wonderful future is yours with an F.C.C. commercial radio telephone or telegraph operators license, leading to top-salaried jobs in aviation, broadcasting, transportation and Civil Service. Sensational new simplified HOME STUDY course teaches you in the shortest possible time at lowest possible cost. NO OTHER COURSE LIKE IT! Proven valuable during World War II in speedily training thousands of men, eliminates tedious schooling, exam. papers, wading through books. Each page of text directly related to official F.C.C. exam. questions, thus assuring you of all theory requirements.

The entire course, nothing else to buy, containing 230 pages of complete material, diagrams, etc., yours for only \$9.95. Send check or money order; or pay Postman \$9.00 upon receipt, plus C.O.D. charges. Complete satisfaction or money refunded within ten days.

STREAMLINED SELF STUDY COURSES
509 5th Ave. Dept. A New York, N. Y.

AUDIO (SOUND) ENGINEERING COURSE HOME STUDY TRAINING

Prepare yourself, in your spare time for a BIG PAY JOB as an AUDIO ENGINEER. Practical, easy-to-understand lessons, written by nationally recognized Audio Engineers and Educators.

Prepare for a SUCCESSFUL CAREER in the TELEVISION, RADIO, DISC AND TAPE RECORDING, ELECTRONICS AND MOTION PICTURE INDUSTRIES.

Training will not interfere with present employment.

EARN WHILE YOU LEARN
WRITE FOR COMPLETE DETAILS—TODAY
B. M. Klekner, D.Sc., Ph.D.
President

HOLLYWOOD TECHNICAL INSTITUTE
3359 Cahuenga Boulevard
Hollywood 28, California



RADIO ENGINEERING

B. S. DEGREE IN 27 MONTHS

Complete Radio Engineering course incl. Telev., U.H.F. and F.M. BS Degree Courses also in Mech., Civil, Elect., Chem. and Aero Eng.; Bus. Adm., Acct. Extensive campus, modern buildings, well equipped labs. Low cost. Prep. courses. Personalized instruction. Heavy demand for graduates. Placement service. Founded in 1884. Prepare now for the civil and military opportunities ahead. Enter Jan., March, June, Sept. Write for Catalog.

TRI-STATE COLLEGE
24111 COLLEGE AVE. ANGOLA, INDIANA



Complete Home-Study Course for Passing FCC Amateur Radio Examinations

- LOW COST •
- PERSONAL COACHING •
- MONEY-BACK GUARANTEE •
- Write for Details •

FEDERAL ELECTRONICS INSTITUTE
34 East Putnam Ave., (Dept. F), Greenwich, Conn.



Be a "key" man. Learn how to send and receive messages in code by telegraph and radio. Commerce needs thousands of men for jobs. Good pay, adventure, interesting work. Learn at home quickly through famous Candler System. Qualify for Amateur or Commercial License. Write for FREE BOOK.

CANDLER SYSTEM CO.
Dept. 3 M Box 928, Denver 1, Colo., U.S.A.

LEARN DAY and EVENING CLASSES TELEVISION

ELECTRONICS-RADIO
Modern Laboratory Instruction in

- SERVICING
- BROADCAST OPERATING
- ELECTRONIC and TV ENGINEERING

G.I. APPROVED

WRITE FOR ILLUSTRATED CATALOG
ELECTRONICS INSTITUTE, Inc.
21 HENRY, DETROIT 1, MICH.

RADIO ENGINEERING DEGREE IN 27 MONTHS

Intensive, specialized course including strong basis in mathematics and electrical engineering, advanced radio theory and design, television. Modern lab. Low tuition. Self-help opportunities. Also 27-month courses in Aeronautical, Chemical, Civil, Electrical, and Mechanical Engineering. Approved for G.I.'s. Enter, Dec., March, June, Sept. Catalogue.

INDIANA TECHNICAL COLLEGE
1511 E. Washington Blvd., Fort Wayne 2, Indiana



EVERY RADIOMAN Can Use These SERVICE HINTS!

Valuable Manual Yours—FREE!

Every page of "How to Simplify Radio Repairs" is packed with on-the-bench, practical ideas. Contains photos, charts, diagrams—no fluff—no vague theory. In plain every-day language it gives you priceless suggestions—new servicing ideas. You'll use and benefit from the experience of experts.

Partial list of contents: How to Localize Trouble; How to Service Amplifiers; How to Test for Distortion; How to Test Audio Circuits; How to Test Speakers; How to Find Faults in Oscillators; How to Test Radio Parts—and it's all yours—FREE! No obligation.



FEILER SEND COUPON OR PENNY POSTCARD FOR YOUR FREE COPY TODAY!

FEILER ENGINEERING CO., Dept. 11RC1
8026 N. Monticello Ave.
Skokie, Ill. (Suburb of Chicago)

Please RUSH my FREE copy of "How to Simplify Radio Repairs."
Name.....
Address.....
City.....Zone.....State.....



RADIO ENGINEERING

FM—Television—Broadcast

Police Radio, Marine Radio, Radio Servicing, Aviation Radio and Ultra High mobile applications. Thorough training in all branches of Radio and Electronics. Modern laboratories and equipment. Old established school. Ample housing facilities. 7 acre campus. Small classes, enrollments limited. Our graduates are in demand. Write for catalog.

Approved for Veterans

VALPARAISO TECHNICAL INSTITUTE
Dept. C VALPARAISO, INDIANA



RADIO and TELEVISION

Thorough Training For Men and Women in All Technical Phases

APPROVED FOR ELIGIBLE VETERANS
DAY—EVENINGS WEEKLY RATES
FREE PLACEMENT SERVICE FOR GRADUATES
For Free Catalog Write Dept. RC-51

RCA INSTITUTES, Inc.
A Service of Radio Corporation of America
350 WEST 4TH STREET NEW YORK 14, N. Y.

TELEVISION

PREPARE FOR A GOOD JOB!
COMMERCIAL OPERATOR (CODE)
RADIO SERVICEMAN

TELEVISION SERVICING
BROADCAST ENGINEER

Approved for Veterans
SEND FOR FREE LITERATURE

BALTIMORE TECHNICAL INSTITUTE
1425 Eutaw Place, Dept. C, Baltimore 17, Md.



RADIO COURSES

- RADIO OPERATING • CODE
- RADIO SERVICING • ELECTRONICS
- F.M. TELEVISION

Preparation for Civilian, Maritime, Army and Navy license requirements. Write for Catalog TE

TRADE & TECH. SCHOOL 15 W. 63 St., N. Y. 23
Eldicott 2-8117

LEARN AMATEUR RADIO

- Radio • Television
- Communications • Electrical inspector courses.

FCC License preparation.
Amateur Radio Station on premises.
Build your own equipment in our Laboratories.

C. Gallo W2AWI (Director)

LINCOLN SCHOOL OF RADIO & TV INC.
1851 B'way (61st St.) New York, N. Y.

FUNDAMENTALS OF ELECTRICAL ENGINEERING, by Fred H. Pumphrey. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York, N. Y. 5 3/4 x 8 3/4 inches, 668 pages. Price \$7.65

This book is designed for those taking a full-year's course in basic electrical engineering. Similar in many respects to existing books on the subject, the author departs from the usual treatment by trying to make the reader understand electrical principles through simple explanation and the use of illustrative examples. The book has the further advantage that numerous additional topics such as non-linear resistors (varistors), stabilized amplifiers and electronic instruments have been added.

A good working knowledge of algebra and calculus on a college level is required. Considerable material is devoted to power engineering, not always of interest to those in the communications field. Evidently intended as a book requiring supplementary classroom instruction, the section on vacuum tubes particularly calls for additional reading and guidance.—MC

AUDEL'S TELEVISION SERVICE MANUAL, by E. P. Anderson. Published by Theo. Audel Co., 49 W. 23 St., New York 10, N. Y. 5 x 6 1/2 inches, 396 pages. Price \$2.00.

Although this book is titled a TV Service Manual, only 3 chapters are directly concerned with servicing. Actually it covers the whole range of TV reception from placement of TV receivers in the home, through adjustment of receiver controls and antenna installation to a discussion of color TV conversion methods.

Despite the fact that some material is dated (notably the chapter on TV receiver fundamentals and the inclusion

of an obsolete map of proposed coaxial and microwave TV network routes) or has appeared in manufacturers' literature previously, the book will be useful to students and beginners who wish a practical introduction to television.

A comprehensive glossary and index also are included.—MHG

AUTOMOTIVE MANUAL—ELECTRICAL-RADIO WIRING DIAGRAMS. Published by the E. I. Electrical Press, Hinsdale, Ill. 8 1/2 x 11 inches, 87 pages. Price \$2.00.

The main objective in preparing this manual, according to its foreword, was to supply electrical wiring diagrams and radio schematics for leading automobiles in use since World War II. It was originally compiled for the use of students in the E-I Electrical School.

The book consists of wiring diagrams of automobiles and schematics of their radios. Since there are cases where several models may use the same radio, the pages of wiring diagrams are more numerous than those of radio schematics. However, no less than seven schematics of various Ford-Lincoln-Mercury radios appear, and 12 of General Motors radios. In all, diagrams of radios used in cars of 11 manufacturers are printed, as well as electrical wiring diagrams of the cars.—FS

CONVERTING TO LARGE PICTURE TUBES. Published by the American Distributing Co., 1810 Winchester Street, Baltimore, Md. 8 1/2 X 11 inches, 42 pages, 1951. Price \$1.50.

This manual covers the conversion of 16 TV sets, including Admiral, Crosley, G-E, and RCA. It is written in notebook style with instructions printed as Step 1, Step 2, etc. Steps of mechanical change are listed in greater detail than

SPECIAL!! 6 TUBE AC-DC KIT

At Last! A low-priced kit designed for high sensitivity, excellent selectivity and good tone quality. Uses 25L6, 25Z6, 6SQ7, 6SA7, 6SK7, 6SK7 in an easily constructed circuit. The 6 Tube Kit is shipped with all parts, including punched chassis, resistors, condensers, coil, sockets, PM Speaker, hardware, etc.

And at a closeout price of only **\$6.95**

X182 less tubes and cabinet
X183 Extra for matched set of six tubes for kit **\$3.25**

5 TUBE AC-DC SUPERHET KIT

Five tube superheterodyne kit, A.C.-D.C. contains all components required to construct this latest design, highly sensitive superheterodyne broadcast receiver complete with black bakelite cabinet (excludes wire and solder) Price \$7.95
Extra for a kit of five tubes (1-12SK7, 1-12SA7, 1-12SQ7, 1-35Z5 and 1-50L6) \$2.95.

YOUR MONEY RETURNED IN FULL—

If the New Regency Television Booster fails to improve your television enjoyment! Bring your picture out of the snow and reduce interference!

- Push-Pull Neutralized triode design assures high gain without adding snow.
- No external impedance matching devices required.
- Inductive tuning assures same high-gain wide-band operation on all channels.
- Single knob tuning control.
- Underwriters approved with 90 day RMA guarantee.

LOWEST Price—ONLY **\$19.11**

MODEL NFRD—RADIO NOISE FILTER

If it doesn't work, send it back!

We absolutely guarantee that our Model NFRD will eliminate all line noises when properly connected to radios, television sets, short wave sets, motors, electric shavers, refrigerators, vibrators, oil burners, transmitters, and all other sources of interference. This unit will carry up to 12 amperes or 1 1/2 KW of power and may be used right at the source of interference or at the radio.

Small size only 3"x1 1/2"x7 1/2". Very low price only

Each **\$1.95**

A SCIENTIFICALLY DESIGNED PHONO SCRATCH FILTER

Resonated at approximately 4500 cycles effectively reducing objectionable needle scratch without altering the brilliancy of reproduction.

Contains a HI-Q SERIES resonated circuit. Tested by means of an audio oscillator and an oscilloscope to give 22 db attenuation with very low signal loss.

EASY TO ATTACH

Just two wires to clip on. Compact **\$1.98**

Price

THREE TUBE PHONO AMPLIFIER

An assembled unit ready for installation using tone and volume control and six feet of rubber **\$2.95**

cord

(Not including Tubes)

With Complete Set of Tubes..... **\$3.95**

PHONO OSCILLATOR

Wireless phono oscillator transmits recording for crystal pick-ups or voice from carbon mike through radio without wires. Can also be used as an intercomm by using P.M. speaker as mike.

Price (excluding tubes)..... **\$2.95**

With Complete Set of Tubes..... **\$3.95**

CRYSTAL DIODES

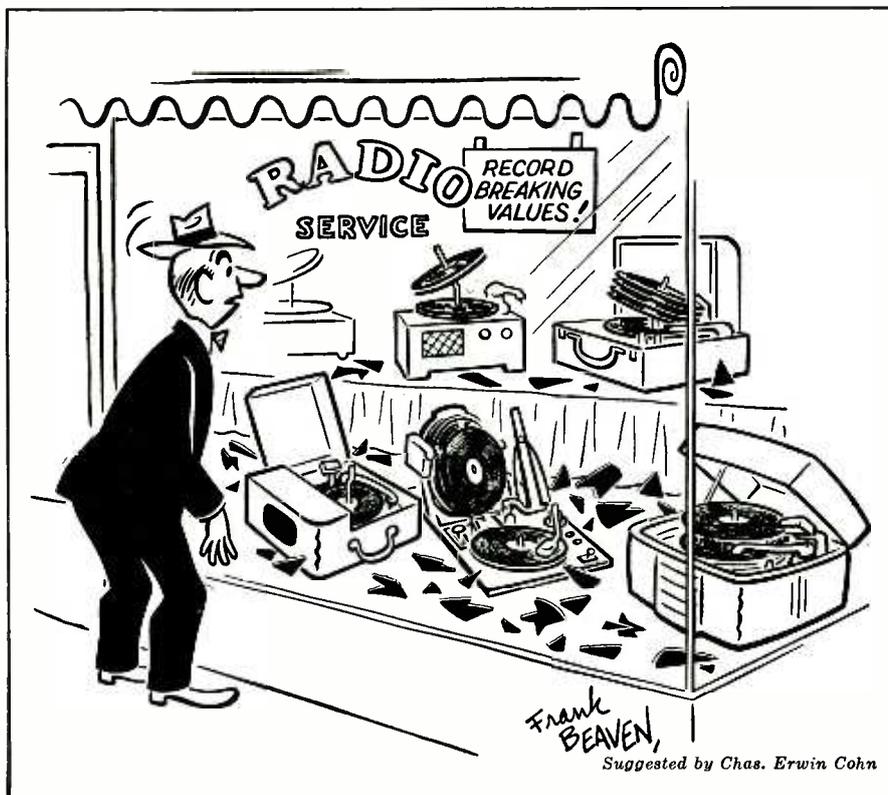
Std. makes

1N34..... .75 1N34A..... .75 1N23B..... 2.25

Satisfaction guaranteed on all merchandise
All prices subject to change without notice.

RADIO DEALERS SUPPLY CO.

154 Greenwich St. New York 6, N. Y.



ADVERTISING INDEX

TAB That's A Buy!

866A KIT and XFORMER
2 Tubes, Sects, xfmr, 115v, 60vce Impt., output 2.5 W/10 KHz. \$5.98

DIODE PROBE TUBE!
Unexcelled for NO-LOSS UHF Testing. Ultra-sensitive. Sub-miniature. Envelope. App. 1/4"x3/8". Element & Probe at Tip. Low Pwr. Htr. BIASING NEW W/Data. VB92. 25¢. 5 for \$1.00

FULL-WAVE BRIDGE RECTIFIERS

18 VAC Input	14 VDC Output
2 Amps . . . \$ 2.40	12 Amps . . . \$ 7.50
4 Amps . . . \$ 2.85	24 Amps . . . \$14.00
8 Amps . . . \$ 3.65	
36 VAC Input	28 VDC Output
2 Amps . . . \$ 3.75	8 Amps . . . \$ 9.95
4 Amps . . . \$ 7.00	12 Amps . . . \$14.00

"WILLIAMSON" 10W HI-FI KIT
10 to 20000 cycles with Ease! Internationally Famous; For HiFi enthusiasts. Incl. pwr supply, RCA Chassis. Less Pre-Amp & outpt xfmr. Preselected parts. Balanced resistors pwr. supply & 5 tubes. . . . \$29.95
Wilson Preamp Kit & Tone boost Amplifier chassis parts, pwr supply & 5 tubes. . . . \$34.95

SUPER-Wide-Range HI-FI TRIODE 10W KIT
10 to 20000 cycles. Max. Harmonic Distortion 13 1/2% at full output & only 1/2% at 5W output. Includes Bass & Treble tube boost & Tone ckt & Preamp 4 G.E. pickup & 2 tubes (7) tubes. Parts, RCA chassis & info., less outpt xformer \$29.95 (UFC HiFi Outpt. Xfmr for P.P. 2A3, 6B4, 6A5 & 6L6. Csl Cap 30 W. Sec. 16, to 250 ohms. . . . \$ 9.98
G.E. Helic Cartridge perm needle. . . . \$ 1.98
GE Dual Reluc Cartridge RFX 050 . . . \$ 7.29
G.E. Helic Cartridge RFX 142. . . . \$ 1.98
GE S1201 Hi-Fi Hvy Duty 12" PM Spkr. . . . \$18.98
Sensational 10" HiFi Spkr Ideal 10 Watt Home Size. Concentric. Separate Driver Woofer & Horn. Driver Tweeter-30 to 16000 cps Range. . . . \$18.98
Electro Voice EV16H dual twilt Cart. . . . \$ 3.98
Extra dual needle for Tilt Cart. . . . \$ 1.20
"LP" Anti-Static Dual Good 100 plays. . . . \$.69

Sell Your SURPLUS TUBES & Gear
"TAB"—Send List & Best Prices

APS13/RT34 30mc If Less Tubes As Is . . . \$7.98
RADIO COMP RCVR Lest. Tubes 5.98
Solsyns GEJ1G1 UFIXM no returns, 2 for . . . 4.9
Tuning MTR GE2 1/2" DC 5ma. Spl. . . . 1.29
ANT-42/ARB-42H 12" 1000 Hz. 1.00
RSTR KIT 100 assd 1 1/2" W to 2megs 100 for . . . 3.98
CIRCULAR SLIDING RULE Plastic Rd equiv 12" rule .98
Sharpening Stone Carborund Co. \$2.25
PL259 Coax Plug s.55 50239 Coax Jack55

SNOOPERSCOPE
Image-Converter Tube Hi Sensitivity simplified design 2" dia. Williams screen. Resolution up to 350 lines/inch. Complete. data tube. Ed. \$4.98. 2 for \$1.00
RADIOACTIVE MATERIALS 1 1/2" 911: 3 for 1.25
DIAG CUTTERS 6 1/2" Hvy Duty Eng. Steel. 1.69
1N34 tubes @ \$.69; 1N34A @ \$.89; 1N35 @ 1.95
CIRCULAR SLIDING RULE Plastic Rd equiv 2 1/2" Radius 98c
6J6 @ \$1 or 12 for \$10. 6X4 @ \$49 or 12 for 5.00

KITS

Silver & Mica Cndrs	30 for \$2.50
Controls, 50 ohm to 2 Megs	10 for 2.98
Resistors, 1/2 & W, to 2 Megs	100 for 5.98
Vitreous WW Resistors	50 for 1.98
Sockets, Asstd, 8, 7, 5, 4P	25 for 2.49
Rotary switches, Asstd	6 for 1.75
G&P Tube Caps, Asstd	50 for 1.00
Coil Forms, Th'd Sim HF	50 for 1.00
Iron Core Slub & Screw	50 for 1.00
Knobs, Asstd, w/1000 Hz. Ticks	50 for .98
Spaghetti Sleeving, Asstd.	75 ft for 1.00
Ceramic Cndrs, Asstd.	12 for 1.00
Fuses, Asstd, 1/4, 1/2, 5/8, 1, 2, 5, 10, 20, 30	10 for 1.00
Grommets, Rubber Asstd.	50 for 1.00
Resistors, 2 W Asstd.	25 for 3.98

BUILD A BANTAM 1-WATT XMITTER
With This Bargain Foundation Unit Free Instructions. Takes 2 Pwr In. RT 243 Xtals & Coil—w/140 Mmf Cndr & Xtal Socket. Xtal & Coil. 2 for \$0.49
Complete. Xtal & Coil. 2 for \$1.69

MERCURY THERMO-REGULATOR
Dual Ckt. 115V & 325V. Extremely Sensitive & Accurate for Most Exactng Requirements—RESEARCH, FIRE PREVENT, FREEZE PT CONTROL, or MAX-MIN TEMP Control. Brand New, Individ. Boxes w/data & ckt. List over \$20. Specify . . . \$8.98, 12 for \$10.00

HEINEMANN MAGN. BRKRS | CIRCUIT BREAKERS
Amps: 0.22, 1, 2, 3, 5, 7, 12, 15, 20, 25, 30, 35, 40, 50, 70, 100, 180 each . . . \$1.69
Sq. D & Ch Toggle Sw Brks. Amps: 5, 10, 15, 20, 25, 30, each . . . \$1.98
Mixon Thral Push Button Brks. Amps: 5, 10, 15, 20, 30, each . . . \$.89

BLOWERS
Cool That Tube: 175 CFM 220 V AC. . . . \$11.98
40 CFM 28V AC DC \$5.25; 70CFM 115V AC 400 cyc. \$4.49
40 CFM BLOWER 24VDC Exceptional buy. \$6.98
250 CFM 28V AC DC \$9.95; w/Matching 115V AC Trans. . . . \$11.95

NEW THRIFT-LITE
Lifetime Photo-Flash Not a kit. Incl. Pwr pck, lite grd Lamp, Refl. 1 1/2 cord 1/1000 Sec flash every 7 sec. True daylight color. Usable all cameras oper 115VAC w/lite Type AC40 \$41.98
Complete Outfit for AC & Battery opr. Incl. AC40&BP25 portopak & all access for KodakCompur shutters. Complete . . . \$69.95
Write for Complete "THRIFT-LITE" Data Boosterpacks, Ext. lites, Units for focal plane shutters & accessories. We buy, sell & swap.

TAB "SUN-FLASH" LAMPS

"TAB" No.	Replaces	W-sec. Max.	Each
U10	GE FT110	100	\$11.79
No. 1	ANGLO 5004	100	11.98
238T	GE FT114	200	10.98
59GT	GE FT402	500	16.98
VA	VA (130)	500	16.98

R4340 FLASH TUBE—Nationally Advtd @ 57. \$36.00
35mm FILM & microfilm 20 exp. P/cart. 5 for 1.00
X-400 Air Corps Lamp 175 168K 169 AX equip 14.98

STORAGE BATTERIES
36 volt WILLARD Mini-BRAND NEW! 5 oz. Designed Portable Equip Models . . . 98c; 4 for \$3.28
2V/27AH Willard BH54 PLUS 2 Volt Vibrator 11.98
6V/40AH Willard BE149 6 Volt 40 Ah 11.98
6V/40AH Willard ER40-B 6 Volt 40 Ah 11.98
Battery Acid, (R-Exp) . . . 1 pt. 59c; 2 pts. .98
Hydrometer 1.06 1 1/4" Grad. . . . 1.98
Electrolyte Meas. Tube, 12" lg.25
Spec Grav Ind & Merc. Thermom98

DRY BATTERIES
Sig Corps—BRAND NEW—Tested, Shelf Dated—Guaranteed.
1A43 30/45 1/2 1.25
45/30 Volt NEW 1949 Batty Sim BURGESS XX30B 12x2x4 1/4"79c; 3 for \$2.00

\$5 Min. 25% Dep. F.O.B. NYC.
Prices Subject to change.
Dept. IRE, 6 Church Street
New York 6, N. Y., U. S. A.
Ch. Church & Liberty Sts.
Room 200, Phone Worth 2-7230

Adelman, Nat	126
Aerovox Corporation	50
Alliance Manufacturing Co.	65
Allied Radio Co.	102
American Electrical Heater Co.	101
American Phenolic Corp.	82
Ampco, Inc.	102
Amplifier Corporation of America	122
Anchor Radio Corp.	17
Astoria Corporation	18
Astron Corporation	118
Barry Electronics Corp.	130
Belden Manufacturing Co.	102
Bell Telephone Labs.	10
Blonder-Tongue Labs.	84
Boyce-Roche Book Co.	108
Brach Manufacturing Co.	55
Brooks Radio & Television Corp.	124, 125
Burstein Applebee Co.	112
Capitol Radio Engineering Institute	9
Certified Television Labs.	108
Chester Radio Co.	113
Cleveland Institute of Radio Electronics	127
Coin Radio & Television Corp.	104
Commercial Trades Institute	115
Communications Equipment Co.	109
Concord Radio Corp.	109
Coyne Electrical & TV Radio School	112, 116
Crest Laboratories, Inc.	122
DeForest's Training, Inc.	11
Devo Radio, Inc.	102
DuMont, Allen B. Labs.	Inside Front Cover
Electro Products Labs.	92
Electro Sales	105
Electro-Voice, Inc.	22
Electronic Instrument Co., Inc.	22
Electronics Measurements Corp.	118
Electronic Technical Institute	126
Feiler Engineering Co.	79, 128
Friedman & Company, Charles	121
G & G Radio Parts Service	123
General Electric Co.	53
General Test Equipment	118
Good, Inc., Don.	108
Gould Green	108
Harvard Corporation	130
Harvard Laboratories	104
Heath Company	93, 94, 95, 96, 97, 98, 99, 100, 102
Hudson Specialties Co.	127
Hytron Radio & Electronics Co.	59
Instructograph Company	105
International Resistance Co.	76, 77
JFD Manufacturing Co., Inc.	129
Jackson Electrical Instrument Co.	68
Kedman Company	122
Lafayette Radio	186
La Pointe-Plascomold Corp.	64
Leetone Radio Co.	131
Macromed, Inc.	109
Mallory & Co., Inc., P. R.	Inside Back Cover
McGraw-Hill Book Co.	114
Merit Corp.	114
Metropolitan Electronics & Instrument Co.	90
Midwest Radio & Tel. Corp.	81
Miles Reproducer Co., Inc.	79
Milwaukee School of Engineering	103
Miller Company, J. W.	116
Miles Electronics, Inc.	121
National Company, Inc.	104
National Plans	123
National Schools	102
Niagara Radio Supply Co.	117
Ohmite Manufacturing Co.	66
Opportunity Adlets	122
Perfection Electric Co.	79
Permotux Corporation	72
Precision Apparatus Co., Inc.	92
Prentice Hall, Inc.	115
Pres-Probe Co.	92
Progressive Electronics Co.	81
RCA Institutes, Inc.	23
RCA Victor Division (Radio Corporation of America)	Back Cover
Radiart Corporation	49, 110
Radio Apparatus Corp.	110
Radio City Products Company, Inc.	127
Radio Corporation of America	129
Radio Dealers Supply Co.	129
Radio Receptor Co., Inc.	84

RADIO SCHOOL DIRECTORY

Page 128

Baltimore Tech. Inst.	
Candler System Company	
Commercial Radio Inst.	
Electronics Institute, Inc.	
Federal Electronics Inst.	
Hollywood Technical Inst.	
Indiana Technical College	
Lincoln School of Radio & TV, Inc.	
Martin School, Don	
RCA Institutes, Inc.	
Streamlined Self-Study Course	
Tri-State College	
Valparaiso Technical Inst.	
YMCA Trade & Technical Schools	

Rauland Corporation	63
Ray Company	86
Raytheon Mfg. Co.	78
Regency Div. (I.D.E.A., Inc.)	79
Rinehart Books, Inc. America	91
Rose Company	120
Sams & Co., Inc., Howard W.	16, 88, 106
Sanett, Bol.	86
Simpson Electric Co.	72
Soundtronics Labs., Inc.	123
Sprague Corporation	45
Sprayberry Academy of Radio	9
Stan-Burn Radio & Electronics Corp.	114
Stevens Electronics Corp.	118
Superior Instruments Co.	112
Supreme Incorporated	74
Supreme Publications	132
Sutton's Wholesale Electronics, Bill	126
Sylvania Electric Products, Inc.	51
Tad	130
Tarjian Inc., Sarkes	137
Tech-Master Products Co.	110
Technifax	107
Tel-A-Ray Enterprises, Inc.	115
Television Communications Institute	103
Tec, Inc.	107
Transvision, Inc.	83
Triplett Electrical Instrument Co.	103
Tung-Sol Electric Co.	108
Turner Company	52
United Catalog Publishers, Inc.	113
Ward Products Corp.	113
Weller Electric Corp.	58
Wells & Winegard	120
Wells Sales	132
West Region Electronics	92
Wholesale Radio Parts Co., Inc.	118
Wincharger Corp.	111

THE WORLD'S SMALLEST, YET

Most Powerful Radio Loop Antenna

GRAYBURNE

Ferri-Loopstick

©Grayburne

Length: 2". Diameter: 1/2"

HIGHEST EFFICIENCY: Has a Q of 240-275; ordinary loops have only 110. (Measurements made with Boonton Q-Meter.)

OMNI-DIRECTIONAL: Equally sensitive and efficient at every angle. Needs no orientation.

GREATER RECEIVING RANGE: Boosts sensitivity and signal-to-noise ratio—of special importance to portables.

INCREASED BUSINESS: Ferri-Loopstick improves set performance so amazingly, your customers will call you a "miracle man." Every AM set-owner is a HOT PROSPECT!

LOW COST: Consumer List Price only 75c. Liberal discounts.

SERVICEMEN: For name of your nearest Ferri-Loopstick distributor, write to us NOW!

GRAYBURNE CORPORATION
103 LAFAYETTE ST. NEW YORK 13, N.Y.

CARTER DYNAMOTORS
BRAND NEW—ORIGINAL MFR'S SEALED CARTONS . . .

6V. INP.—400 V.D.C. out @ 375 Ma. List \$71.40
Only \$28.00

6V. INP.—590 V.D.C. out @ 250 Ma. List \$73.50
Only \$33.00

● ULTRA-COMPACT ● FINEST MADE

Quality, tested tubes—new & guaranteed in stock now; many others not listed (XMTG, etc.)—Write for low, low bids on your requirements—

1N21	\$.80	6AU6	\$.55	12AV6	\$.55
1N21-B	3.00	6AV6	50	12AU7	.80
1N23	95	6BA6	65	12AT7	.95
1N23-A	2.75	6BD6	50	12BA6	.65
1N23-B	4.00	6BE6	55	12BE6	.65
1N34	70	6BQ6GT	85	12BH7	.75
1B3GT	.85	6CD6G	1.50	25L6GT	.50
1R5	65	6SH7	60	35C5	.65
1U4	65	6J56T	50	35Z5GT	.50
3A5	65	6J6	90	50C5	.65
3D6	50	6R8	75	50L6GT	.60
3S4	90	6SD7GT	75	80	.50
3Q4	55	6SN7GT	65	4-125-A	27.50
5U4G	60	6T8	80	304TH	11.50
5V4G	1.05	6U4GT	75	304TL	11.50
5Y3GT	40	6V6GT	55	813	8.95
6AB4	75	6W4GT	50	9555	.45
6AG5	65	6X4	55	9004	.40
6AL5	40	6Y6G	75	9005	1.35
6AS5	75	6X5GT	45	0A2	1.10
				0B2	1.20

NEW SELENIUM RECTIFIERS

Current (CON'T)	18/14 VOLTS	36/28 VOLTS	54/40 VOLTS	110/100 VOLTS
1 AMP.	\$ 2.40	3.75	\$ 6.95	\$10.50
2 AMP.	3.85	7.00	9.00	
4 AMP.	5.85	9.00		
6 AMP.	5.90	12.50		
10 AMP.	8.50	14.00		
12 AMP.	14.00	27.00		

"We can manufacture other rectifiers to Specs." We have an interesting inventory of equipment.

BARRY ELECTRONICS CORP.
136 Liberty Street New York 6, N. Y.
RE ctor 2-2563

Terms: 25% with order, balance C.O.D.—Add few cents for postage—ALL MERCHANDISE GUARANTEED F.O.B., N.Y.C.

In Volume Controls, too... fast, sure fit is important

In a survey of hundreds of servicemen, the importance of fast, sure installation was emphasized time after time in connection with volume controls. If you want a control that lets you do the job fast . . . and do it right . . .



Make Sure! Make it Mallory!

When you use the Mallory Midgetrol*, you get a combination of features that can't be matched.

First, you get a *permanently fixed, tubular brass shaft* that can be adapted for split-knurl or flattened type knobs in a few seconds by inserting one of the steel shaft ends supplied in every package. This means utmost convenience without sacrificing the stability of permanent, two-point shaft suspension.

Second, you get the convenience of AC switch design that permits secure attachment, *without*

removing the control housing. Positive indexing assures proper position.

Third, you get exceptionally accurate resistance values and taper curves.

Fourth, you can be sure of years of quiet, satisfactory service life through extremes of humidity and temperature.

Make it Mallory and make sure! Ask your distributor to show you the time-proved Mallory Midgetrol with the new features that make installation faster and simpler than ever.



Single Section Control Illustrated

DualconcentricMalloryMidgetrols can be made up easily by combining factory-assembled front and rear sections of desired resistance values. Ask your Mallory Distributor for details!

*Depend on your Mallory Distributor
for precision quality at competitive prices*

P. R. MALLORY & CO. INC.
MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
• RECTIFIERS • VIBRAPACK* POWER SUPPLIES • FILTERS

*Reg. U.S. Pat. Off.

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

*Reg. U. S. Pat. Off.

THE QUALITY OF RCA TUBES IS UNQUESTIONED



Extra Performance

as a matter of course...with RCA tubes

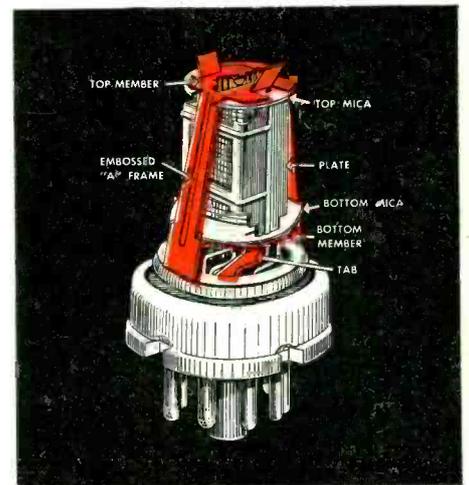
The RCA-developed "A" frame construction—used in 6 of the metal-type r-f amplifiers—is one of the many improvements that contribute to the *extra* performance of RCA tubes.

The "A" frame—shown in red—consists of a top member, two vertical members, and a bottom cross member. The ribbed uprights are welded to the cross member... the feet of the uprights are welded to the grounded metal header. In effect a truss, this rigid "A" frame acts as the supporting member for the tube elements. Its increased resistance to vibration reduces the possibility of electrode displacement due to wear on the holes in the mica spacers... and thereby

plays an important role in reducing microphonics and maintaining uniform tube characteristics.

In addition to imparting rigidity to the tube elements, the top and bottom members of the "A" frame serve as shields. The two ears on the top member add to its effectiveness in reducing grid-to-plate capacitance... the tab on the lower member—which extends down to the stem—provides additional shielding between grid and plate leads.

The *extra* performance built into RCA tubes accounts for their high quality, long life, and dependability. They cost no more. Why not use them for your daily tube requirements?



Keep informed—keep in touch with your RCA Tube Distributor



RADIO CORPORATION of AMERICA
ELECTRON TUBES
HARRISON, N. J.