RADIO & TELEVISION NEWS

AUGUST
1953
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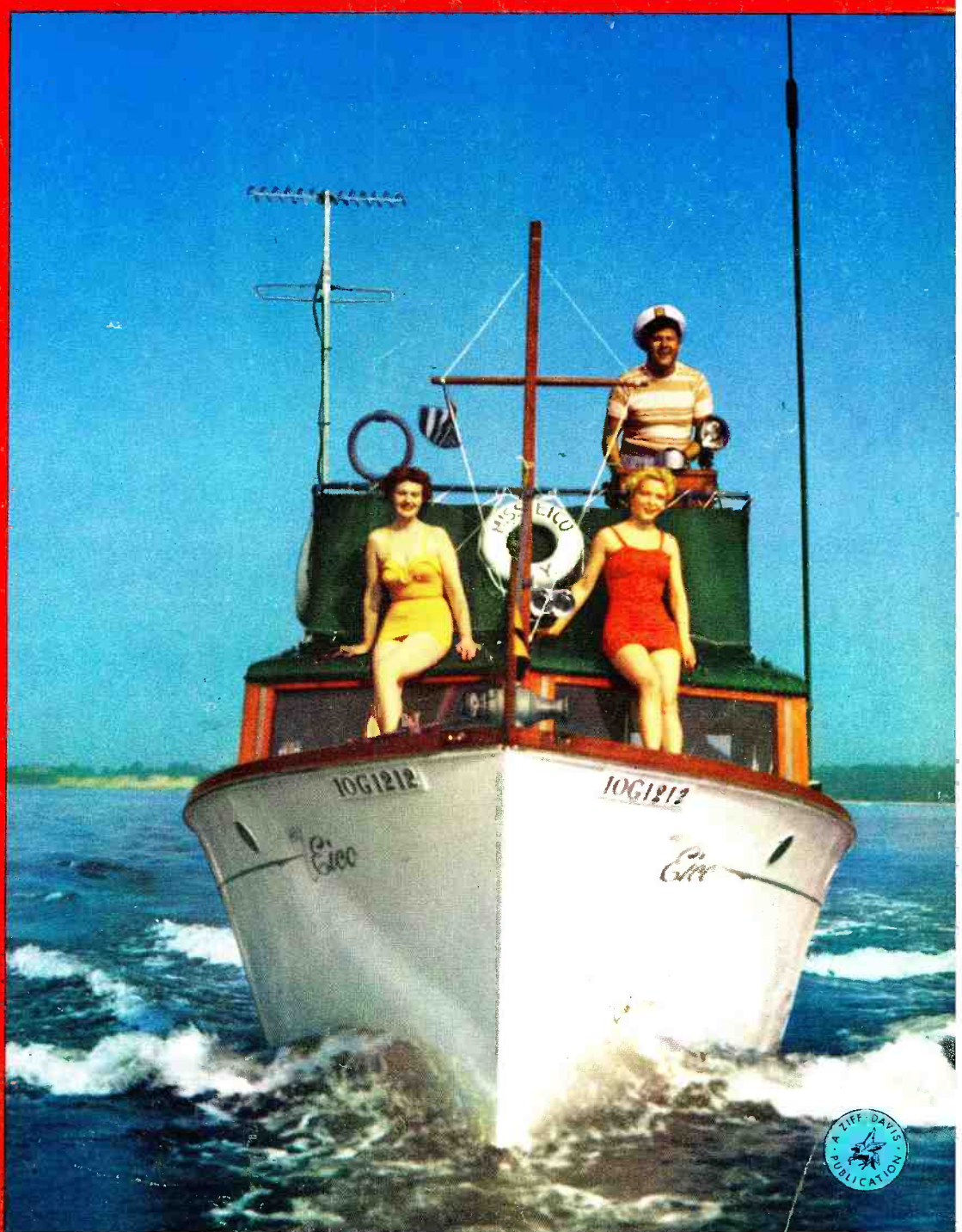
In Canada 40¢

IN THIS ISSUE



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An RCA Tube starts working for you from the instant the customer first sees the familiar red, black, and white carton. You have her confidence from the start, because she knows and respects the RCA trademark.

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Helping you to safeguard your reputation is a vital, everyday service of RCA Tubes. And that protection is yours at no extra cost.

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Here's *your* key to better business... RCA's dynamic Dealer Identification Program. Ask your **RCA Tube Distributor** for your copy of the colorful, 16-page booklet "A Magic Pass-Key to Customer Confidence." It tells you how you can become a Registered Dealer . . . and get *extra* sales benefits.

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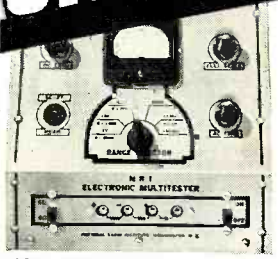
YOU BUILD THIS TRANSMITTER

with parts I send. With this Transmitter you practice how to put a station "on the air." You perform procedures demanded of Broadcast Station Operators, conduct many experiments, make many practical tests.

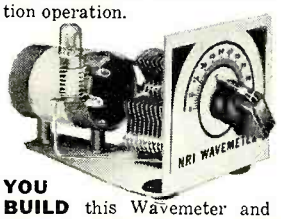
LEARN COMMUNICATIONS by PRACTICING at Home in Spare Time

YOU BUILD this Transmitter Power Supply used in the basic experiments in RF and AF amplifiers, frequency multipliers, buffers, etc.



YOU MEASURE current, voltage (AC, DC and RF), resistance and impedance in circuits with Electronic Multitester you build. Shows how basic transmitter circuits behave; needed to maintain station operation.

YOU PRACTICE setting up code, amplitude and frequency modulation circuits (put voice, music, etc., on "carrier signals" you produce). You learn how to get best performance.



YOU BUILD this Wavemeter and use it to determine frequency of operation, make other tests on transmitter currents.

Get Practical Experience on Circuits Common to Radio & TV

Ever think HOW FAST Radio-Television Communications is changing, developing, growing? Have you considered what this amazing progress can mean to you?

Even without Television the industry is bigger than ever before. 105 million home and auto radios, 2900 Radio Broadcasting Stations, 108 TV Stations with 1800 more now authorized. Expanding use of Aviation and Police Radio, Micro-Wave Relay, Two-Way Radio for buses, taxis, etc. makes opportunities for Communications Technicians and FCC Licensed Operators. New jobs, more jobs for beginners! Better jobs, better pay for experienced men!

Television Is Today's Good Job Maker

In 1952, over 18,000,000 homes had TV sets. More are being sold every day. The "Freeze" on building new TV stations has been lifted. The time to act is NOW! Start learning Radio-TV communications. America's fast growing industry offers good pay, a bright future, security. If you are a beginner, my course can help you get FCC License, prepare for the job you want. If you've had some training in Radio or Radar, or as a Licensed Operator, my course modernizes, increases the value of your knowledge.

J. E. SMITH, President
National Radio Institute
Washington, D. C.

For 38 years, the leader in training men for Radio-Television.

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Mail coupon now for facts about my practical course in Radio-Television Communications. Let me send you my FREE book. See the nine big Kits of Parts I send that "bring to life" theory you learn. You get practical experience by working on circuits common to both Radio and Television; also lessons on TV principles. Read about the Transmitter you build and operate, about the Electronic Multitester you get. All equipment is yours to keep.

My graduates are filling jobs, making good money in both Radio and Television. Remember, the way to a successful career in Television is through experience in Radio.

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Send today! See what my Communications course is like. Find out how I get you ready for a brighter future, better earnings, more security in Radio-Television. Send coupon now in envelope or paste on postal. NO OBLIGATION, NO SALESMAN WILL CALL! My book, sent to you FREE, tells the full story. J. E. SMITH, President, Dept. 3HE, National Radio Institute, Washington 9, D. C. Our 39th year.

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If you prefer a good-pay job in Radio-Television Servicing . . . or your own money-making Radio-Television Sales and Service Shop, I'll train you at home. My famous Servicing Course also includes many Kits of Radio Parts. You use them to get PRACTICAL EXPERIENCE with circuits common to Radio and Television. I also show you how to make $5, $10 a week or more EXTRA MONEY fixing neighbors' Radios while training. Full information in my 64-page book. . . . Mail coupon.

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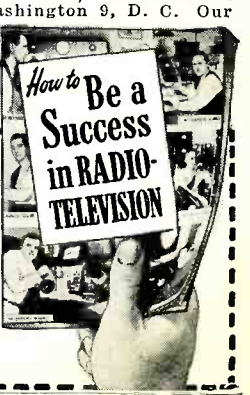

TRAINED THESE MEN

"My position with WNBT is video control engineer on the RCA color project. I owe a lot of my success to your textbooks."—Warren Deem, Malverne, N. Y.

"I am a technician at WTOP in Washington and I like it very much. Most of my radio knowledge was from N.R.I."—John Britto, Hyattsville, Md.

"A former employer recommended N.R.I. training. Now employed as transmitter operator at WKBO."—Albert Herr, New Cumberland, Pa.

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Radio News Trademark Reg. U. S. Pat. Office • Television News Trademark Reg. U. S. Pat. Office.

COVER PHOTO: The "Miss Eico", a 31-ft. motor launch carrying an extensive array of radio gear. The boat offers remote control of its radiotelephone system on the flying bridge. (Ektachrome by Jay Seymour)

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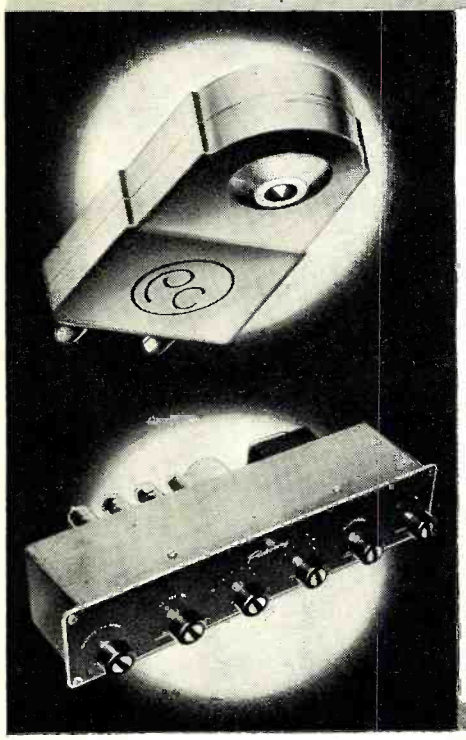
PICKERING

PROFESSIONAL AUDIO EQUIPMENT

BALANCED COMPONENTS / MAXIMIZE PLAYBACK PERFORMANCE



PICKERING CARTRIDGES . . .

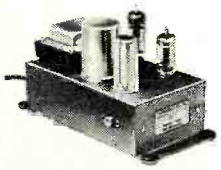
are the choice of audio engineers throughout the world. They are universally acclaimed because of their high output, wide range performance and low distortion. They are used wherever a fine cartridge is required in radio stations, recording studios and for purposes of quality control by leading record manufacturers.

MODEL 410 AUDIO INPUT SYSTEM . . .

is designed to provide a complete audio control center. Model 410 may be used in any high quality playback system. Three input channels are provided—one for magnetic cartridges and 2 "flat" channels for other audio circuits. A 3-position equalizer network is built into the magnetic cartridge channel and provides accurate equalization for LP, AES and 78 rpm recording characteristics. Separate bass and treble controls are also provided. These are of the step-type and permit bass and treble adjustments in 2 db increments. The tone control circuits are intended to compensate for record characteristics and for listener-environment acoustical conditions. *They are not intended to compensate for amplifier and/or loudspeaker deficiencies.* Model 410 is intended for use with the highest quality professional type playback equipment. The output of the Model 410 is fed from a cathode-follower circuit and will work into any high quality audio or line amplifier having a high impedance input. It may also be used with a transformer for the purpose of feeding a 500 ohm line. Because of its flexibility, low noise and low distortion level, it is ideally suited for bridging and monitoring purposes and for critical listening applications.

THE MODEL 190 ARM . . .

is designed primarily for use with microgroove records. Its design has been recognized by leading audio engineers as that which incorporates all of the desirable tracking characteristics. Analysis has shown that for maximum performance with LP records the vertical mass of the moving arm element must be held to a minimum and further, that the arm must be counterbalanced about the vertical axis. This permits minimum stylus or tracking force and provides maximum record life. The Model 190 Arm embodies these all important features necessary for proper microgroove record playback.



MODEL 230H EQUALIZER-PREAMPLIFIER . .

is unique in its accuracy of equalization and frequency response. The intermodulation distortion is .2 per cent at normal output level. It is intended for use with high quality amplifiers having gain and tone controls. When used with the Pickering Model 132E Record Compensator the 230H is ideal for radio station and recording studio use and for applications requiring accurate low noise and distortion free playback.

MODEL 132E RECORD COMPENSATOR . . .

is designed to be used in conjunction with a magnetic cartridge preamplifier such as the Pickering 230H or any preamplifier which provides 6 db per octave bass boost. Six playback positions are incorporated:

1—European 78 rpm Records
2—Victor 45 rpm and Decca 78 rpm Records
3—No high frequency roll-off, 500 cycle turnover
4—All Capitol Records, new Victor 33⅓, Audio Engineering Society Curve
5—Columbia, London and most LP Records
6—To remove the hiss from old noisy records

Precision elements are used in its construction to give accurate compensation. The 132E is inherently a low distortion R-C device.

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Check the specs...

Check performance...

Then, They'll Choose Hallicrafters

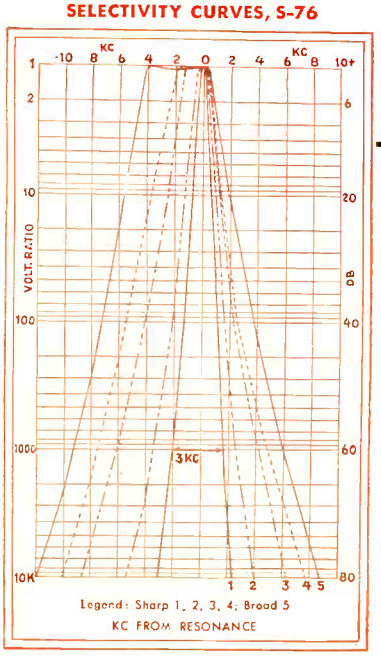
Model S-76

Double conversion receiver. Broadcast Band 538-1580 kc plus three short-wave bands covering 1720 kc-34 Mc.

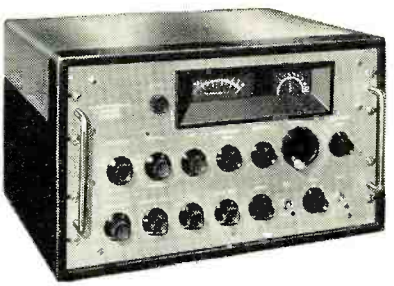
Calibrated electrical bandspread for easy tuning. Double superhet with 50 kc second i-f and giant 4-inch "S" meter. Five position selectivity, one r-f, two conversion, two i-f stages, temperature compensated. 3.2 or 500 ohm outputs.

Satin black steel cabinet. 18½" x 8⅞" x 9½" deep. Nine tubes, voltage regulator, and rectifier. For 105/125 V. 50/60 cycle AC. Use R-46 speaker. . . **$179.50**

SELECTIVITY CURVES, S-76



Do you know any better way, any other way, to judge SW equipment than to check the specifications and the performance? Frankly that's the only valid way we can think of to make sure you get your money's worth. Check these specs. Take a look at the selectivity curve for the S-76. It is typical of the outstanding value Hallicrafters offers in every price class.



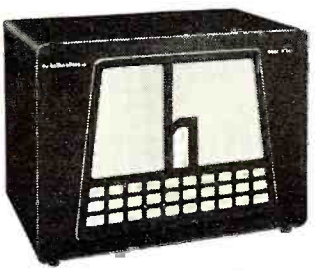
Model HT-20. T.V.I. suppressed 100 watt AM-CW transmitter with all spurious outputs above 40 Mc at least 90 db. below full rated output.

All stages metered; single meter with eight position meter switch; output tuning indication. Frequency range of 1.7 Mc to 31 Mc continuous on front panel control. Seven tubes plus five rectifiers. For 105/125 V. 50/60 cycle **$449.50**

Model SX-71. Covers Broadcast Band 535-1650 kc plus four short-wave bands covering 1650 kc-34 Mc. and 46-56 Mc.

Narrow Band FM one r-f, two conversion, and three i-f stages. Temperature compensated, voltage regulated. Three watt output (terminals for 500 and 3.2 ohms).

Satin black steel cabinet. 18½" x 8⅞" x 12" deep. 11 tubes plus regulator, rectifier. For 105/125 V. 50/60 cycle AC. Use R-46 speaker. . **$224.50**



Model R-46. Matching 10" PM speaker for use with Hallicrafters communications receivers SX-71, SX-76, SX-73 or SX-62. 80 to 5000 cycle range. Matching transformer with 500-ohm input. Speaker voice coil impedance, 3.2 ohms.

Satin black steel cabinet matches all Hallicrafters receivers. Cloth covered metal grille. 15" x 10⅞" x 10⅞" deep. Ship. wt. 17 lbs. . **$19.95**

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For the RECORD

BY THE EDITOR

ENGINEERING AND THE FUTURE

THE engineering profession, particularly in the electronics field, is riding at an all-time high. According to an analysis in a recent issue of the magazine *"U. S. News & World Report,"* college graduates in general and engineering graduates in particular were never in greater demand. Students and young people would do well to analyze their aptitudes and talents in the light of this demand and seriously consider entering the field.

A year ago, the Survey Committee of Engineers Joint Council indicated a shortage of about 80,000 engineers. This shortage is gradually being reduced but there is still a demand for about 42,000 engineers a year, and the total number of engineering graduates this year will probably not exceed 21,000. A similar situation holds true for scientists.

The present salary scales for graduate engineers would make the old-timers who graduated during the depression really drool. The starting scale runs roughly $350 a month, with extremes of as much as $500 being reported. This is for men with very little or no experience, just getting out of school.

These factors make engineering a very attractive and promising field. The long-term trend still favors the engineer and with the rapid developments in electronics and other fields, this trend may even be accelerated.

There are many other factors that make the engineering field attractive. Here is a chance to get in on the ground floor of some of the most startling developments of modern times. Here is a chance to satisfy one's inherent thirst for knowledge regarding the "why's" and "wherefore's" of scientific knowledge. Here is a chance to do something really constructive—increase the standard of living, develop something "new" that gives a feeling of accomplishment.

One of the questions asked of our readers in a recent survey dealt with the "special interests," including those readers attending classes in college and in trade school. We found as a result that a total of 61,673 were presently studying subjects in electronics. Nearly 24,000 of these readers were going to a trade school and another 20,000 were attending college. The survey showed that more than 24,000 were currently studying engineering and nearly 17,000 were studying communications. It has been most gratifying to the editors that ever since World War II there has been an ever-increasing number of high school graduates entering the field of engineering as a profession.

In addition to these men, we find that over 25,000 of our readers are studying servicing. While the total of the above is but a drop in the bucket compared to the requirements of the electronics industry, it does show that these students are greatly augmenting the entire engineering profession in our electronic industry.

Our high schools are doing an excellent job of training students to enter engineering colleges but still more must be done to cut down on the mortality rate. The analysis mentioned above reveals that many students are deficient in math. Others have not been taught to work and to think. These factors are of supreme importance to the engineer, and must be recognized early by engineering students. Probably the major reason for this is the shortage of good high school teachers who are able to inspire their students to think and work.

Another factor which is rapidly entering into the engineering field is that of executive ability and training. More and more of the larger companies are drawing from their engineering staffs to fill executive positions. This means even greater opportunities for engineers in the years to come. It also means greater responsibilities, more intensive training, and the development of aptitudes not ordinarily required in engineering as such. These aptitudes come under the broad heading of executive ability. It used to be the common impression that executive ability, or lack of it, was born in a person. However, it has been proved time and again that this ability can be developed to a remarkable degree.

What does all this add up to? It means that more and more of our students in high school and college should seriously consider entering one of the various engineering fields. It means further that these students must learn to discipline themselves to work and to think. They must learn how to get along with other people—how to organize and direct various activities—how to get the utmost in cooperation from associates—how to handle problems in human relations. More attention to the humanities can perhaps assist in this direction.

This might appear to be a difficult road to travel, but the rewards more than justify the difficulties. The feeling of satisfaction resulting from a job well done is worth many a tedious hour of study and preparation...O. R.

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84-568. *Only* **$38.71**

Model 650: Single Switch

Single selector switch for all ranges. Complete frequency coverage from 15 cps to over 110 mc with one probe. Ranges: DC v., 0-1-5-10-50-100-500-1000; AC-RF v., 0-1-5-10-50-100-500; peak-to-peak volts, 0-2.8-14-28-140-280; ohms, 0-1000-10,000-100,000-1 meg.-100 meg.-1000 meg. Large 5½" meter with 4⅜" scale. 3¾ x 5½ x 7½"; complete with power cord, DC v. and ohms lead, AC-RF volt tube probe, battery Shpg. wt., 6 lbs.

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84-564. HV Probe. *Only* **$14.21**

Model 3441 TV-FM Oscilloscope

Vertical deflection sensitivity .01 rms v/inch. Vertical response 4 mc. Horizontal, 20 cps to 150 kc; deflection sensitivity, .1 rms v/inch. Vertical input impedance, 2 megs, 20 mmf (with probe). Reads peak-to-peak volts direct on meter. 0-1000 in 8 ranges. Linear sweep: 10 cps to 60 kc/second. Phased 60 cycle horizontal sweep and return trace eliminator for use with sweep generators. Synchronizing and horizontal sweep selector combined in one simple control. Has phone jack for hearing wave-form under observation; simplifies audio circuit tracing. Uses 5" cathode-ray tube (5UP1). Fully shielded and fused. Complete with tubes, 2 coaxial cables, rubber-covered test leads, low capacity probe and instructions. Size: 15¹¹⁄₁₆" x 16 x 11½". For 105-115 volts, 50-60 cycles AC. Shpg. wt., 65 lbs.

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Model 630A: ½% Resistors

Overall accuracy: 1½% on ohms and 0-1200 DC volts; 4% on 6000 DC volts and all AC ranges. Features mirror scale to eliminate errors in reading due to parallax; uses ½% resistors. Ranges: DC and AC volts 0-3-12-60-300-1200-6000 (DC at 20,000 ohms per volt, AC at 5000 ohms per volt); DC current, 0-60 microamps, 0-1.2-12-120 milliamps, and 0-12 amps; resistance, 0-1000-10,000 ohms, and 0-1-100 megohms; db. —30 to + 70 in 6 ranges; output volts. 0-3-12-60-300-1200-6000. Single knob selects both circuit and range. 5½" meter with 4⅜" scale. 7½ x 5½ x 3⅞". With batteries and 50" test leads. Shpg. wt., 6 lbs. Here's the compactly built unit-constructed VOM—ideal for all applications requiring top accuracy. **84-574.** *Only* **$48.51**

Model 666R: 1000 ohms/volt

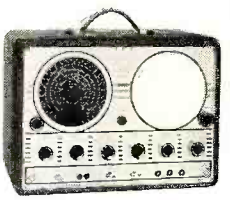
Economical pocket-size VOM with handy single selector switch. Only 2 controls—the range switch and the ohms adjust control. 1000 ohms/volt sensitivity on AC and DC volt ranges. Red Dot 3" 0-200 microammeter movement with 250 millivolt sensitivity. Ranges: DC and AC volts, 0-10-50-250-1000-5000; DC ma, 0-10-100; DC amps. 0-1; ohms, 0-3000-300,000; megs. Size: 3⅛ x 5⅞ x 2⅝". Complete with batteries, 50" test leads with banana plugs and alligator clips. Shpg. wt., 3 lbs.

84-557. *Only* **$25.97**

Model 666RL. Same as above, but in camera-type black leather case. Shpg. wt.,4 lbs.

84-538. *Only* **$31.85**

Model 3434A TV-FM Sweep Generator



High output on VHF and sufficient harmonics for UHF. Continuous tuning to 240 mc covers all TV, FM and IF ranges with no gaps. Sweep center frequency: 0-60-120 and 120-240 mc. Sweep width: 0-12 mc, continuously variable. Marker frequencies: 3.5-4.9, 19.5-29.3, 29-48.6 (fundamentals); harmonics to 240 mc. Crystal frequency: to 20 mc on fundamentals: harmonics to 216 (crystals not supplied). Modulation: 600 cycles. Output 1 to 1.5 volts. Two built-in markers: absorption and pip and crystal. Ladder type attenuator. Horizontal bar generator for vertical alignment. Large mirror scale for precise marker adjustment. 15¹¹⁄₁₆ x 11½ x 8¼". With 2 coaxial cables, ground straps, test leads and instructions. For 105-115 v., 50-60 cycles AC. 45 lbs.

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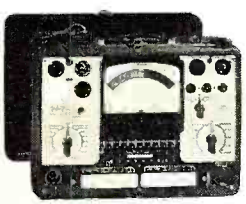

3413A Tube Tester

Tops for flexibility and simplicity. Tests all modern tubes (including 9-pin noval) pilot lamps, ballast tubes, resistors, etc. 6" Red Dot lifetime guaranteed meter gives quick, accurate BAD—?—GOOD tests. Checks emission, shorted and open elements. Built-in Speed-Roll chart. Counter-portable case. 15¹¹⁄₁₆ x 11½ x 6⅛". Shpg. wt., 28 lbs.

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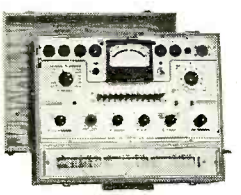
TYPE BV ADAPTOR. T2247-BV. Checks TV picture tubes with 3413A. Shpg. wt., 1 lb.

84-539. *Only* **$7.74**

3423 Tube-Tester



New Proportional Mutual Conductance type for all TV and Radio tube tests. Gives mutual conductance readings in micromhos. Six plate voltages for tube tests, including 0-10 AC variable for low voltage tubes. 4 KC used to make mutual conductance tests. Also has GOOD—?—BAD scale. Checks for shorts, leakage, gas, noise. Tests all tube types speedily and accurately. Built-in Speed-Roll chart. Limed-oak case, 14¾x18¾x6½". Shpg. wt., 21 lbs. With accessories and instructions. For extremely accurate and completely dependable testing of all tube types—this is the instrument to own.

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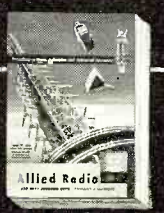


Make your selections from the world's largest stocks of tubes, parts, test instruments, audio equipment, amateur gear, industrial components—*everything* in electronics at lowest prices. Get your FREE catalog now.

ALLIED RADIO

ALLIED RADIO CORP., Dept. 1-H-3
833 W. Jackson Blvd., Chicago 7, Ill.

☐ Send FREE 1953 Allied Catalog.
☐ Please ship the following Triplett instruments .....

..... $ ..... enclosed

Name .....

Address .....

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

Quality conscious dealers want the Nepco Line

Experience is a great teacher. And experience has taught more and more TV installers and service men they can't afford to risk their reputations on inferior materials.

That's why so many demand the NEPCO LINE—television's "Master of the Elements." They've found that National Electric's complete line of TV Antennas, Mounting Accessories, and Wire provides built-in ruggedness . . . meets the test of time and weather—and *assures their reputation in both* the new and replacement markets.

NEW MASTER OF THE ELEMENTS

EXAMINE THE NEPCO LINE—

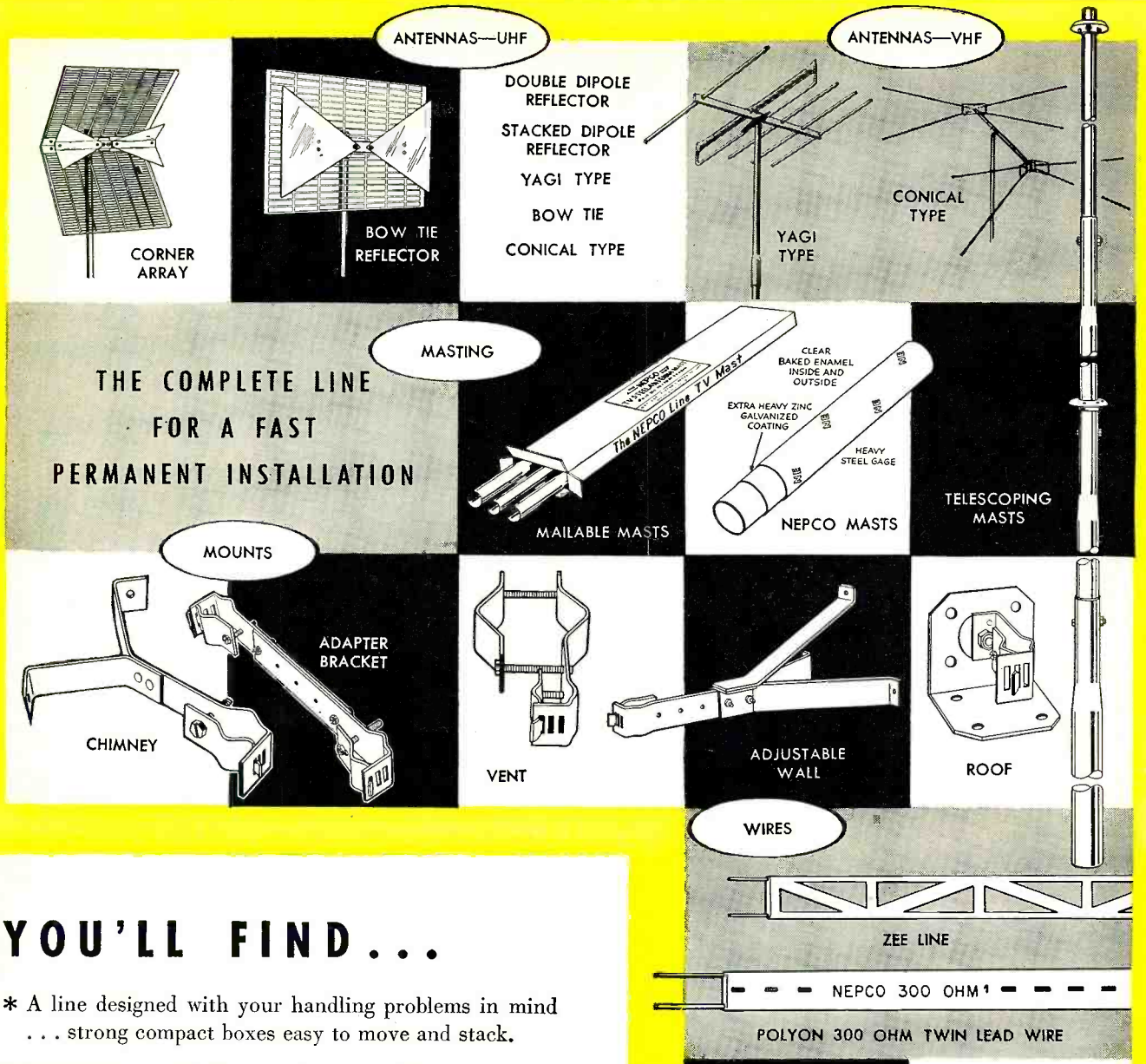
Quality materials with the strength to stay on the job . . .

* Extra heavy zinc galvanizing on all parts.
* Baked on "Shera-solution" for *extra* corrosion protection.
* Rigid heavy gauge steel used in all mounts (1¾"x⅛").
* Two 15′ *stainless steel* chimney bands, 5/16" eye bolts, and 4 heavy gauge banding clips with patented imbedding screws available with each chimney mount.
* All hardware corrosion-protected in the same complete manner as the mounts.
* Every item in the NEPCO Line is engineered, tested and field proved to assure long service on the job.

Plus features for fast, easy installation and handling

* Unique adjustable mast clamp with one bolt mounting.
* Exclusive antenna mast clamp with positive alignment in all planes.
* Patented imbedding type screw for positive electrical and mechanical locking.
* Versatile mounts that accommodate all types of installations.

National



YOU'LL FIND...

* A line designed with your handling problems in mind . . . strong compact boxes easy to move and stack.
* Large easy-to-read illustrated package labels.

In addition . . .

Brand recognition has been gained for the NEPCO Line through superior service on the job, and a national advertising and promotional program has created acceptance for this quality line.

The NEPCO Line is priced right for your customers.

Write, wire or phone for the name of your nearest representative today

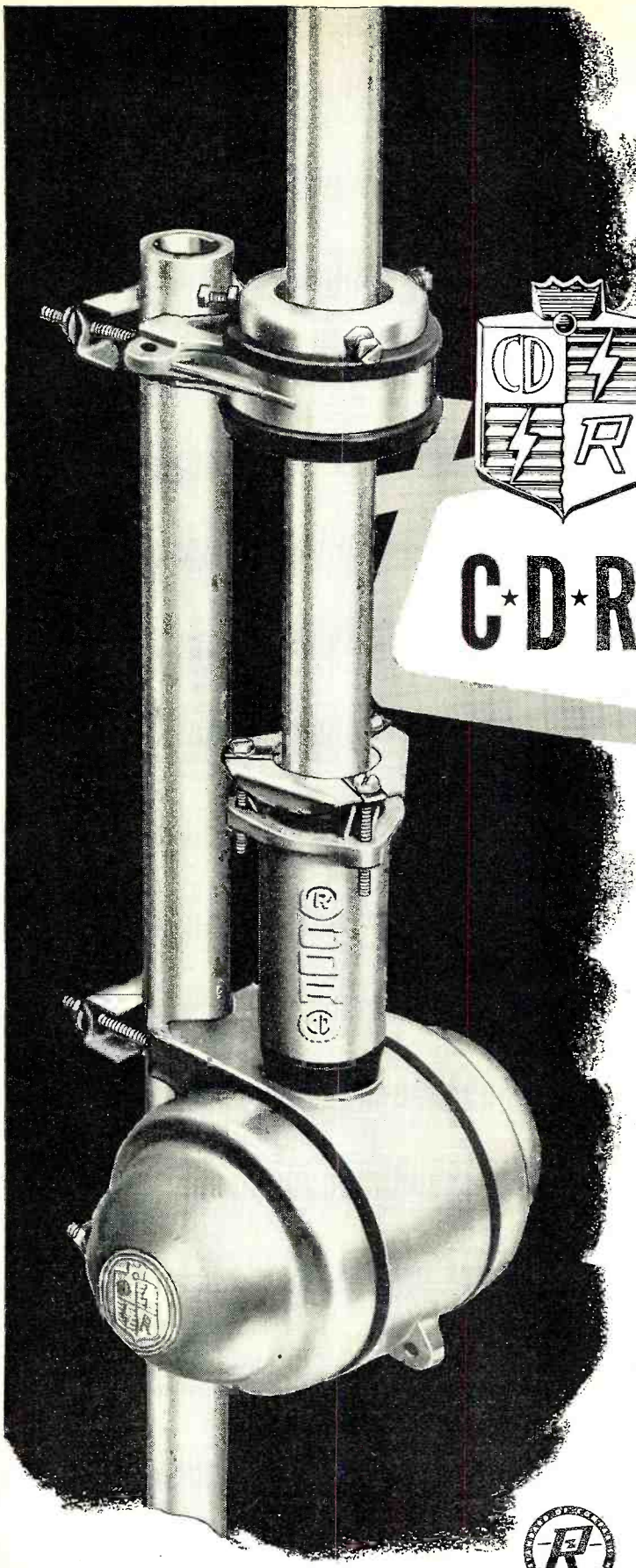
Plus

Wall Brackets
Guy Rings
Chimney Banding
Banding and Mast Clamps

THE NEPCO LINE

Electric Products

Radio & Television Department, Pittsburgh, Pa.



In a Class by Itself

the C·D·R Rotor

Speedy Installation ... the servicemen's dream come true! No loose parts to assemble ... no kits with loose washers, nuts and bolts ... quick mounting antenna mast collet plus four wire cable hookups!

Dependable ... experience has proven that once a CDR ROTOR is up ... it's THERE TO STAY! No costly call-backs! Completely weather-sealed and streamlined ... it's the outstanding value in the field!

Powerful ... sturdy in design to support and TURN ANY TV ANTENNA array ... never a worry about the CDR rotor working! Locking instantly it will not drift! Instantly reversible ... makes a complete revolution in 45 seconds!

MODEL TR-12 A special combination value consisting of complete rotor including thrust bearing ... handsome modern design plastic cabinet with meter control dial, only $47.95

MODEL TA-6 Thrust bearing accessory, separately $4.95

MODEL TR-11 Same as TR-12 without thrust bearing .. $44.95

THE RADIART CORPORATION
CLEVELAND 13, OHIO

SUBSIDIARY OF
CORNELL-DUBILIER ELECTRIC CORP.

CORNELL-DUBILIER
SOUTH PLAINFIELD, NEW JERSEY

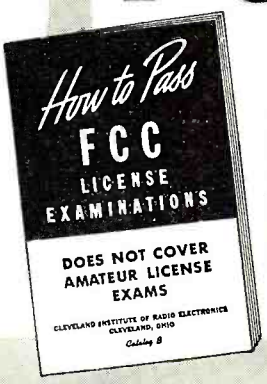
How to Pass FCC COMMERCIAL Radio Operator License Exams

Let me send you FREE the entire story

Just fill out the coupon and mail it. I will send you, free of charge, a copy of "How to Pass FCC License Exams," plus a sample FCC-type Exam, and the amazing new booklet, "Money-Making FCC License Information."

EDW. H. GUILFORD
Vice President

I can train you to pass your FCC License Exams in a minimum of time if you've had any practical radio experience — amateur, Army, Navy, radio servicing, or other. My time-proved plan can help put you, too, on the road to success.



FREE

Tells where to apply and take FCC examinations, location of examining office, scope of knowledge required, approved way to prepare for FCC examinations, positive method of checking your knowledge before taking the examination.

GET YOUR FCC TICKET IN A MINIMUM OF TIME

Get this Amazing Booklet FREE

TELLS HOW

HERE IS YOUR GUARANTEE

If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training without additional cost of any kind, until you successfully obtain your Commercial license, provided you first sit for this examination within 90 days after completing our course.

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

Letter from nationally-known Airlines, "We would also appreciate if you would place the following additional advertisement in your bulletin—Wanted—Superintendent of Communications . . . Salary $666.66 per month."

Letter from nationally-known airplane manufacturer, "We need men with electronic training or experience in radar maintenance to perform operational check-out of radar and other electronics systems . . . starting salary . . . amounting to $329.33 per month."

These are just a few examples of the job offers that come to our office periodically. 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 2210½ Wilshire St., Bakersfield, Calif.	2nd Phone	16
Clifford E. Vogt Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch 38 Beucler Pl., 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
CARL E. SMITH, E. E., Consulting Engineer, President
Desk RN-55 — 4900 Euclid Bldg., Cleveland 3, Ohio

TELLS HOW **TV ENGINEERING INCLUDED IN OUR TRAINING & COACHING**

Our Amazingly Effective
JOB-FINDING SERVICE
Helps CIRE Students Get Better Jobs
Here are a few recent examples of Job-Finding results

GETS FIVE JOB-OFFERS FROM BROADCAST STATIONS
"Your 'Chief Engineer's Bulletin' is a grand way of obtaining employment for your graduates who have obtained their 1st class license. Since my name has been on the list I have received calls or letters from five stations in the southern states, and am now employed as Transmitting Engineer at WMMT."
Elmer Powell, Box 274, Sparta, Tenn.

GETS CIVIL SERVICE JOB
"I have obtained a position at Wright-Patterson Air Force Base, Dayton, Ohio, as Junior Electronic Equipment Repairman. The Employment Application you prepared for me had a lot to do with my landing this desirable position."
Charles E. Loomis, 4516 Genessee Ave., Dayton 6, Ohio.

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

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

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

Get All 3 FREE

MAIL COUPON NOW

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-55
4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

B

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 amazing new booklet, "Money-Making FCC License Information."

☐ Tell me how I can get a TV Engineering Course without additional charge.

NAME .....

ADDRESS .....

CITY..... ZONE..... STATE.....

Paste on 2-cent post card or send air mail

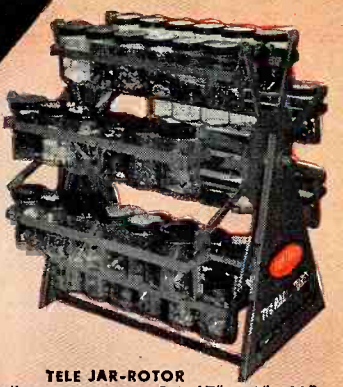
To help you boost your sales and make more money

RAYTHEON

makes these

SALES AND SHOP AIDS

available to you



TELE JAR-ROTOR
A perfect small parts storage unit. Only 17" x 15" x 13". Has 48 transparent plastic jars.

ILLUMINATED OUTDOOR SIGN
Double sided, formed plastic sign. 36" x 24" UL approved.

THREE DIMENSIONAL PLASTIC ILLUMINATED SIGN
A colorful "3-D" flasher illuminated formed plastic beauty.

DISPLAYS
Six color displays that sell your service.

REFLECTORIZED OUTDOOR METAL SIGN
Two sided metal sign to catch the eye of passers-by.

TUBE AND TOOL CARRYING CASE
Holds 137 tubes — plus all regular tools.

TRANSPARENT PLASTIC WINDOW STREAMER

PLASTIC "WILL RETURN" DIAL SIGN

SHOP JACKETS AND COATS
Full length or jacket style.

ILLUMINATED TEST PATTERN CLOCK
A Telechron Motored beauty.

Write for FREE BOOKLET!

Pictured are only a few of the many useful shop aids and sales promotion items that Raytheon has made available to you. There are many others — job tags and record cards, imprinted stationery, post cards, ad mats, shipping labels, decals, paper bags, giant outdoor thermometers, etc. — all designed with your needs in mind. Many items are free, the rest available at very low cost. Ask your Raytheon Tube Distributor about them or write for free Booklet. Address your request to Department A, Raytheon Manufacturing Company, Receiving Tube Division, 55 Chapel Street, Newton 58, Mass.

RAYTHEON®

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY

Receiving Tube Division

Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

RAYTHEON MAKES ALL THESE:

RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

Leonard C. Lane, B.S., M.A. President of Radio-Television Training Association. Exec. Dir. of Pierce School of Radio and Television.

I GIVE YOU *MORE* EQUIPMENT TO TRAIN YOU BETTER

Set up your own home laboratory with the 15 BIG TV-Radio kits we send you. You build AND KEEP your own complete BIG SCREEN TV RECEIVER, Super-Het Radio Receiver, R.F. Signal Generator, Combination Voltmeter-Ammeter-Ohmmeter, C-W Telephone Receiver, AC-DC Power Supply. Everything is furnished complete, including all tubes, plus big TV picture tube.

GET MORE!

LEARN MORE!

EARN MORE!

THOUSANDS OF NEW JOBS IN TELEVISION

I PREPARE YOU AT HOME IN YOUR SPARE TIME

MORE TRAINING TO FIT YOU FOR THE BETTER PAY JOBS

Thousands of new jobs will open up right in your own state, now that the government has lifted restrictions on new TV stations. My simple, successful methods have helped hundreds of men — most of them with NO PREVIOUS TRAINING — find places in America's booming TELEVISION and Electronics industries. You too can get the success and happiness you always wanted out of life within months . . . studying at home . . . as I train you to become a full-fledged TV TECHNICIAN. Many of my students make as much as $25.00 a week repairing Radio-TV sets in their spare time while learning . . . pay their entire training almost from the very beginning from spare time earnings . . . start their own profitable service business.

But I don't stop after I qualify you as a TV Technician . . . although right there you can choose from among dozens of fascinating careers! I continue to train you — AT NO EXTRA COST — to qualify for even better pay in the BETTER JOBS that demand FCC licenses, with my . . .

MORE VALUE!

YOU GET A ROUND TRIP TO NEW YORK CITY AT NO EXTRA COST

FROM ANYWHERE IN THE U.S. OR CANADA — I pay your way to New York and return, PLUS 2 FREE weeks, 50 hours of advanced instruction and shop training at the PIERCE SCHOOL OF RADIO & TELEVISION. You use modern electronics equipment, including student-operated TV and Radio stations. You go behind the scenes of New York's big Radio-TV centers, to study first hand. And I give you all this AT NO EXTRA COST! (Applies to complete Radio-TV course only.)

Only RTTA makes this amazing offer.

I GET MY GRADUATES GOOD PAYING JOBS

"Thanks to your training, I qualified for a good job as a Receiver Tester at Federal Telephone and Radio." — **Paul Frank Seier**

"I'm making good money in my own business, repairing and installing radio and TV sets — thanks to your training." — **Irwin Polansky**

"Your excellent instruction helped me get my present job as an airport radio mechanic for American Airlines. — **Eugene E. Basko**

"I'll always be grateful to your training which helped me get my present fine position as Assistant Parts Manager." — **Norman Weston**

Many others working at NBC, RCA, CBS, DuMont, Philco, Emerson, Admiral and other leading firms.

FREE FCC COACHING COURSE

PREPARES YOU AT HOME FOR YOUR FCC LICENSE.

THE BEST JOBS IN TV AND RADIO REQUIRE AN FCC LICENSE.

Given at **NO EXTRA COST** after TV Theory and Practice is completed.

NOW! ADVANCED FM-TV TRAINING

If you have previous Armed Forces or civilian radio experience—my ADVANCED COURSE can save you months of training. Full theory and practical training . . . complete with kits, including BIG SCREEN TV RECEIVER and FREE FCC License Coaching Course.

FREE EMPLOYMENT ASSISTANCE

My vocational adviser will help you obtain a good-paying job in the locality of your choice.

VETERANS!

MY SCHOOLS FULLY APPROVED TO TRAIN VETERANS UNDER *NEW* G.I. BILL! If discharged after June 27, 1950 — CHECK COUPON BELOW!

Also approved for RESIDENT TRAINING in New York City . . . qualifies you for full subsistence allowance up to $160 per month.

MAIL COUPON TODAY!

BOTH FREE! New Illustrated Book and Sample Lesson. Learn How My Simple Methods Make Success Easy!

NO SALESMAN WILL CALL!

Mr. Leonard C. Lane, President
RADIO-TELEVISION TRAINING ASSOCIATION
1629 Broadway, Radio City Station
New York 19, N. Y. Dept. T-8

Dear Mr. Lane: Mail me your NEW FREE BOOK and SAMPLE LESSON that will show me how I can make BIG MONEY in TELEVISION. I understand I am under no obligation and no salesman will call.

(PLEASE PRINT PLAINLY)

Name _____ Age _____

Address _____

City _____ Zone _____ State _____

I am interested in: ☐ Radio-TV ☐ Advanced FM-TV.
VETERANS: If qualified under new G.I. Bill, check your choice: ☐ Home Study ☐ Resident Study.

RADIO-TELEVISION TRAINING ASSOCIATION

1629 Broadway, Radio City Station, New York City 19, N. Y.

LICENSED BY THE STATE OF NEW YORK

Spot Radio News

★ **Presenting latest information on the Radio Industry.**

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

COMPATIBLE COLOR, which dazzled members of Congress during that striking Princeton show, at this writing is being readied for a grandstand appearance before the seven guardians of the airlanes, the Commission, by the folks who staged the demonstration in New Jersey, *RCA*. Originally, the industry committee studying color was scheduled to file a petition as a body. Now, according to company spokesmen, two petitions may be filed, with the NTSC delaying its presentation until the late Fall.

The early prospects for color have so excited broadcasters, that over thirty affiliates of *RCA's NBC* net have signed affiliation contract supplements allowing them to carry colorcasts when the reds, greens, and blues begin coming over the coax. Among those who said yes, were WBRE-TV, Wilkes-Barre; WSYR-TV, Syracuse; WJAC-TV, Johnstown; WLWD, Dayton; WLWC, Columbus; WLWT, Cincinnati; WSAZ-TV, Huntington; WDSU-TV, New Orleans; KSTP-TV, St. Paul-Minneapolis; WKY-TV, Oklahoma City; KCBD-TV, Lubbock; WBAP-TV, Fort Worth; KPRC-TV, Houston, and KPTV, Portland.

According to the company's production experts, setmaking should begin about nine months after government approval is received; thus sets *might* be available *next* Spring. However, many have indicated, and quite strongly, that the Winter of '54, probably around Thanksgiving or Christmas looks like a more realistic dateline for color-chassis deliveries.

In the meantime, NTSC task groups are pushing ahead with their exhaustive tests. Particularly active are the field panels which have members in New York, Chicago, Syracuse, Philadelphia, and Washington constantly probing and conducting actual observation tests. Not only are they concerned with the effectiveness of color reception, but the compatibility of chassis for viewing and listening, too. According to the test procedures of one sub-committee, task groups are responsible for official tests in strong signal, intermediate strength signal,

NEW TV GRANTS SINCE FREEZE LIFT

Continuing the listing of construction permits granted by FCC since lifting of freeze. Additional stations will be carried next month.

STATE	CITY	CALL**	CHANNEL	FREQUENCY (mc.)	POWER* (Video)
Idaho	Meridian	. . . . .	2	54-60	16.5
Illinois	Rockford	. . . . .	13	210-216	195
Ohio	Cincinnati	WCIN-TV	54	710-716	89
Oregon	Eugene	. . . . .	13	210-216	56
Pennsylvania	Lancaster	. . . . .	21	512-518	18
Texas	Harlingen	. . . . .	4	66-72	13
"	Lubbock	KFYO-TV	5	76-82	100
Wyoming	Casper	KSPR-TV	2	54-60	1.2
Hawaii	Honolulu	. . . . .	4	66-72	58

REVISED CALL LETTER LISTING

(Since the publication of the listings last month, the following final TV call letters have been assigned to new stations by the Commission.)

STATE	CITY	CALL	CHANNEL	FREQUENCY
California	Fresno	KJEO	47	668-674
"	San Francisco	KSAN-TV	32	578-584
Florida	Lakeland	WOTV	16	482-488
Louisiana	Alexandria	KSPJ	62	758-764
Minnesota	Minneapolis	WTCN-TV	11	198-204
Michigan	Cadillac	WWTV	13	210-216
Missouri	Cape Girardeau	KGMO-TV	18	494-500
New Hampshire	Keene	WKNE-TV	45	656-662
Pennsylvania	Lancaster	WWLA	21	512-518
Tennessee	Knoxville	WCEE-TV	26	542-548
Texas	Victoria	KNAL-TV	19	500-506

*ERP = (effective radiated power, kw.). **Call letters without TV suffix from application files and subject to change; except where included in calls such as KKTV or WTVT. . . = Call letters to be announced

WE BELIEVE *Norman Foster's recent advertisement in the Chicago "TV Guide" is of interest to the entire television and radio industry. Consequently, with Mr. Foster's permission, we are reprinting it here as a public service for every television and radio service technician in America.*

Harry Kalker

(HARRY KALKER, President)

SPRAGUE PRODUCTS COMPANY

(Distributors' Division of the Sprague Electric Company)

North Adams, Massachusetts

NORMAN FOSTER

UNFORTUNATELY

Because of the Greed of a Few,

THE ENTIRE TV SERVICE INDUSTRY MUST SUFFER

HERE IS WHAT I HAVE DONE TO GUARANTEE YOU HONEST TV SERVICE

1. The name, Foster Television is not taken from a street, a deck of cards, or a country, and it is not an adjective. It comes from the name of its sole owner, Norman Foster. I have spent 22 years in the Radio, Electronics and Television service business, and in these years I have worked for just about every type of Operator, good, bad and indifferent. When the time came that I could open my own business, I decided that because of the reputation that the Radio and Television repair business has always had, a company operating so honestly that they could invite their customers into the shop to watch their work being done could be a success. The volume of business we did last year proves I was right.

2. The reason that a service man would attempt to sell you something you do not need is because he had something to gain personally. Many Television service operators hire men, driving their own cars, on a percentage basis. This is advantageous because the service company can be in business with practically no investment. Under these conditions if this man needs money, it's only human nature that he is going to want to do the thing to your television set that will make him the most money—whether it be 5 tubes or haul it to the shop.

3. Every man that I have, works by the hour and punches a time clock. He drives a company owned new truck bearing my name and his equipment and uniforms are furnished to him without charge. He has orders to repair your set in your home whenever possible. He receives the same amount of money whether he repairs 1 set or 10, and whether he charges $1 or $10. His rate of pay and his advancement are based on the number of sets he can repair in the home.

4. Our service call price is a flat $3 and covers all labor necessary to make any repair possible in your home except cleaning a screen, for which we charge $1 extra. It is evident that on this basis we do not make money on every job, but with the large volume of business we do, it has averaged out to a modest profit at the end of the year. You can bring your set into our shop and not only save this service charge, but also see it repaired while you wait. There is no minimum charge on this service. You pay only for the actual time spent on your set.

5. How fast can service be? I have a large fleet of trucks operating throughout Chicago from 9:30 A.M. to 11:00 P.M. I do not advertise one hour service and I do not believe that anything but a coincidence could give such fast service. Because it is impossible to predict in advance how long each job will take a man, the best we can do is to offer same day service. Occasionally at this time of the year, bad weather causing slow driving, makes it necessary to postpone calls received late, until the next day.

6. Quality of parts. I use only nationally advertised tubes and parts. Every tube I sell is new, fresh and cartoned, bearing a name and a date, and is coded by the manufacturer to indicate that it is a tube manufactured and guaranteed for replacement use. I do not use bulk or surplus tubes. Every picture tube I sell bears a serial number and has a factory registration certificate to guarantee that it is a new first quality tube. I do not sell rebuilt or rejuvenated picture tubes. I use only Sprague plastic sealed condensers, which are far superior to the parts used in many TV sets.

7. I guarantee every part I replace for 90 days. If a part or tube I have replaced fails, it is replaced at absolutely no charge to you. Our guarantee is further underwritten by the American Mutual Liability Insurance Co. by arrangement with the Raytheon Manufacturing Co.

8. I have not satisfied everybody and I do not claim to. I cannot repair a set that needs a new picture tube for $3 and I cannot give a $60 service contract with each call. Nothing less would satisfy certain people. However, if you hear a complaint against Foster Television, that same person will generally have one against the plumber, the auto mechanic, the dentist and nearly everyone else who is unfortunate enough to do business with him. I need and value your patronage and I will sincerely respect it.

Norman Foster

Open 9:30 am-8:30 pm

- **Home Service to 11 pm**
- **Sundays 11 am-3 pm**
- **HUmboldt 9-0911**

YOU CAN DEPEND ON

FOSTER TV

2922 MILWAUKEE AVENUE

CHICAGO

and fringe signal areas. For the intermediate signal-strength tests, signals between 3000 and 10,000 microvolts are required.

In studying the signals, eight tests are made for resolution, over-all picture quality, flicker, brightness, contrast, picture texture, adequacy of sync, and sound quality. The over-all picture quality report, it is said, reveals the general impression a picture makes on the observer, and also if such defects as poor focus, streaking, beats, or noise, appear. In scrutinizing picture texture, observers are required to look for dot structure, dot crawl, moire, or beat patterns in the picture. Viewers are warned that they must look carefully to see if they recognize any limitations in subject matter. They are also obliged to look for evidence of brightening of the horizontal retrace lines due to presence of color sync signals, and make a record of such observations for several possible settings of the horizontal hold control, with brightness control set for best monochrome picture.

A novel scoring technique has been prepared to permit an evaluation of observed results. Two scales are provided, and a series of numbers from *one* to *six* to simplify identification. To illustrate, not perceptible represents condition 1; just preceptible, 2; definitely perceptible, but not objectionable, 3; somewhat objectionable, 4; definitely objectionable, 5; and not usable, 6. In the second scale, which is complementary, 1 means excellent; 2, good; 3, passable; 4, not quite passable; 5, poor; and 6, not usable.

The comprehensive tests also involve detailed studies of such problems as susceptibility to co-channel and adjacent-channel interference. In the former test, a lab signal generator is modulated with a signal from a scanner or other pickup equipment in accordance with the NTSC proposed signal, and applied to a color set. Then an interfering signal is applied to the set at a —40 db level. Signals are non-sync, co-channel type and the receiver picture is evaluated for the effects of this interference. A performance comparison is also made with operation of a black and white signal, under similar conditions. The tests are repeated with offset carrier operations at a —28 db level.

Everyone in industry and Washington is well aware of the thoroughness of the work of these task groups, and certainly their efforts will play a major role in producing better color-casting and viewing.

GLOBAL TV, a doodling idea for years, which last Spring captured the fancy of Washington legislators and prompted the evolution of a blueprint for a North Atlantic Treaty TV plan, plus the introduction of a bill in the Senate to establish a Commission on Cooperative International Relations, which would encourage existing agencies . . . "to design . . . and

(*Continued on page* 111)

CREI prepares you quickly for success in

- BROADCASTING
- TELEVISION
- MANUFACTURING
- COMMUNICATIONS
- SERVICING
- AERONAUTICAL ELECTRONICS

The handwriting is on the wall.

The signs are plain as to the future of the trained men in the electronics industry. It is a tremendous industry, and—at the *present time* there are more jobs than there are trained men to fill them. But—when there's a choice between a trained and untrained applicant, the trained man will get the job. Your biggest problem is to decide on—and begin the best possible training program.

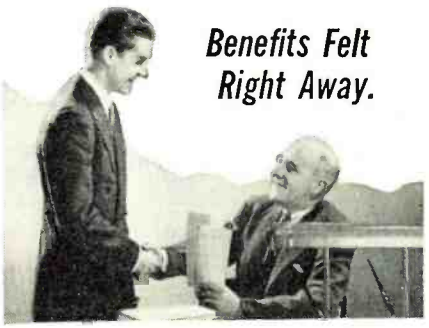
CREI Home Study . . . The Quick Way to Get There.

Since 1927, CREI has given thousands of ambitious young men the technical knowledge that leads to more money and security. The time-tested CREI procedure can help *you*, too—if you really want to be helped. CREI lessons are prepared by experts in easy-to-understand form. There is a course of instruction geared to the field in which you want to specialize. You study at *your* convenience, at *your* rate of speed. Your CREI instructors guide you carefully through the material, and grade your written work personally (not by machine).

Industry Recognizes CREI Training.

CREI courses are prepared, and taught with an eye to the needs and demands of industry, so your CREI diploma can open many doors for you. Countless CREI graduates now enjoy important, good-paying positions with America's most important companies. Many famous organizations have arranged CREI group training for their radio-electronics-television personnel. To name a few: All America Cables and Radio, Inc.; Canadian Aviation Electronics, Ltd.; Canadian Broadcasting Co rporation; Columbia Broadcasting System; Canadian Marconi Company; Hoffman Radio Corporation; Machlett Laboratories; Glenn L. Martin Company; Magnavox Company; Pan American Airways, Atlantic Division; Radio Corporation of America, RCA Victor Division; Technical Appliance Corporation; Trans-Canada Air Lines; United Air Lines. Their choice for training of their own personnel is a good cue for *your* choice of a school.

Benefits Felt Right Away.



Almost immediately, you feel the benefits of CREI training. Your employer, when informed of your step toward advancement (only at your request), is certain to take new interest in you and in your future. What you learn in CREI Home Study can start helping you do a better job immediately.

CREI also offers Resident Instruction

at the same high technical level—day or night, in Washington, D. C. New classes start once a month. If this instruction meets your requirements, check the coupon for Residence School catalog.

INFORMATION FOR VETERANS

If you were discharged after June 27, 1950—let the new G. I. Bill of Rights help you obtain resident instruction. Check the coupon for full information.

Get this fact-packed booklet today. It's free.

Called "Your Future in the New World of Electronics," this free illustrated booklet gives you the latest picture of the growth and future of the gigantic electronics world. It includes a complete outline of the courses CREI offers (except Television and FM Servicing) together with all the facts you need to judge and compare. Take 2 minutes to send for this booklet right now. We'll promptly send your copy. The rest—your future—is up to you.

MAIL COUPON TODAY

CAPITOL RADIO ENGINEERING INSTITUTE
Dept. 118 3224 16th St., N.W., Washington 10, D. C.

Send booklet "Your Future in the New World of Electronics" and course outline.

CHECK FIELD OF GREATEST INTEREST
- ☐ TV, FM & Advanced AM Servicing
- ☐ Practical Radio Engineering
- ☐ Broadcast Radio Engineering (AM, FM, TV)
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- ☐ Aeronautical Radio Engineering

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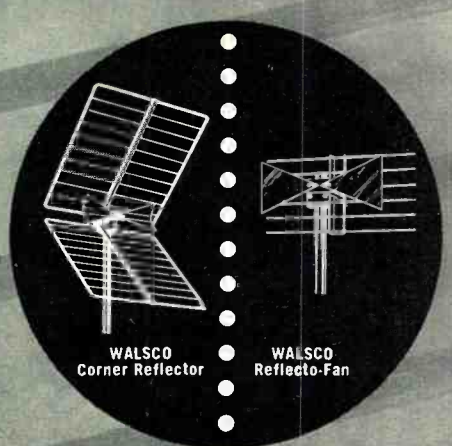
WALSCO

HAS THE ONLY UHF ANTENNAS WITH AMAZING

X-77

INSULATOR

Hollow, unbreakable X-77 Insulator used exclusively on Walsco Corner Reflector and Reflecto-Fan.



X-77 *insulator* makes Walsco the most efficient, all-band UHF antennas in America. Nothing compares with it!

X-77 is *hollow*, allowing lead-in wire to pass through the center. Wire is kept completely *out* of field pattern. It eliminates broken wires caused by strain of wire on antenna terminals.

X-77 can't break . . . ever! It's *5 times stronger* than polystyrene. Silicone treated to shed dust and moisture . . . not affected by extreme heat, cold or wind.

X-77 is non-hygroscopic. Outstanding insulating qualities will last *indefinitely*.

Largest in demand everywhere

	Catalog No.	Description	Avg. Gain (db)	List Price
Reflecto-Fan	4400	Single Bay	7.0	$ 6.75
	*4402	Dual Stack	11.0	14.25
	*4404	4 Bay Stack	14.5	35.00
Corner Reflector	4450	Single Bay	11.2	14.50
	*4452	Dual Stack	16.4	32.00

*Supplied with complete stacking kit.
Mast not included in prices.

WALSCO

Walter L. Schott Co.

Los Angeles 18, Calif.
Chicago 6, Ill.

Overseas Representative: Ad Auriema, Inc., 89 Broad St., New York 4, N.Y.

ADVANCE! Raise your earning power—learn RADIO-TELEVISION-ELECTRONICS by SHOP-METHOD HOME TRAINING

GOOD JOBS AWAIT THE TRAINED RADIO-TV TECHNICIAN

There is a place for *you* in the great Radio-Television-Electronics industry when you are trained as National Schools will train you at home!

Trained technicians are in growing demand at good pay—in manufacturing, broadcasting, television, communications, radar, research laboratories, home Radio-TV service, and other branches of the field. National Schools Master Shop-Method Home Training, with newly added lessons and equipment, trains you in your spare time, right in your own home, for these fascinating opportunities. OUR METHOD IS PROVED BY THE SUCCESS OF NATIONAL SCHOOLS TRAINED MEN, ALL OVER THE WORLD, SINCE 1905.

EARN WHILE YOU LEARN

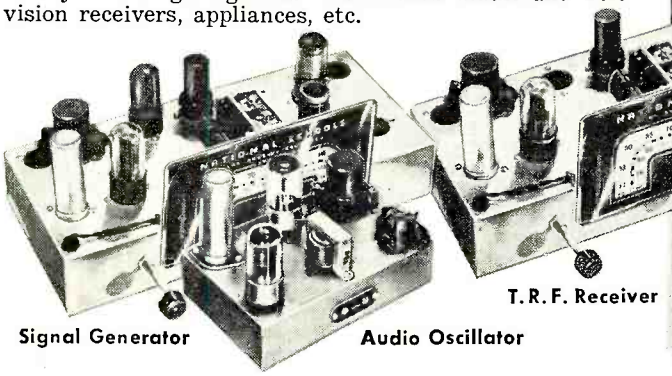
Many National students pay for all or part of their training with spare time earnings. We'll show you how you can do the same! Early in your training, you receive "Spare-time Work" Lessons which will enable you to earn extra money servicing neighbors' and friends' Radio and Television receivers, appliances, etc.

MASTER ALL PHASES!

Get Master Shop-Method Home Training from an Established Practical Resident School with its own Training Shops, Laboratories, Studios — almost 50 Years of Successful Experience in Training Ambitious Men.

We Bring National Schools To You!

Superheterodyne Receiver



Signal Generator — Audio Oscillator — T.R.F. Receiver

LEARN BY DOING

You receive and keep all the modern equipment shown above, including tubes and valuable, professional quality Multitester. *No extra charges.*

FREE! RADIO-TV BOOK AND SAMPLE LESSON!

Send *today* for National Schools' new, illustrated Book of Opportunity in Radio-Television-Electronics, and an actual Sample Lesson. No cost—no obligation. Use the coupon now—we'll answer by return airmail.

National Schools Training is All-Embracing

National Schools prepares you for your choice of many job opportunities. Thousands of home, portable, and auto radios are being sold daily—more than ever before. Television is sweeping the country, too. Co-axial cables are now bringing Television to more cities, towns, and farms every day! National Schools' *complete* training program qualifies you in all fields. Read this partial list of opportunities for trained technicians:

Business of Your Own • Broadcasting
Radio Manufacturing, Sales, Service • Telecasting
Television Manufacturing, Sales, Service
Laboratories: Installation, Maintenance of Electronic Equipment
Electrolysis, Call Systems
Garages: Auto Radio Sales, Service
Sound Systems and Telephone Companies, Engineering Firms
Theatre Sound Systems, Police Radio
And scores of other good jobs in many related fields.

APPROVED FOR VETERANS AND NON-VETERANS
Check coupon below

Both Resident and Home Study Courses Offered!

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LOS ANGELES 37, CALIFORNIA • ESTABLISHED 1905
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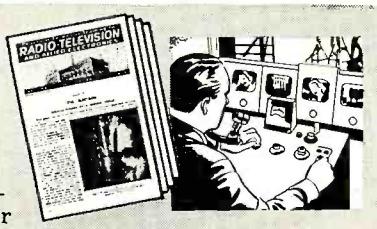
TELEVISION TRAINING



You get a complete series of up-to-the-minute lessons covering all phases of repairing, servicing and construction. The same lesson texts used by resident students in our modern and complete Television broadcast studios, laboratories and classrooms!

FIND OUT NOW—MAIL COUPON TODAY!

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Los Angeles 37, California

Mail in envelope or paste on postal card.

Send FREE Radio-TV Electronics book and FREE sample lesson. I understand no salesman will call on me.

NAME _____ AGE ____
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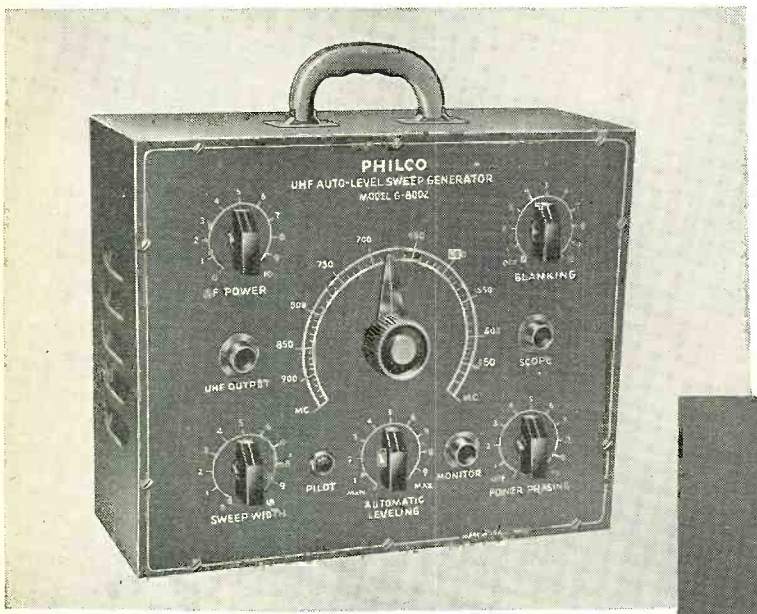
CITY _____ ZONE ____ STATE _____

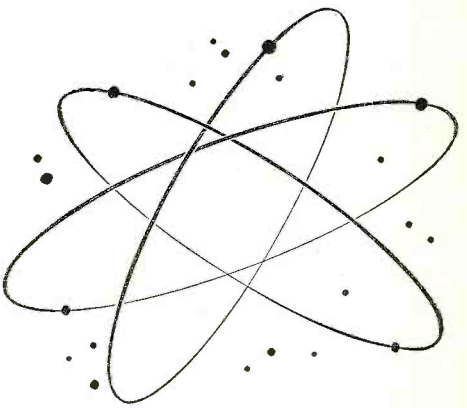
☐ Check here if released from service less than 4 years ago.
☐ Check here if interested in Resident Training at Los Angeles.

Specifically DESIGNED FOR



UHF Auto-Level Sweep Generator

Model G-8002. The newest, most modern, most inexpensive UHF sweep generator on the market. Checks sweep alignment with *any* test oscilloscope. Its output is controllable . . . makes possible overall trouble shooting and testing of low level units such as UHF tuners, boosters, converters, etc.

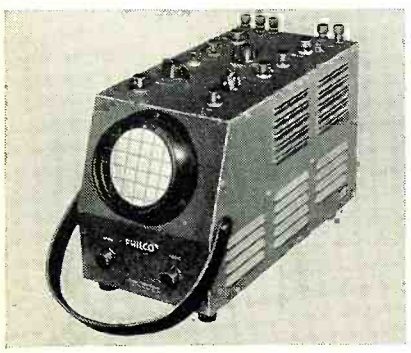


PHILCO Test Equipment

Field Strength Meter

Model M-8104. More features than any other unit at this popular price. Reads signal strength directly from the dial from 10 to 100,000 microvolts. A serviceman's time saver to measure actual TV picture signal strength.

NOW YOURS ON NEW EASY PAYMENT PLAN

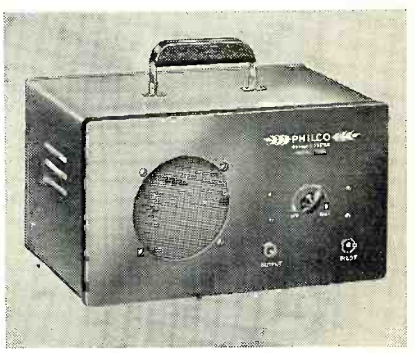


3-inch TV Oscilloscope

Model S-8200. The most practical portable unit available for bench or field servicing. Preset horizontal and vertical sweep rates take the guesswork out of trouble shooting. Ideal for television because of its high sensitivity and wide response.

Cathode Ray Tube Checker

Model 7053. Tests *all* picture tubes used in home TV receivers. Special cathode-ray tubes are easily checked by using plug-in adapters. Eliminates trouble shooting guesswork. Neon lamp indicates shorts and open elements in the electrodes of the gun.

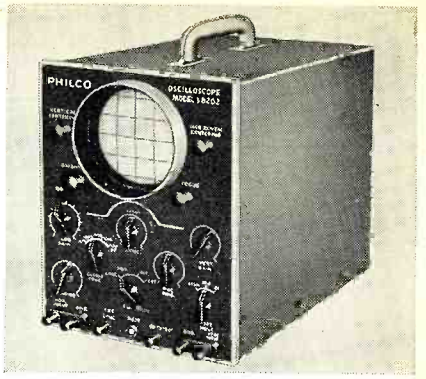


Dynamic Signal Tracer

Model 7031. An extremely versatile instrument . . . this unit is designed for fast diagnosis of radio trouble by audibly monitoring RF and AF circuits. Can be used to accurately check P.A. systems, microphones and phonograph pick-up circuits.

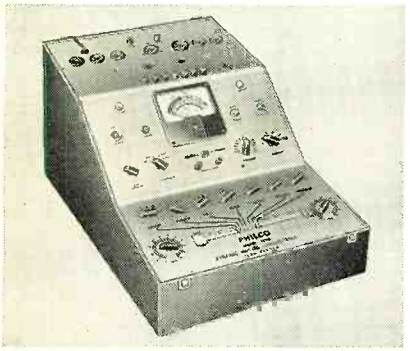
THE SERVICEMAN

The Philco test equipment line is new! New circuits, new styling, new ruggedness, new versatility, new accuracy! Each piece of equipment is precision-built and now brings new features specifically designed *with your needs and your problems in mind!* Look over the individual instruments shown on these pages, and then mail the coupon below or get in touch with your Philco distributor to find out how easy it is to own a complete Philco Test Equipment Service Laboratory.



5-inch High Gain Oscilloscope

Model S-8202. This outstanding scope is built to the highest standards of test instruments . . . It features the highest gain 10 millivolts/inch, and widest frequency range at its popular price. Wide sweep ranges allow flexibility in sweep circuit trouble shooting.



Mutual Conductance Tube Checker

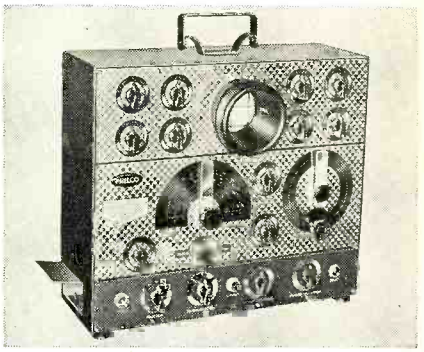
Model 7052. Tests more different type tubes than any unit on the market, from subminiature to acorn low power transmitting tubes . . . Forecasts tube life . . . employs roll chart instead of cards . . . for use as a portable or counter top unit.

Model M-8100

Model M-8102

Model M-8100. The rugged PHILCO CIRCUIT MASTER is one of the finest vacuum tube voltmeters ever designed. With its companion unit the famous . . .

Model M-8102. PHILCO CIRCUIT TESTER you have a combination engineered to meet the most rigid specifications for reliability, durability and accuracy of design.



Visual Alignment Generator

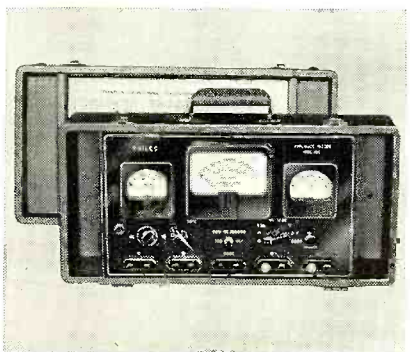
Model 7008. Combines in *one* economical instrument functions that can be approached only in a cumbersome collection of costly devices. No special scope connections are required for the most accurate visual alignment that is possible to achieve.

For new FREE BOOKLET fill out and mail this coupon

OR SEE YOUR PHILCO DISTRIBUTOR

VHF to UHF Signal Generator Adapter

Model G-8000. The most economical system yet designed to produce UHF signals for TV receiver tests. Through a conversion process this unit produces from an input VHF signal, UHF signals having the same characteristics as the VHF signal.



Appliance Tester

Model 5007. The ultimate in versatility. A one package, all purpose, portable appliance service unit. Permits over-all analysis of refrigerators, ranges, air conditioners and household appliances. With "pick-up" elements to determine temperature.

PHILCO CORPORATION
Accessory Division
Allegheny Ave. & "A" St.
Philadelphia 34, Pa.

☐ I am interested in the Philco Test Equipment shown here. Please send me details of your SPECIAL PURCHASE PLAN for obtaining these units.

☐ Please send FREE copy of your new booklet on Philco Test Equipment.

NAME_____

ADDRESS_____

CITY_____ STATE_____

Within the INDUSTRY

JAMES L. BYROM has been named to the new position of director of engineering for *General Dry Batteries, Inc.* of Cleveland.

The position was created as part of the company's broad program to strengthen its functional organization and to expand all phases of engineering activities in producing a full line of dry-cell batteries for radios, hearing aids, etc.

Mr. Byrom was formerly vice-president and general manager of the *Chandler-Evans Division* of *Niles-Bement-Pond Co.* and prior to that served *Underwood Corp.* and *National Carbon Co.* in engineering capacities.

* * *

DR. W. R. G. BAKER, *General Electric Company* vice-president and general manager of its Electronics Division, has been awarded the Medal of Freedom by the Honorable Earl D. Johnson, under-secretary of the Army.

Dr. Baker was awarded the medal for accelerating the application of electronics to the solution of Army research and development problems. He led a mission of leading scientists and industrialists to Korea in the summer of 1952, to study the problem of utilizing electronic devices and principles to the maximum extent in modern war, thereby increasing the effectiveness of the individual soldier and reducing the cost of human life.

* * *

LEO G. SANDS has been appointed to the post of sales manager of *Langevin Manufacturing Corporation* of New York.

Mr. Sands recently resigned as president of *Bogue Railway Equipment Division,* manufacturer of railway electrical and communications equipment. He had also served *Bogue Electric Manufacturing Company* as general sales manager.

In his new position, Mr. Sands will make his headquarters at the company's main offices at 37 West 65th Street, New York City.

* * *

RUSS DIETHERT of the Chicagoland Chapter was unanimously elected national president of "The Representatives" at the organization's annual delegates' meeting held recently in Chicago. Norman B. Neely of the Los Angeles Chapter was the retiring president.

Wally B. Swank of the Empire State Chapter was named first vice-president, Dean A. Lewis of the California Chapter was elected second vice-president, and Ross Merchant of the Wolverine Chapter, third vice-president.

Ronald G. Bowen of the Rocky Mountain Chapter was elected national secretary while George Petitt of the Chicago Chapter was named national treasurer.

Mose S. Branum of the Southwestern Chapter was elected to serve on the board of governors for a three-year term.

* * *

EDWARD L. NUNG, formerly manager of the Long Island City parts division plant of *Sylvania,* has been named manager of the tuner division of *P. R. Mallory & Co., Inc.* of Indianapolis . . . **DONALD H. KUNSMAN** is the new vice-president of the *RCA Service Company.* He will be in charge of the consumer products service division . . . *CBS-Columbia Inc.* has appointed **LOUIS HAUSMAN** to the post of vice-president. The firm is the television and radio receiver manufacturing subsidiary of the *Columbia Broadcasting System, Inc.* . . . **C. J. HARRISON** has been named to the newly-created post of marketing manager for the television transmitter division of *Allen B. Du Mont Laboratories, Inc.* He will supervise field sales activity, order administration, the division's advertising and publicity program, as well as coordinate all contract processing . . . **EDWIN I. GUTHMAN,** head of one of the largest independent coil manufacturing companies in the country, died recently of a heart attack. He was 49 years old at the time of his death. He was the president and founder of the *Edwin I. Guthman Co.* of Chicago . . . *General Electric Company's* tube department has named **GRADY L. ROARK** to the post of manager of marketing with headquarters in Schenectady . . . **LEONARD L. ROSENFELD** has been named production manager of *Jerrold Electronic Corporation.* He was formerly chief industrial engineer in the Joliet, Ill., plant of the *F. W. Sickles Division* of *General Instrument Corp.* . . . **WEBSTER E. BARTH** has been appointed general sales manager of *La-Pointe Electronics Inc.* In his new post he will coordinate the sales efforts of all of the company's divisions.

* * *

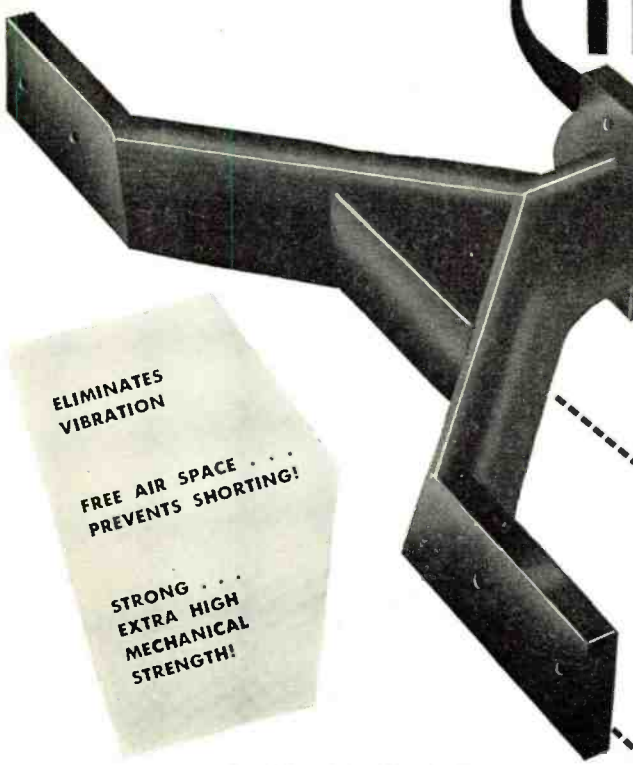
THE MAGNETIC RECORDING INDUSTRY ASSN. has been recently formed by a majority group of the leading tape recording manufacturers in the U. S.

The meeting to discuss the forma-

ONLY TELCO UHF ANTENNAS HAVE THE "WISHBONE"

TELCO

UHF "WISHBONE" HIGH DI-ELECTRIC INSULATOR

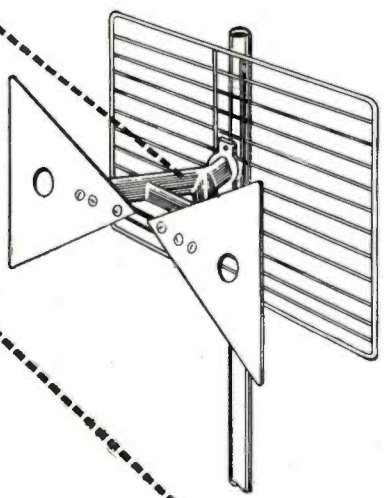


ELIMINATES VIBRATION

FREE AIR SPACE . . . PREVENTS SHORTING!

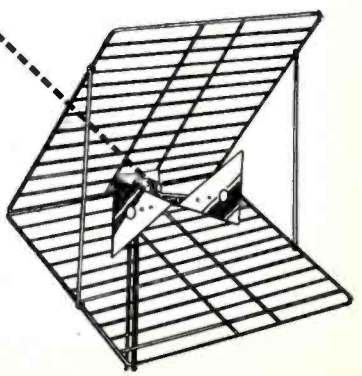
STRONG . . . EXTRA HIGH MECHANICAL STRENGTH!

- EASY TO INSTALL
- ELIMINATES GHOSTS
- VERY HIGH GAIN



No. 8965—Butterfly Wishbone Antenna, complete with stacking bar. List $7.50

THAT'S RIGHT . . . Only TELCO'S got this remarkable new free air insulator . . . the "Wishbone" . . . that absolutely prevents shorting out under any conditions. Sturdy vibration-proof reflector and rugged aircraft aluminum elements are fastened to the "Wishbone" to prevent vibration and shaky pictures. Antenna performance is proved by actual UHF field testing . . . assures high gain on all channels. Better buy TELCO . . . your all-ways best UHF Antennas!



No. 8984 Wishbone Corner Reflector. List $14.50

TELCO

FREE! WRITE TODAY **for all-new 32-page TELCO Catalog. Send Postcard.**

TELEVISION HARDWARE MFG. CO.

DIVISION OF GENERAL CEMENT MFG. CO.

904 TAYLOR AVENUE • ROCKFORD, ILLINOIS

tion of this new trade association was called by Joseph F. Hards, vice-president of *A-V Tape Libraries Inc.* Tape manufacturers and firms manufacturing related tape recording equipment voted unanimously to form the new association.

Tape recording manufacturers attending the initial meeting included *Ampex Electric Corp., Audio Devices, Inc., Bell Sound Systems, Brush Electronics Co., Crestwood Recorder Division* of the *Daystrom Electric Corp., Dukane Corporation, Fidelitone, Inc., Magnecord Corp., Minnesota Mining and Manufacturing Co., ORRadio Industries, Inc., The Pentron Corporation, Webster-Chicago Corp.,* and *Webster Electric Co.*

Mr. Hards was elected president *pro-tem.* An organizing committee has been appointed to outline the purposes and functions, and to draw up the by-laws of the association.

* * *

EUGENE F. PETERSON has been appointed manager of marketing for *General Electric Company's* radio and television department.

He was formerly manager of marketing for the company's tube department with headquarters in Schenectady. He will now be located at the Electronics Park plant in Syracuse.

Upon graduation from college, and after serving a year as a professor of physics at Sterling College, Mr. Peterson joined the *G-E* test engineering program in 1933. He joined the Tube Department in 1934 and completed the company's advanced course in engineering in 1936.

He has served in various engineering and supervisory capacities at the company's Schenectady and Owensboro, Ky. plants. He was named manager of marketing for the tube department in 1951.

* * *

MILWAUKEE SCHOOL OF ENGINEERING recently celebrated its 50th anniversary with a banquet attended by state and civic dignitaries.

Founded in 1903 by Oscar Werwath, the school has grown until today it has an annual enrollment of 1500 full-time and 350 evening students. Nearly 50,000 students have received training at the school since 1903.

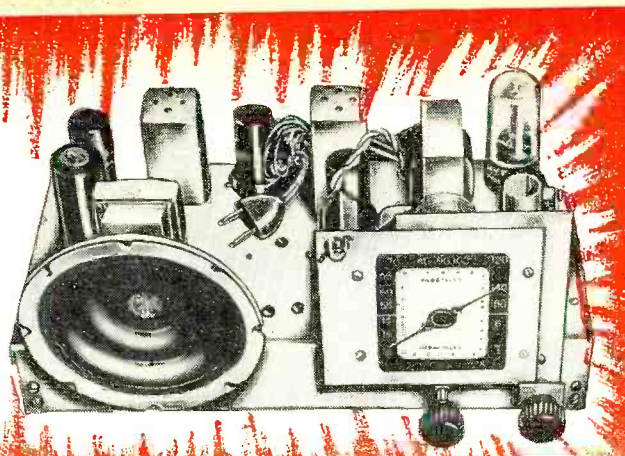
Karl Werwath, son of the founder, assumed the presidency upon his father's death in 1948. Another son, Heinz M. is controller and treasurer.

* * *

MOTOROLA, INC. of Chicago is currently celebrating its 25th year in the electronics field.

Founded in 1928 as *Galvin Manufacturing Company* by Paul V. Galvin, the firm had six employees and a capital fund of $565. The company, now *Motorola, Inc.,* has since grown

(*Continued on page* 105)



TRAIN *FASTER* — TRAIN *BETTER* — TRAIN *EASIER*

IN 10 MONTHS — OR LESS — FOR

RADIO-TELEVISION

Our 21st Year Training Men for Greater Incomes and Security in Radio-Television

I SEND YOU 18 BIG KITS

of Radio Television parts and equipment. Much of your training will be actual construction and experimentation . . . the kind of truly PRACTICAL instruction that prepares you for your Radio-Television career.

Frank L. Sprayberry
President
Sprayberry Academy of Radio

YOU BUILD the Television set and the powerful superhet radio receiver shown above. IN ADDITION to the other test units shown here (many are not shown because of lack of space). All equipment I send you is YOURS TO KEEP.

Approved for Veterans under the G. I. Bill

NEW! NO OBLIGATION PLA

You Have No Monthly Payment Contract to Sign
Pay For Your Training as You Earn and Learn

You can get into Radio-Television, today's fastest growing big money opportunity field, in *months* instead of years! My completely new "package unit" training plan prepares you in as little as 10 months or even less! *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. Start your own profitable Radio-Television shop . . . or accept a good paying job. I have trained hundreds of successful Radio-Television technicians during the past 21 years—and stand ready to train you, even if you have no previous experience! Mail coupon and get all the facts—FREE!

Valuable Equipment Included With Training

The new Sprayberry "package" plan includes many big kits of genuine, professional Radio-Television equipment. You perform over 300 demonstrations, experiments and construction projects. You build a powerful 6-tube 2-band radio set, multi-range test meter, signal generator, signal tracer, many other projects. All equipment and lessons are *yours to keep* . . . you have practically everything you need to set up your own profitable Radio-Television service shop.

Earn Extra Money While You Learn!

All your 10 months of training is IN YOUR HOME in spare hours. Keep on with your present job and income while learning. With each training "package" unit, you receive extra plans and "Business Builder" ideas for spare time Radio-Television jobs. New television stations everywhere, open vast new opportunities for trained Radio-Television Technicians—and those in training. If you expect to be in the armed forces later, there is no better preparation than practical Sprayberry Radio-Television training.

SPRAYBERRY ACADEMY OF RADIO

111 NORTH CANAL ST.
Dept. 25-Z, Chicago 6, Ill.

MAIL COUPON TODAY! NO OBLIGATION

I invite you to get all the facts—

FREE TO YOU 3 BIG RADIO-TELEVISION BOOKS

I want you to have ALL the facts about my new 10-MONTH Radio-Television Training —without cost! Rush 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. No obligation and no salesman will call. Mail coupon NOW!

SPRAYBERRY ACADEMY OF RADIO, Dept. 25-Z
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. Be sure to include 3 books FREE.

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

Address.....

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

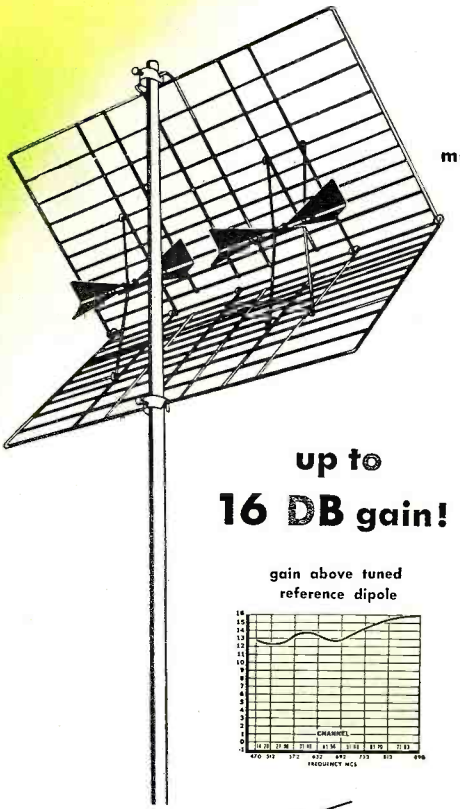
Rx for UHF's fringe areas!

CHANNEL MASTER'S all-UHF TWIN CORNER REFLECTOR

the most sensitive fringe area antenna ever developed for UHF!

- Two dipoles—actually two antennas in one.
- Provides twice the gain of any standard-type UHF Corner Reflector.
- Instantly installed in just three steps.
- Furnishes far better picture quality — at far greater distances.

  Eliminates UHF's TWIN TERRORS. Features vibration-proof construction; and "free-space" terminals.

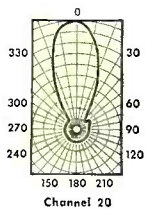


model no. 406

up to 16 DB gain!

gain above tuned reference dipole

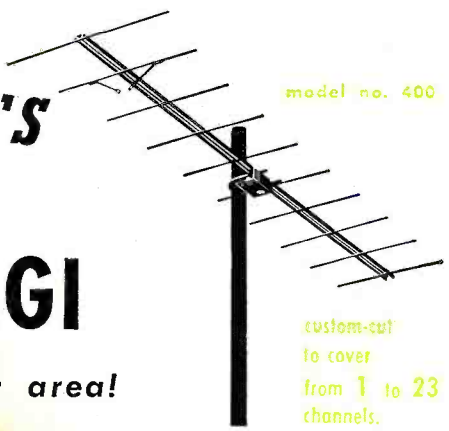
horizontal polar pattern (relative voltage)



practically no assembly necessary

CHANNEL MASTER'S 10-ELEMENT DELTA-WELD YAGI

custom-designed for your specific area!



model no. 400

custom-cut to cover from 1 to 23 channels.

CHANNEL MASTER engineering pays off on UHF!

- Elements permanently WELDED IN POSITION on crossarm.
- Custom construction — designed for almost any UHF area.
- Delta-matched dipole for excellent impedance match.
- Brilliant performance. Average gain: over 11 DB, single bay; over 14 DB, stacked. Even higher on some models.
- Eliminates UHF's TWIN TERRORS.

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.

Write for complete technical literature.

This man can save you service-time, work and money

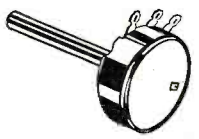
YOUR Centralab Distributor has Custom Controls for 277 major manufacturer's listing in his Centralab Control Guide. Each is cataloged for quick reference so he can fill your orders accurately and systematically.

These controls are factory-specified type equipment on practically all major radio and TV sets on the market today. They're *exact* duplicates of the original part — some even closer tolerance than specified by the original set manufacturer — produced with the same modern, precision equipment and *carrying the same Centralab guarantee.*

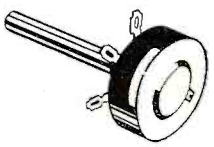
To give you an idea of the wide usage, these 277 major manufacturers use these same controls in *50,552* different applications. That's a mighty strong tribute to the performance of Centralab controls!

Remember, when you use genuine Centralab replacements, you have assurance of a lasting repair job. Because they are custom-designed, you work faster . . . make a cleaner installation . . . insure greater customer satisfaction. That's why it's a good idea to see your Centralab Distributor *first* for genuine control replacements.

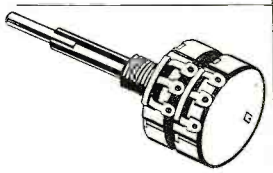
HERE ARE JUST 4 EXAMPLES OF THE WIDE USAGE OF CENTRALAB CONTROLS



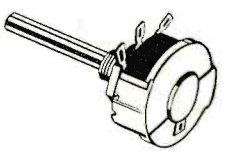
SVS-926 — Focus Control — used as original equipment by 6 manufacturers in 120 applications.



S-119 — Volume Control — installed as original equipment on sets of 5 manufacturers in 12 applications.



SBB-505 — Vertical and Horizontal Hold Control — included as original equipment in 38 applications by 4 manufacturers.



F-122 — Volume Control — 6 manufacturers use this control as original equipment in 9 applications.

Centralab
ERL

A Division of Globe-Union Inc. 910-H E. Keefe Ave., Milwaukee 1, Wisconsin In Canada, Box 208, Ajax, Ontario

Now a new synthetic helps dial telephone service

In a large, modern telephone office, two million relay contacts await the orders of your dial to clear a path for your voice. They open and close a billion times a day.

Unrolled view (one-third size) of capacitor unit wound with "Mylar." The transparent film is only 0.0005" thick yet stands handling without breaking.

AMONG the elements that guard your dial telephone service are electrical capacitors. They help prevent the formation of arcs that pit and may eventually destroy relay contacts. But millions more of these capacitors are needed each year. How could they be made less costly?

Bell Laboratories engineers, on the lookout for new materials, became alert to the possibilities of the new "Mylar" polyester film. A product of the Du Pont Company, "Mylar" is chemically the same as Du Pont's "Dacron" polyester fiber used to make fabrics. Bell engineers discovered that it also had remarkable dielectric properties—of just the right kind to help their capacitor problem.

The film takes the place of impregnated paper formerly used to separate the metal foil electrodes. It is tougher, stands more voltage and needs no impregnation. The new capacitors require no protective housing and are *much* smaller and less costly.

Here is another example of the way America's technology advances through the sharing of knowledge. Just as Bell Telephone Laboratories makes many of its discoveries—the Transistor, for example—available to other companies, so does it adapt the inventiveness of others when it can help your telephone service.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields

FAR BETTER RECEPTION

IN EVERY LOCATION

with Sensational New

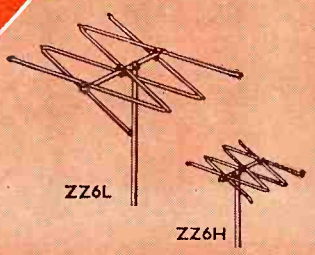
TRIO ZIG-ZAG

Patent Pending

TV ANTENNAS

SUBURBAN MODELS

Models ZZ4A and ZZ6A give you all-channel (2 thru 13) reception in ONE SINGLE BAY ANTENNA. The Model ZZ4A has excellent gain and is designed for suburban areas. Model ZZ6A has even greater gain and provides excellent all-channel reception in near fringe areas.



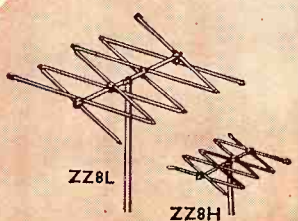
NEAR FRINGE MODELS

For near fringe area reception, the Models ZZ6L and ZZ6H are recommended. Model ZZ6L covers Channels 2 thru 6, Model ZZ6H is for Channels 7 thru 13. Both antennas offer high gain with patterns and front-to-back ratios similar to cut-to-channel yagis.

From ultra-ultra fringe to metropolitan areas, the sensational new TRIO ZIG-ZAG TV Antennas are providing clear, enjoyable TV pictures.

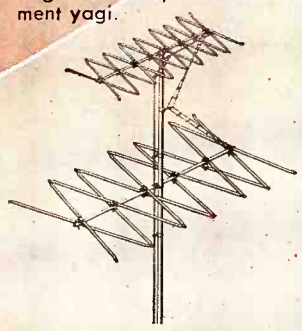
Enthusiastic reports are pouring in from across the nation, testifying to the high efficiency of the new, exclusive TRIO ZIG-ZAG TV Antenna design.

Yes, results — not mere claims — have made the TRIO ZIG-ZAG America's most wanted TV antenna!

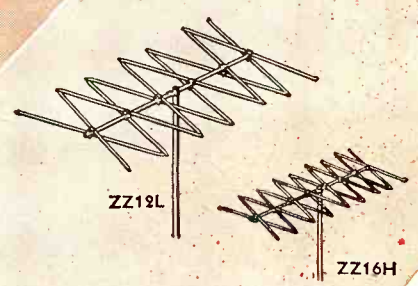


FRINGE MODELS

Models ZZ8L and ZZ8H were designed for normal fringe area reception and provide clear, snow-free pictures. Forward lobe patterns and front-to-back ratios are similar to a good single channel, multi-element yagi.



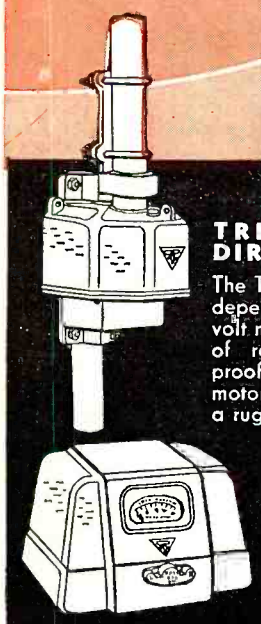
ZZ12L and ZZ16H are stacked for all VHF Channel Reception



ULTRA FRINGE MODELS

The extremely high gains of the ZZ12L and the ZZ16H models provide unequalled reception in ultra-fringe areas. Model ZZ12L covers Channels 2 thru 6 and Model ZZ16H, Channels 7 thru 13. These two models when stacked, are fed with only one 300 ohm line and provide ALL VHF CHANNEL RECEPTION. Line match is excellent and front-to-back ratios are unusually high.

** To provide even greater strength, TRIO Antennas now have stamped steel element clamps.*



TRIO ROTATOR AND DIRECTION INDICATOR

The TRIO Rotator is America's most dependable — has two powerful 24 volt motors — one for each direction of rotation. Absolutely weatherproof, permanently lubricated. All motors, shafts and gears mounted on a rugged, one-piece casting for true alignment, strength and longer life. Every TRIO Rotator fully guaranteed for two years! Beautiful Direction Indicator has "finger tip" control — no need to hold knob for rotation. A touch of the finger starts it — a touch stops it!

TRIO

TRIO MANUFACTURING COMPANY • GRIGGSVILLE, ILLINOIS

Sweeping the Country!

BUY DIRECT AND SAVE

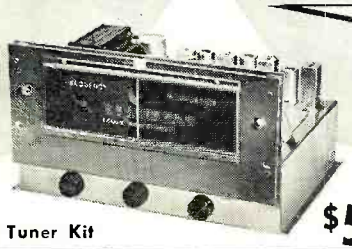
'PRE-FAB'

COLLINS TUNERS and RECEIVERS

AUDIO PRODUCTS CO.

Collins Audio Products Co. is in no way affiliated with Collins Radio Co.

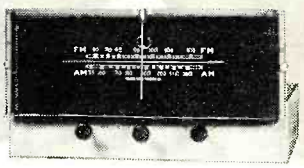
Two ALL NEW Complete Kits for Every High-Fidelity Need



FM Tuner Kit **$55**

The FM-11 tuner is available in kit form with the IF Amplifier mounted in the chassis wired and tested by us. You mount the completed RF Tuning Unit and power supply, then after some simple wiring, it's all set to operate. 11 tubes: 6J6 RF amp, 6AG5 converter, 6C4 oscillator, 6BA6 1st IF, (2) 6AU6 2nd and 3rd IF, (2) 6AU6 limiters, 6AL5 discriminator, 6AL7-GT double tuning eye, 5Y3-GT rectifier. Sensitivity 6 to 10 microvolts, less than ½ of 1% distortion, 20 to 20,000 cycle response with 2DB variation. Chassis dimensions: 12½" wide, 8" deep, 7" high. Illustrated manual supplied. Shipping weight 14 lbs.

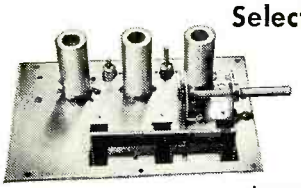
Each Collins Tuner Kit is complete with punched chassis, tubes, power transformer, power supply components, hardware, dial assembly, tuning eye, knobs, wire, etc., as well as the completed sub-assemblies: FM tuning units, AM tuning units, IF amplifiers, etc., where applicable. Since all these sub-assemblies are wired, tested and aligned at the factory, Collins Pre-Fab Kits are easily assembled even without technical knowledge. The end result is a fine, high quality, high fidelity instrument at often less than half the cost — because you helped make it and bought it direct from the factory. Bring your present reproducing system up to date with a new Collins Tuner.



FM/AM Tuner Kit **$77.50**

The original 15 tube deluxe FM/AM pre-fab kit redesigned on a smaller chassis. The tuner now measures 14" wide by 12" deep by 7½" high. This attractive new front and dial assembly opens up new applications where space is at a premium. Kit includes everything necessary to put it into operation—punched chassis, tubes, wired and aligned components, power supply, hardware, etc. Kit comprises FMF-3 tuning unit, IF-6 amplifier, AM-4 AM tuning unit, magic eye assembly and complete instructions. All tubes included. Shipping weight 19 lbs.

Selected Basic Components For Special Applications

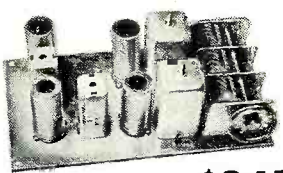


FMF-3 Tuning Unit **$15.25**

The best for FM. The most sensitive and most selective type of "front end" on the market. 6 to 10 microvolts sensitivity. Image ratio 500 to 1. 6J6 tuned RF stage, 6AG5 converter, 6C4 oscillator. Permeability tuned, stable and drift-free. Chassis plate measures 6½"x4½". In combination with the IF-6 amplifier, the highest order of sensitivity on FM can be attained. Tubes included as well as schematic and instructions. Draws 30 ma. Shipping weight FMF-3: 2½ lbs. Dial available @ $3.85

IF-6 Amplifier **$19.75**

A remarkable value! 6 tubes are used in the IF amplifier: 6BA6 1st IF, (2) 6AU6 2nd and 3rd IF's, (2) 6AU6 limiters and 6AL5 discriminator. High gain, wide-band response (200 KC) for highest fidelity. 20 to 20,000 cycles. Distortion less than ½ of 1%. Draws 40 ma @ 220 volts. Chassis plate dimensions: 11-5/16"x2½" Shipping weight: 3 lbs.



AM-4 Tuning Unit **$24.50**

Tops in AM superhet performance! A 3-gang tuning condenser gives 3 tuned stages with high sensitivity and selectivity. Assembly is completely wired, tested and aligned ready for immediate use. Frequency coverage 540 KC to 1650 KC at a sensitivity of 5 microvolts. Tubes 6BA6 RF amplifier; 6BE6 converter; 6BA6 IF amplifier and 6AT6 detector. Draws 30 ma @ 220 volts. Mounts on a chassis plate measuring 4"x7⅜". Shipping weight 2½ lbs. Dial available at $3.85.

RD-1C Tuner & Dial **$28.50**

The COLLINS RD-1C FM tuner chassis is unique in the field. A whole, compact FM tuner and dial that fits in the palm of your hand. Convert AM sets to FM/AM receivers for only a few dollars! Unlimited applications where space is at a premium. Use in conjunction with your phonograph amplifier. Full frequency response to 20,000 cycles. Sensitivity 20 microvolts, permeability tuned. Tuning unit and IF amplifier on the same chassis plate. Draws 40 ma @ 100 volts. Tubes: 6AG5 converter, 6C4 oscillator, (2) 6AU6 IF amplifiers, 6AL5 in new ratio detector circuit. Shipping weight tuner and dial 5 lbs.

MAIL COUPON TODAY

To: Collins Audio Products Co. Inc.
P.O. Box 368, Westfield, N. J.
Tel. WEstfield 2-4390

☐ FM Tuner Kit ☐ FM/AM Tuner Kit ☐ Slide Rule Dial Assembly
☐ FMF-3 Tuning Unit ☐ IF-6 Amplifier ☐ RD-1C Tuner and Dial
☐ AM-4 Tuning Unit

NAME.....

ADDRESS.....

CITY.....STATE.....

Amount for Kit $..... See weights, add shipping cost $.....

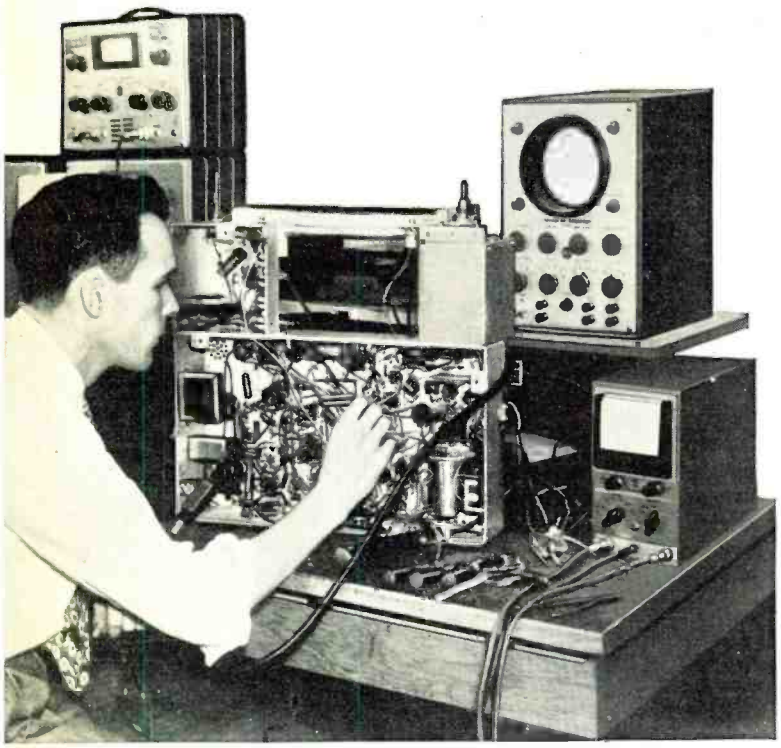
Total amount enclosed $..... Check ☐ Money Order ☐

WHEN YOU THINK OF TUNERS, THINK OF COLLINS AUDIO PRODUCTS

START ON THE ROAD TO SUCCESS
Study the RCA TV Servicing Course in your spare time

ARE YOU SATISFIED with the position you now hold? Do you feel you're worth more money? Are you pleased with yourself, your work, your associates . . . and your future? What does the next year hold for you . . . and the year after that?

Are you content merely to plod along through the best years of your life . . . or do you want to get into more pleasant work . . . hold a well-paid job . . . perhaps establish your own business?



If you are looking for a REAL opportunity . . . If you want to GROW with a GROWING INDUSTRY . . . If you want to grasp the success that should be yours, *then we say to you, study TV Servicing.*

Everyone knows that Television is the fastest growing industry today. Opportunities are going begging for men who have the training and ability to grasp them. Now *is the time to start on the road to success in TV Servicing.*

Study at Home in your spare time

The RCA Institutes Home Study Course in TV Servicing is easy to learn. You progress rapidly, step by step, as you learn the procedure of servicing and trouble-shooting TV receivers and installing TV antennas. Hundreds of pictures and diagrams help you understand the how-it-works information and the how-to-do-it techniques.

A Service of Radio Corporation of America

The RCA Institutes TV Servicing course was written and planned by instructors with years of specialized experience in training men. You get up-to-the-minute information, too, because you study right at the source of the latest developments in Television. Your lessons are carefully examined and accurately graded by competent teachers who are interested in helping YOU to succeed.

RCA Institutes is licensed by the University of the State of New York . . . an affiliate member of the American Society for Engineering Education . . . approved by leading Radio-Television Service Organizations.

It costs so little to gain so much

RCA Institutes makes it easy for you to take advantage of the big opportunities in TV Servicing. The cost of the TV Servicing Home Study Course has been cut to a minimum. You pay for the course on a pay-as-you-learn unit lesson basis. *No other home study course in TV Servicing offers so much for so little cost to you.*

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.*

SEND FOR FREE BOOKLET—Mail the coupon—today. Get complete information on the RCA INSTITUTES Home Study Course in Television Servicing. Booklet gives you a general outline of the course by units. See how this practical home study course trains you quickly, easily. Mail coupon in envelope or paste on postal card.

MAIL COUPON NOW!

RCA INSTITUTES, INC., Home Study Dept. RN853
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.)

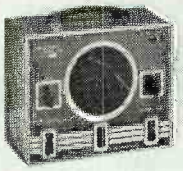
Name_____
(please print)

Address_____

City_____ Zone_____ State_____

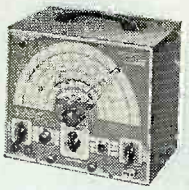
RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.

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

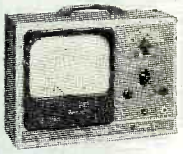


145K SIG. TRACER
KIT $19.95 WIRED $28.95

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

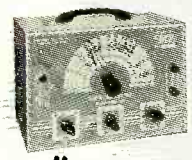


360K SWEEP GEN.
KIT $34.95 WIRED $49.95



New 214K VTVM KIT
$34.95 WIRED $54.95

OVER 1/4 MILLION EICO INSTRUMENTS in use the world over!

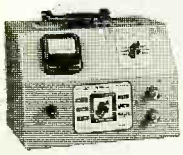


New 377K SINE & SQUARE
WAVE AUDIO GEN. KIT $31.95
WIRED $49.95

New 536K MULTIMETER
KIT $12.90 WIRED $14.90
1,000Ω/v; 31 ranges

EICO new modern facilities for research, development and production—your greater assurance of . . .

LABORATORY PRECISION AT LOWEST COST



1040K BATTERY ELIM.
KIT $25.95 WIRED $34.95

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

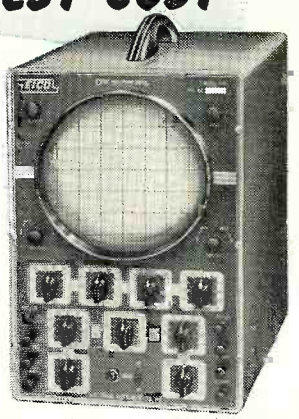
625K TUBE TESTER
KIT $34.95 WIRED $49.95

CRA PIX TUBE ADAPTOR
for Tube Tester $4.50

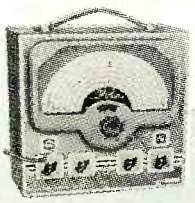
New 565K MULTIMETER
KIT $24.95 WIRED $29.95
20,000Ω/v; 31 ranges

NEW 7" Push-Pull OSCILLOSCOPE

● **V Ampl:** Resp. 10 cps — 1 mc ± 2 db; Sens. 10 mv rms/in. ● **H Ampl:** Resp. 10 cps — 200 kc flat, −4 db at 500 kc; Sens. 0.3 volts rms/in. ● **V Input:** 3-step freq.-compensated attenuator plus cathode follower; 3 meg Z. ● **H Input:** Cathode follower; 1 meg Z. ● **Both V & H Ampls:** push-pull output. ● **Sweep Range:** 15 cps — 100 kc. ● **Sync:** + INT., − INT., EXT., & 60 cps. ● **Distortionless** V & H Trace Expansion & Centering to 1.5 X full screen. ● **Features:** Return trace blanking; int. volt. calibrator; phasing control; direct connection to V plates of CRT. ● **At Front Panel:** sawtooth, 60 cps outputs; intensity mod. & ext. sync inputs. ● **10 tubes** (6 dual-purpose) & 7JP1 CRT.



470K KIT $79.95 WIRED $129.50



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

221K VTVM KIT $25.95
WIRED $49.95

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

HIGH VOLTAGE
PROBE $6.95

You Build *EICO* Kits in One Evening, but . . . They last a Lifetime! and You SAVE OVER 50%

YOU be the judge. See the famous EICO line TODAY — in stock at your local jobber — and SAVE!

Write NOW for FREE newest Catalog R-8.

America's greatest instrument values bear the name—

EICO

NEW!

MODEL 495-K SCOPE VOLTAGE CALIBRATOR
KIT $12.95 WIRED $17.95

ELECTRONIC INSTRUMENT CO., Inc., 84 Withers Street, Brooklyn 11, N. Y.

Reg. U.S. Pat. Off.

Prices 5% higher on West Coast. Specifications and prices subject to change without notice.

FILM FOR TV

By
HENRY J. SEITZ, S.M.P.T.E.

As production costs continue to spiral, more and more of your favorite TV programs will come to you on film.

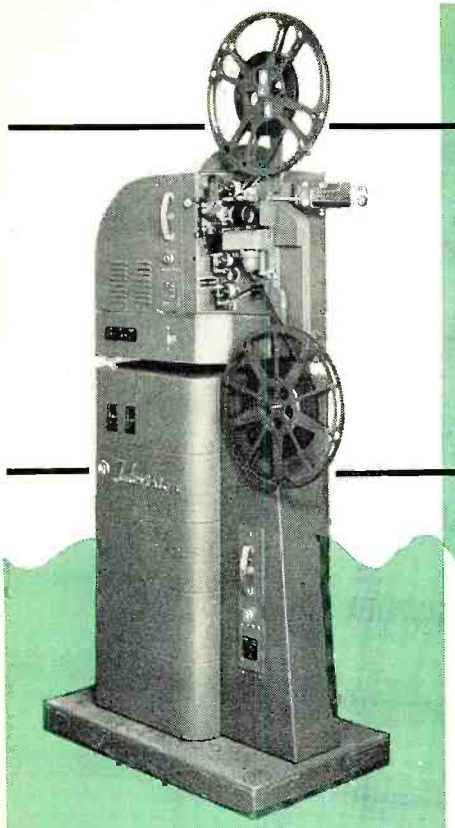


Fig. 1. Over-all view of the 16 mm television film projector designed and built by Radio Corp. of America.

IT IS an obvious conclusion that motion picture films are destined to play an increasingly important role in the future of television. To effectively demonstrate their products at lower cost and at the same time maintain standards comparable to live studio pick-up, alert business executives are turning towards the medium of film advertisement.

An ever increasing footage of commercial film flows daily out of processing laboratories. Kinescope recordings in New York City alone, according to a well-known trade publication, reach 2,000,000 feet per week. The techniques of laboratory quality control are most rigid wherever television is directly concerned.

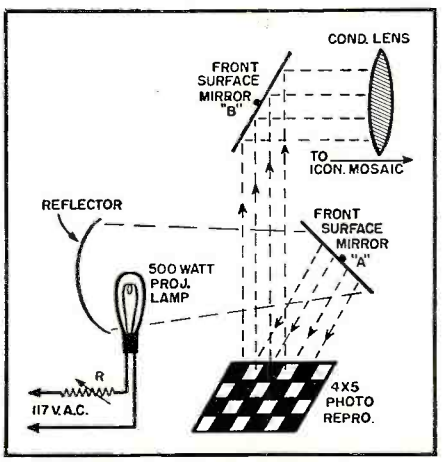
Today phrases like "gamma," "print density" and "tonal gradation" appear in conversation with TV broadcast engineers. It would seem that a creeping technical revolution is slowly taking place, wherein tomorrow's technician must not only be well versed in electronics but in the art of photography as well. Some of the larger advertising agencies, as a matter of fact, employ skilled consultants whose job is to integrate the medium of film to that of television.

In lieu of moving pictures, advertisers will often employ pictorial stills or "telops" as they are sometimes called. (Fig. 2) These may be similar to standard 4x5 photo reproductions. In other cases a slide transparency may be used. Various effects such as dissolves, superimpositions, and even emergency transmission of the TV station's test pattern can be achieved by using either of these devices. A dissolve-to-black, for instance, may be obtained by slowly cutting off the 500-watt lamp filament supply. (See Fig. 2)

Kinescope recording or the filming of moving pictures from the face of a special CRT offers unlimited horizons. In effect it conveniently satisfies the U.S. time zone differences. A hit show that begins at 8:00 p.m. New York time will hardly be acceptable to Californians, where it is only five o'clock in the afternoon. By kinescoping the live show and presenting it over the station's film facilities later in the evening, the sponsor's product is thereby advertised to a West Coast audience.

As an effective transducer for converting film images into their electrical equivalent, the iconoscope (Fig. 3) is presently among the most popular. Its grey scale response has a curve that closely approximates that of the average home television receiver. Furthermore film camera control operators favor the "Ike" because video gain riding is reduced to two major operating controls, namely, gain and pedestal. (Fig. 9)

Fig. 2. How the "telop" device is used to transmit static images in television work.



In this fashion shading problems are reduced to a minimum and necessary critical adjustments can be performed quickly and effectively. Except for ordinary routine maintenance, the iconoscope requires little attention once it has been correctly aligned.

Modern innovations like edge- and back-lighting, have reduced to a minimum certain drawbacks that were prevalent when iconoscopes were first employed. Many old time viewers will undoubtedly recall the anguish experienced whenever their celluloid hero disappeared into the flare at the viewing tube's edge, only to emerge later showered by secondary electrons. In those days the "Ghost Rider" really lived up to his name.

Before proceeding any further, certain basic characteristics of film might well be investigated. For example, an outdoor scene may register a brightness contrast (the ratio between the brightest and darkest values) of 150 to 1 or higher between the bluish light of the sky and the darkest of shadows. The human optical mechanism accounts for an adaptation of about 100 to 1. A theater-type motion picture projector is capable of yielding a screen brightness of 40 to 1. With home TV receivers approximating only 25 to 1, it can readily be seen that film quality is of paramount importance.

To effectively reproduce a good grey scale or tonal gradation between the highlights and shadows, print density should conform to certain basic standards. This, in turn, depends upon a sequence of factors that may well include (*a*) the photographic negative original; (b) laboratory processing, and (*c*) the final printing. Whether 16 or 35 mm, if the release or final print is able to reproduce many delicate shades of grey, it is called "low contrast" film.

On the other hand, films of "high contrast" (contrasty) are extremely black and white. Having little or no grey scale, the end result is a rather harsh picture and one lacking in fine detail. The measure of contrast is in-

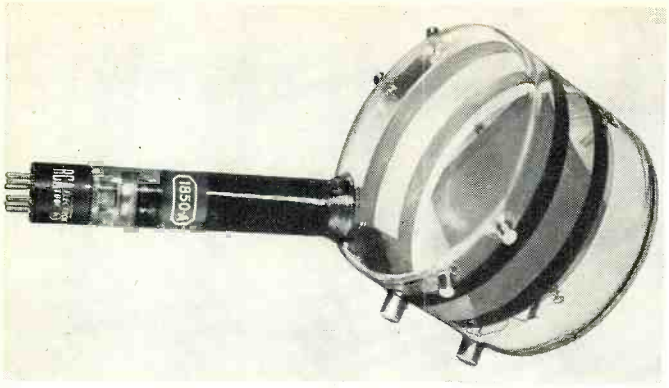


Fig. 3. Over-all view of RCA's Type 1850A iconoscope tube.

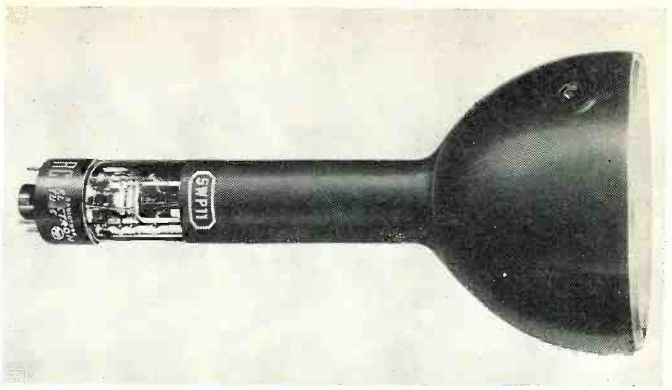


Fig. 4. RCA's 5WP11 transcriber kinescope for TV film work.

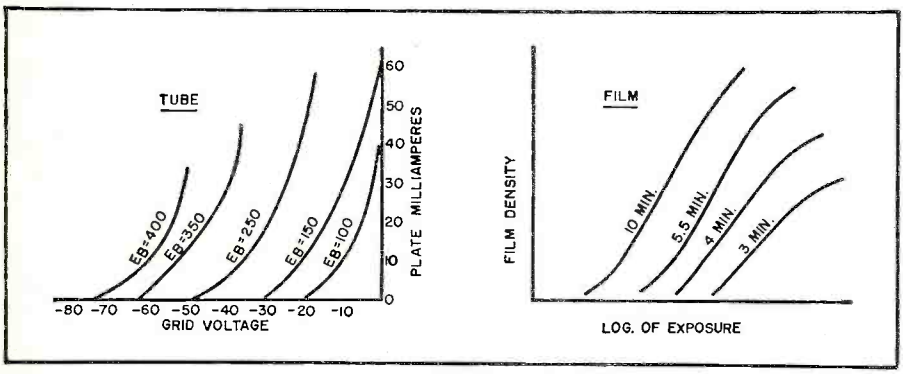


Fig. 5. Demonstrating the similarity between tube and film characteristic curves.

dicated by the letter γ (gamma) of the Greek alphabet.

Film also possesses its own series of characteristic curves remarkably similar to those of vacuum tubes with which we are all familiar. (Fig. 5) However, instead of E_g, E_b being the determinant factors, sensitometry makes use of the relationship between the two variables, exposure and density. Since tubes fall into specialized groups (sharp cut-off, high mu, etc.) it conveniently follows that many types of film stock having countless variations (coarse grain, fine grain, slow speed) are also obtainable.

It can readily be seen that any decrease in light transmission caused by dense or contrasty film, will tend to limit iconoscope action to the lower portion of its own characteristic curve. (Fig. 11) Consequently flare, graininess, and noise have a tendency to be accentuated. Noise acts to prevent the transmission of higher frequencies, so necessary to a sharp, snappy picture.

Obviously the best means of overcoming noise is to maintain a high signal-to-noise ratio. In the *RCA* unit preamplifier special attention is given to the critical film camera input stage. A *Western Electric* 417A dual miniature triode is used. The transconductance (G_m) of this amazing little tube is about 25,000. If we remember our musty classroom texts, ordinary run-of-the-mill triodes fall within a range of only 200 to 5000 micromhos!

This tube, when used as a cascode-type input feeding a 6J6 output (Fig. 8), vastly enhances iconoscope performance. The over-all gain is about three times that of the earlier 6AK5 which was 8. The heater operation is d.c. In addition, low inductance bypass condensers are inserted in the filament circuits. Sixty-cycle problems are thereby eliminated.

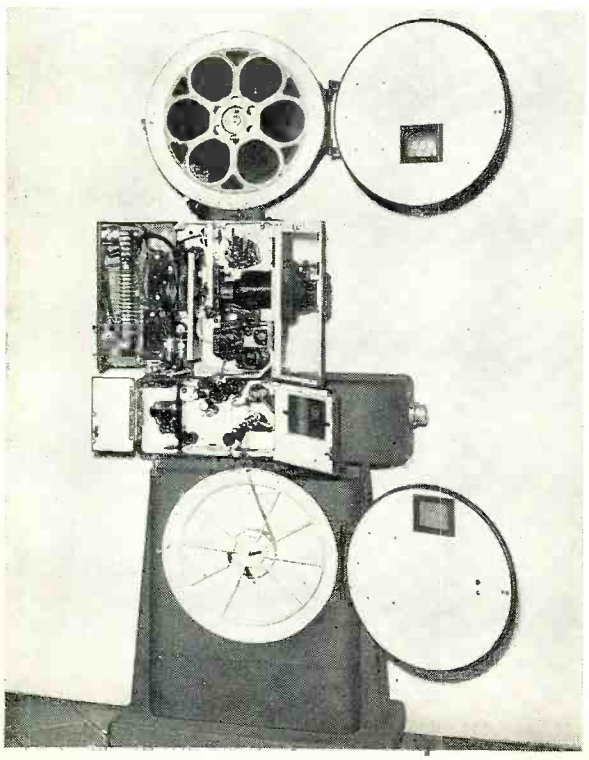
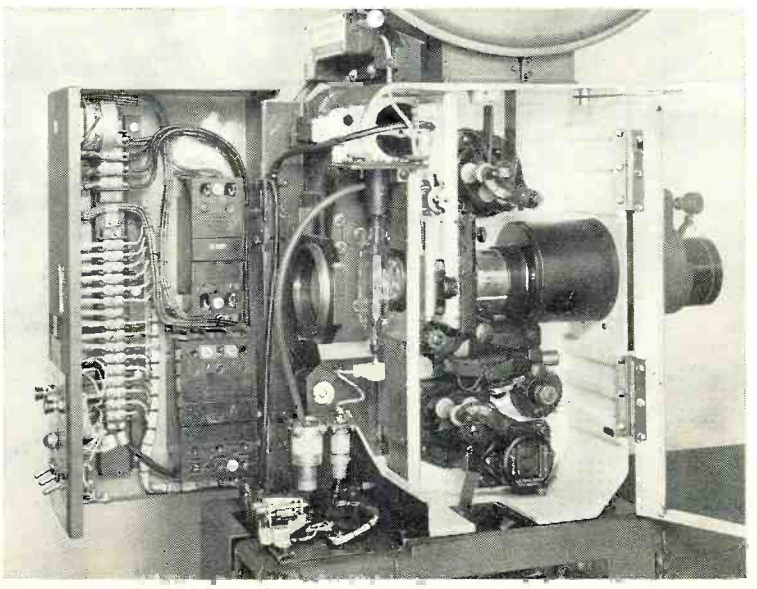


Fig. 6. Radio Corporation of America's TP-35B 35 mm television film projector unit. The intermittent is a three-sided Geneva movement driven by a specially-designed synchronous motor.

Fig. 7. One of the newer type pulsed light film projectors made by RCA. This machine eliminates the need for a shutter and is available in both 16 and 35 mm sizes for television film work.



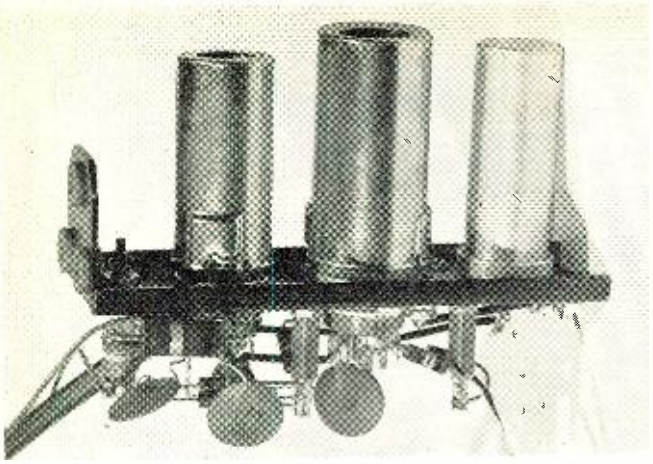


Fig. 8. Cascode preamp using the W.E. 417A (the middle tube).

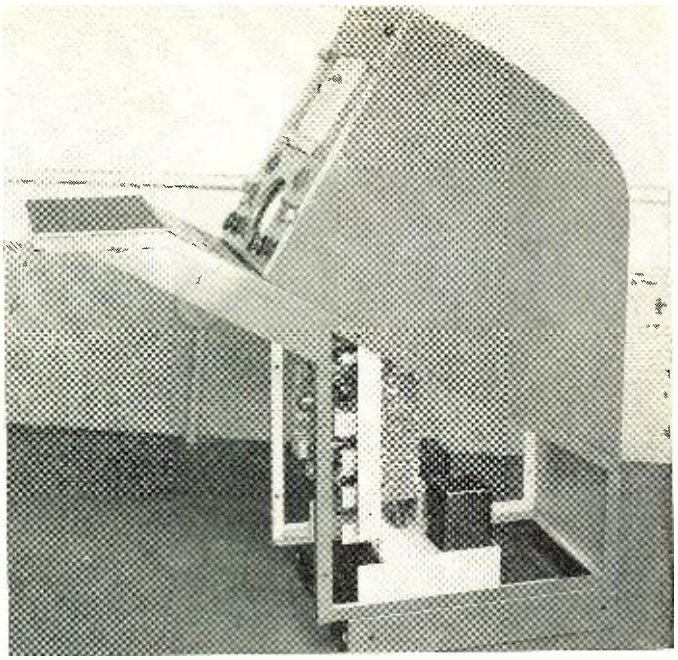


Fig. 9. RCA's new TK-20A film camera control which consists of a console desk section with a control chassis mounted in lower compartment and camera monitor mounted in upper part. A picture amplifier fed by the preamp in the camera, pulse line amplifiers which feed driving signals from the studio sync generator to the camera and monitor, shading signal generators, and several associated camera controls are included in chassis.

Since no subject is more frequently misunderstood, the conversion of moving picture film rate to conform to television standards requires some explanation. Fortunately a standardized projection rate of 24 frames or pictures-per-second holds for both the 16 and 35 mm systems.

In most 16 mm systems (Fig. 10), the projected light illuminating the film is momentarily interrupted by a notched rotary disc called the shutter. This permits the projector's film pulldown mechanism to operate while the screen is dark. Since the next successive film frame now rests in the film aperture, the intense light beam will easily pass through it whenever the notch and beam coincide.

In effect, each frame is projected either two or three times. However, since the entire action takes place in such a rapid sequence, (7.2 inches-per-second for 16 mm) the eye is tricked into believing that it sees a continuous motion of fast moving images.

Since the frame rate for television is 60 fields interlaced to produce 30 complete pictures-per-second, some means must be utilized to compensate for existing frame differences. Standard projection rates, as it was previously mentioned, consist of 24 frames-per-second. We have, therefore, a ratio of 5 to 4 to satisfy. In other words two frames of motion picture film will require the same amount of time as five TV fields or 2.5 TV frames. Therefore by flashing and scanning one film frame twice and the other three times, the difference in frame rate is conveniently satisfied.

Moving pictures consist of a series taken at a 24 frame-per-second rate. Each frame pauses a fraction of a second while being exposed. Conversely, the same principle applies in projection. Television film projectors, on the other hand, employ an intermittent movement. Film advancing mechanisms in the latter type are categorized as 2 to 3 intermittents.

In the *RCA* TP-35B (Fig. 6) the intermittent is a three-sided Geneva movement driven by a synchronous motor. This pulls the film down at unequal time intervals (2:3). Thus a combination of mechanical motion plus iconoscope storage and scanning synthesize to produce television moving pictures—a tribute to engineering ingenuity.

In a typical TV 16 mm system, (Fig. 1), a rotary shutter synchronized at 3600 rpm interrupts the projected light 60 times per second. The shutter is so designed that each flash lasts 1/1200th of a second. By accurately timing these flashes and causing them to fall within the system's vertical blanking period of 1270 microseconds, we impress upon the iconoscope's mosaic information which is then scanned and converted into a video signal.

As will be seen from Fig. 12 these intense bursts of light occur only before or after pulldown. In effect this prevents "travel ghost," a most unpleasant phenomenon, caused by non-synchronous action in the projector's shutter operation. The newer type of pulsed-light machine eliminates the need for a shutter and is available in both the 16 and 35 mm sizes (Fig. 7).

These light flashes coming from the projection lamp must at all times coincide or "lock-in" with the system's vertical blanking interval. Accurate synchronism is maintained by using a common source of a.c. for both the TV station's sync generator and the film projector motors. In addition synchronous type motors are used throughout.

Television recording or the transcribing of images by photographic means sounds complex, however when reduced to its basic fundamentals it practically amounts to no more than a reversal of preceding film techniques. Instead of 24 film frames being converted to 30 pictures-per-second we now work backwards to convert 30 TV pictures to 24 film frames.

The cathode-ray tube, a 5WP11, from which the pictures are taken is one of high resolution and short persistence (Fig. 4). In comparison

(*Continued on page* 130)

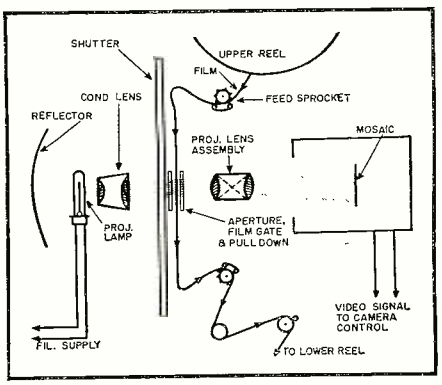
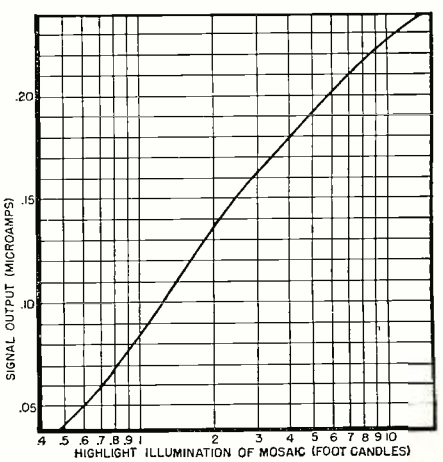
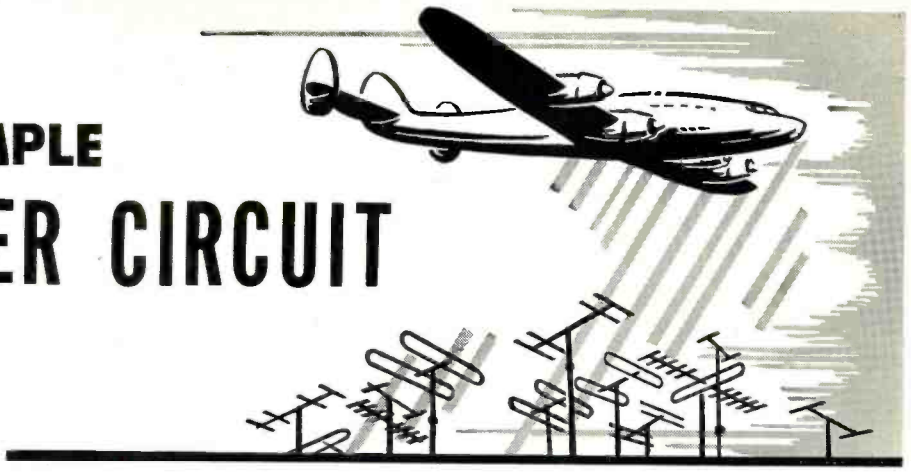


Fig. 10. Typical 16 mm TV-type film projector.

Fig. 11. Iconoscope characteristic curve (1850A).



A SIMPLE ANTI-FLUTTER CIRCUIT



By **JOHN K. FRIEBORN**

This simple British TV circuit may be used in U.S. receivers to eliminate airplane picture flutter.

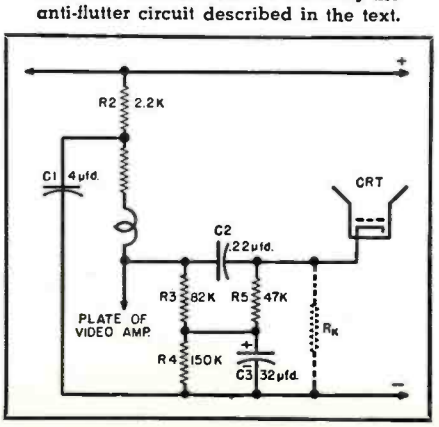
MANY television set-owners have no idea what the effects of airplane flutter look like. A few, who live near airports, hardly know what a television picture would look like without these effects — unless their receivers contain some circuit to reduce them. Most recent American television receivers incorporate automatic gain control circuits which are "keyed" specifically to reduce one of the effects of airplane flutter. Keyed a.g.c. circuits are relatively complex; they require the addition of one tube and several other components to the receiver. Recent 21-inch *HMV* (British) television receivers use a simpler circuit which accomplishes about the same thing.[1] The fact that the circuit and several related ones are covered by a 1951 British patent[2] may or may not account for the fact that nothing of the sort seems to have been used by any American manufacturer in place of a keyed a.g.c. circuit.

Airplane flutter is the name given to the combination of effects on the television picture when a signal reflected from a moving aircraft is combined in the receiver with the direct signal from the station. There are two main effects: first, a "ghost" picture is produced and second, there is a fluctuation in the over-all average brightness of the screen. By using an extremely directional antenna, both effects can be reduced, unless the aircraft is nearly the same direction from the receiver as the transmitter. If a sufficiently directional antenna is impractical, appropriate receiver circuits can at least reduce the amount of brightness fluctuation.

A reflected signal may be in-phase with the direct signal and add to it or out-of-phase and subtract from it. The exact phase relation will depend upon the difference between the times taken by the signal to travel over the direct and reflected paths. If the time difference is exactly enough to allow the r.f. signal to complete a whole number of cycles, the two signals will be in-phase, although they may have slightly different instantaneous modulations. The modulation of the reflected signal, which travels for the longer time, corresponds to an earlier part of each line in the original picture. Therefore, the modulation corresponding to a certain point on the original scene appears later (that is, farther to the right) in the ghost image than in the direct signal image. If the time difference between the two paths is exactly enough to allow a whole number of cycles of the r.f. signal and one-half cycle more, then the signals are out-of-phase and the resultant is generally (neglecting difference in modulation) less than the amplitude of the direct signal alone.

If the signal is reflected from a moving object, such as an airplane, the combined amplitude is increased, decreased, and then increased again, possibly several times. This variation in signal strength results in a variation in the brightness of the reproduced picture on any receiver which can follow these changes in the d.c. component of the video signal. The frequency of the brightness fluctuations depends upon the speed of the aircraft, its position and direction of flight with respect to the transmitter and receiver, and the frequency of the r.f. carrier. A typical range of frequencies under different conditions and on different v.h.f. television channels is from 0.1 to 40 cycles-per-second. The most rapid variations are masked by the persistence of the picture tube phosphor and persistence of vision of the eye, while the slowest variations are not particularly objectionable. The frequency range of objectionable fluctuations may be from approximately 0.5 to 10 cycles-per-second.

Fig. 1. Partial schematic of the British HMV 21-inch receiver showing the anti-flutter circuit described in the text.



Since the fluctuations in brightness are caused by variations in signal strength, one obvious solution to the problem is to keep the signal strength constant by means of an automatic gain control circuit. It should be noted that it is the peak amplitude of the signal which is kept constant by an ideal a.g.c. circuit, so that variations in the average signal strength due to variations in the average brightness of the original scene are reproduced at the receiver. Compensation for such rapid variations in signal strength as those caused by airplane flutter requires a short time constant in the automatic gain control circuit. However, the shorter the time constant in the a.g.c. circuit, other things being equal, the more the circuit is affected by noise. One method of reducing the effect of noise while retaining the short time constant is to key the a.g.c. circuit on for short periods of time and key it off for long periods in between. A keyed a.g.c. circuit is, of course, affected only by the noise which occurs during the small fraction of the total time when it is keyed on. Keyed a.g.c. is an effective solution to the problem of airplane flutter (or at least to the brightness-fluctuation part of the problem), but it *is* complicated.

A different approach to the problem is based on the fact that the fluctuations in brightness are, in effect, spurious video signals of very low fre-

quencies. One simple way to eliminate these very low video frequencies is by using capacitive coupling in the video amplifier and omitting d.c. restoration. This method has two related disadvantages: first, the average brightness is the same for every scene, regardless of what it was originally and second, with the average brightness constant, the blanking level varies, so that additional blanking circuits are necessary to keep the retrace lines from becoming visible occasionally.

The method used in the *HMV* receiver mentioned at the beginning of this article reduces the d.c. component about 50%, but it reduces the amplitude of the most objectionable flutter frequencies much more. A partial schematic diagram of the receiver is shown in Fig. 1. This circuit provides a boost of extremely low-frequency and d.c. components of the video signal in the plate circuit of the video amplifier, by means of R_2 and C_1, then two separate paths for the video signal from the video amplifier plate to the picture tube cathode. The a.c. components of the signal (frequencies from 50 cycles up, under the British standards) are transmitted through C_2 without much loss. The d.c. component is boosted almost 50% by R_2, then applied through R_3, R_4, and R_5, to R_k, the cathode input resistance of the picture tube. The net transmission is said to be about 55%, which would mean a value for R_k of about 140,000 ohms. At one cycle-per-second, the transmission *via* both paths is reduced so that the combined transmission is only about 9%. The overall transmission characteristic is approximately as shown in Fig. 2. This graph shows that the attenuation is considerable over the entire band of frequencies involved in airplane flutter.

A theoretical disadvantage of the circuit of Fig. 1 is that very rapid changes in the average brightness of the original scene would not be realistically reproduced, but such rapid changes hardly ever occur. Probably most people living near airports would be willing to sacrifice perfect reproduction of an occasional lightning flash on a television program in order to have a simple method of reducing airplane flutter.

Many American television receivers which do not have keyed a.g.c. could be modified to incorporate anti-flutter circuits of this type. Several observations can be made which would save some "cut-and-try" time for experimenters wishing to make such modifications.

First, since the circuit is basically a bandstop filter, it may be thought that circuits such as the Wien bridge, the bridged-T, or the parallel-T would be better, since they give almost no output at all at their null frequencies, whereas the original circuit does transmit 9%. The greater attenuation might be desirable, but these circuits have bandwidths less than the one in Fig. 1, so that they may not be effective over as wide a range of flutter frequencies. Also, they require more components.

Second, the original circuit was found to be satisfactory in a receiver tuned to the London television channel, a frequency of less than 50 megacycles. The highest American v.h.f. channel being more than four times as high in frequency, American receivers could be subject to flutter frequencies more than four times as high as those for which the original circuit was found to be effective. The best compromise for all of our channels probably would be obtained with a time constant approximately twice as high as the original, that is, a frequency of maximum attenuation of about two cycles-per-second, instead of one.

Third, it may be desirable to transmit the d.c. component without the 45% loss. This can be done by increasing the values of R_2 and R_4 in Fig. 1. The limit of increasing R_4 would be to make it infinite (that is, an open circuit—omit it altogether). We would still have some resistance effectively in parallel with C_3, the leakage resistance of the condenser, which would reduce the d.c. component of the video signal slightly.

Fourth, if the anti-flutter circuit is used in a receiver which has d.c. reinsertion, it must follow the d.c. reinserter; otherwise, the d.c. re-inserter will cancel out the effect of the anti-flutter circuit. This fact makes it a bit difficult to use the circuit in receivers which have any type of d.c. re-insertion except that based on video amplifier grid-leak bias.

Fifth, the effects of the resistors in the network on the d.c. potentials on the picture tube must be taken into account and compensated for if necessary.

Sixth, the values of the components must be suitable to the impedance level at the point in the receiver where the circuit is to be inserted.

Seventh, the wiring must be carefully done in such a way as to add a minimum of shunt capacitance to the video circuit, as excessive added capacitance would disturb the original high-frequency compensation.

Two typical examples of receivers which can be modified to include this anti-flutter circuit without too much difficulty are shown in Figs. 3 and 4. The component values given in the modified circuits are tentative and may have to be adjusted in a particular receiver to restore the original picture tube potentials or to give maximum reduction of the flutter frequency which is found most troublesome in a particular location.

The *Majestic* Series 106 TV receivers use a diode a.g.c. circuit, grid-leak bias d.c. re-insertion, and grid drive to the picture tube. Modification of this circuit consists simply of inserting the new components between the peaking coils and the grid of the picture tube, see Fig. 3, paying attention to the caution about wiring capacitance given previously.

Fada TV receiver Model S7C20 uses

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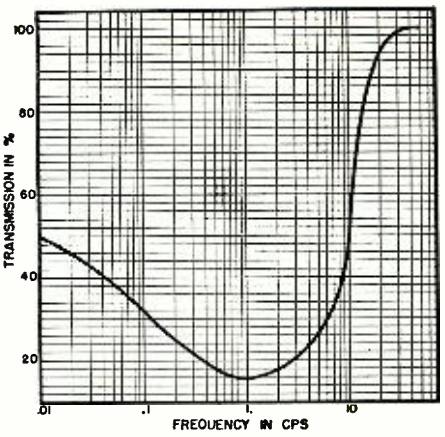


Fig. 2. Low-frequency transmission characteristic of the circuit in Fig. 1.

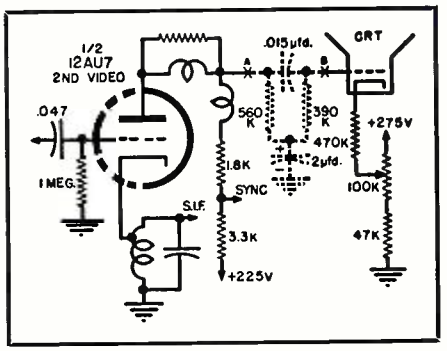


Fig. 3. Partial schematic of the Majestic Series 106 TV receiver showing (dotted) the modification to eliminate flutter.

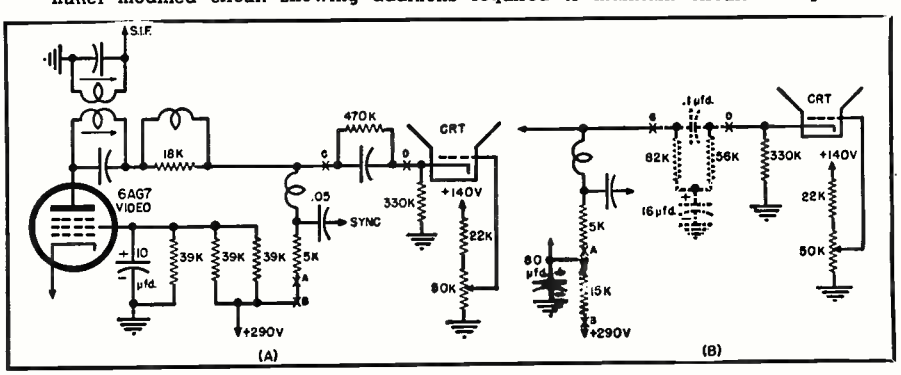
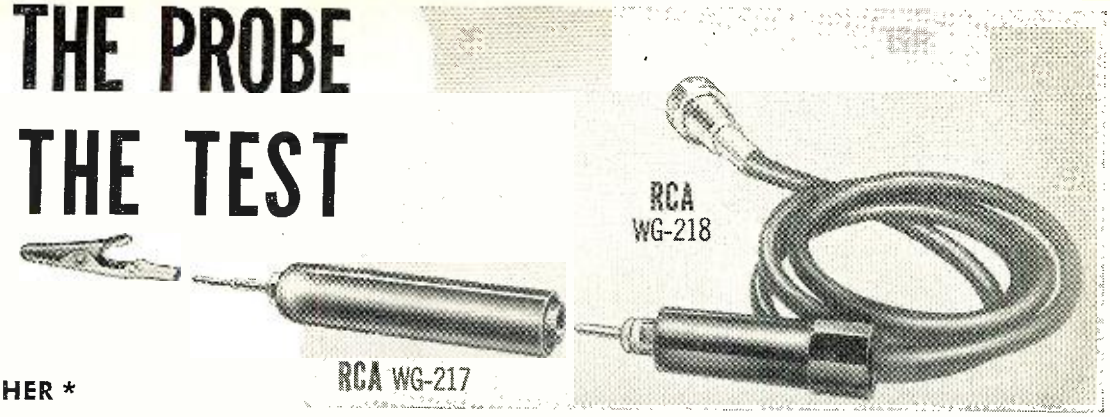


Fig. 4. (A) Original video circuit of the Fada Model S7C20 TV receiver. (B) Anti-flutter modified circuit showing additions required to maintain circuit voltages.

CHOOSE THE PROBE TO FIT THE TEST

By
ART LIEBSCHER *



(Left) The RCA WG-217 isolating probe for d.c. voltage measurements. (Right) Direct WG-218 unit which is used for low-frequency a.c. voltage measurement.

The scope or v.t.v.m. probe you select will affect the test results obtained. Here are pointers on choosing the right one.

IN THE servicing of modern electronic devices, accuracy of measurement is the prime requisite for fast, positive analysis of circuit performance.

Under ideal circumstances, a test instrument would measure the full voltage in any electronic circuit. The instrument would have infinite input resistance and zero shunt capacitance; therefore, it would not cause any detuning, produce any alteration of waveform, nor develop any other detriment to normal operation of the circuit being tested.

From a practical viewpoint, however, it is well recognized that the contact of any measuring device has its immediate effects on the operation of an electronic circuit. Depending on the type of circuit being tested, the actual degree of this effect may vary from negligible shunting to susceptibility to the very approach of a test prod.

While some small amount of power from the circuit must be shared with the resistive input of the testing facilities, those facilities which hold power-sampling requirements to a minimum consistent with stability and accuracy most nearly approach the "ideal." Where high-frequency circuits are concerned, the detuning caused by test prod and cable capacitance is often more serious than the resistive loading problem. Together, these problems so complicate the measurement of electronic circuits as to require complete departure from the use of low-impedance, unshielded test instruments with open-wire test leads. Coping with any one problem leads to a train of problems, each of which must be fully solved to insure accurate and stable readings.

Resistive loading can be minimized by the use of high-impedance electronic measuring instruments. The circuits in such instruments, however, are not normally designed to discriminate between all of the desired and undesired potentials to which they are subjected. Therefore, they must be shielded from extraneous electrostatic and electromagnetic fields which would introduce hum, noise, and other unwanted interference. For this reason, the majority of vacuum-tube voltmeters and oscilloscopes are equipped with metal cases. But the problem of shielding does not end with the case alone, for there must be an electrical link between the point of circuit measurement and the test instrument. This link, in the form of a test lead, must also be shielded. If the test lead is viewed as an extension of the electronic measuring circuit contained in a shielded test-instrument case, the logic of shielding the test lead right up to the tip of the test prod becomes obvious.

Unshielded test leads are sometimes responsible for obscure effects which hinder measurement accuracy. A test lead often acts as an antenna in picking up the signal from one circuit and re-radiating it to another circuit in the device being tested. In this way cross-coupling is established between normally shielded sections of a receiver or other electronic device, even to the extent that regeneration or oscillation occurs.

Although test-lead shielding serves to exclude interference, it increases circuit loading at high frequencies because the capacitance of the shielded wire lowers the effective input impedance of the measuring instrument. However, the capacitance added by the shielded lead is fixed and remains unchanged irrespective of the position or movement of the lead.

The effect of added capacitance can be removed and the smaller loading effect characteristic of open-wire test leads restored through the use of a low-capacitance test probe in conjunction with the shielded lead. The reduction in capacitance, however, is accompanied by a loss in signal voltage entering the test instrument. Low-capacitance probes, therefore, are designed to increase the input resistance of the test instrument. When the signal loss in the probe is regained by amplification in the test instrument, the desired qualities of high input impedance, freedom from interference, and minimum circuit loading are obtained.

Probes, originally used as test prods and intended for convenience in handling the ends of flexible test leads, have now become housings for various circuit components. These components are often required at the point of test contact for least disturbance to the circuit and for maximum efficiency in supplying measurable currents through the test cable to the instrument. Input specifications for test instruments should, therefore, be specified *at the probe,* if they are to represent the true conditions of test application. Panel input terminal specifications are meaningless where test cables must be added to make use of an instrument, for it is as impractical to do without the cable as it is to hold the entire instrument against the circuit being tested.

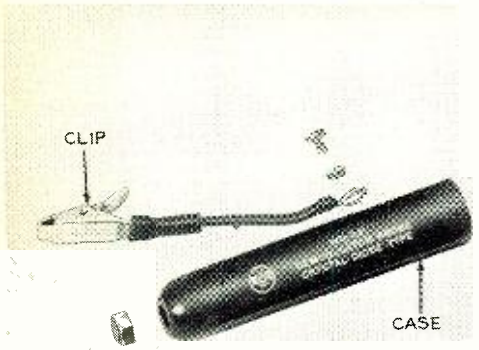
While many electronic test instruments are now equipped with shielded cables, only a few have input cables which are designed for use with a number of different probes. The *RCA* WG-218 direct probe and cable accommodates four varieties of slip-on probes which are now available. Having assorted and quickly interchangeable probes is like acquiring additional instruments.

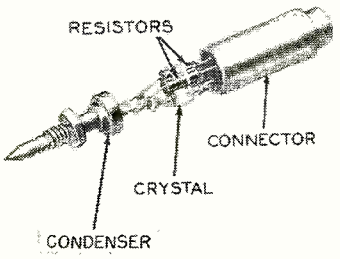
In order to become familiar with the application of various types of probes now commercially available, it is well to consider them first by functional classification. The major classifications are: direct probes, low-capacitance probes, isolating probes, rectifying probes, and multiplying probes.

Direct Probes

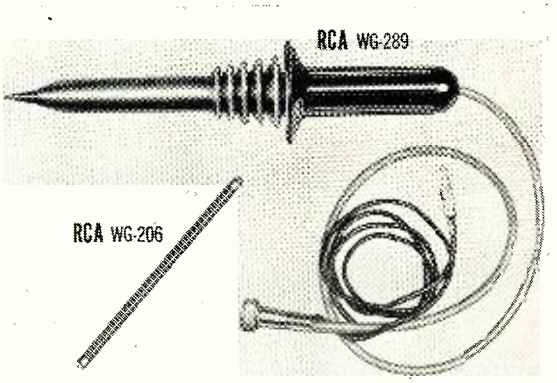
The *RCA* WG-218 direct probe and

* Formerly Test Equipment Specialist, Tube Dept., Radio Corporation of America, Camden, New Jersey





The RCA Model WG-291 demodulator probe of the crystal diode type. See text for details on the various circuit applications for this probe.



WG-289 high-voltage probe with auxiliary WG-206 unit. Latter unit is added to probe to provide required voltage division.

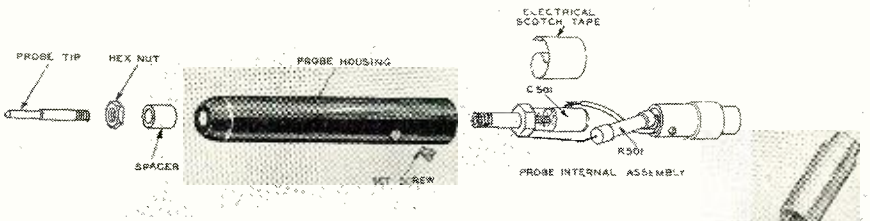
cable is a "straight-through" connection-type test probe attached to a single-lead shielded cable. It possesses the normal electrical characteristics of the cable itself. This probe and associated cable have been standardized for use with *RCA* oscilloscopes and "VoltOhmysts," their principal application being for the transfer of electrical information from a circuit (or slip-on probe) to the input connector on the instrument. When used with *RCA* "VoltOhmysts" and oscilloscopes, this cable provides an over-all input capacitance of approximately 80 $\mu\mu$fd. Because the maximum frequency range of the cable-and-instrument combination varies inversely with the impedance of the voltage source, it is impractical to state one maximum frequency limit. In general, all low-frequency voltages, even those with complex waveforms, can be measured in both low-impedance and high-impedance circuits. Accurate measurement at higher frequencies is limited to lower-impedance circuits.

The direct probe and cable cannot be used in the accurate measurement of voltages of complex waves or pulses having considerable high-frequency content because cable-capacitance loading acts to reduce those voltages. Means for reducing or eliminating the effects of this input capacitance will be discussed in connection with the following probes, most of which are designed for use in conjunction with the WG-218 direct probe and cable.

Low-Capacitance Probes

The use of a small condenser in an oscilloscope probe, connected in series with the capacitance of the shielded test lead, provides a voltage divider having very small input capacitance. This is typified by adding an *RCA* WG-216B low-capacitance probe to the direct probe and cable.

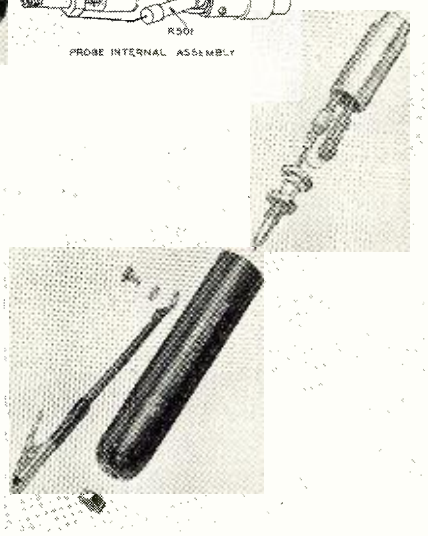
The normal capacitance of a direct probe and cable may be about 70 to 100 $\mu\mu$fd. With selected resistance and capacitance combinations the input capacitance of a low-capacitance probe can be held to a value below 10 $\mu\mu$fd. Low-capacitance input, however, is not obtained without some sacrifice of input signal level, because this type of



"Exploded" view of RCA WG-216B probe showing the various component parts.

probe is a voltage divider. The inherent loss in the WG-216B probe is fixed at a factor of 10 for convenience in calculating the attenuating effect when the probe is used with a calibrated instrument. Because the attenuation factor must be applied at low frequencies as well as high, the probe must be frequency-compensated for a wide response range.

Where the normal resistance of an oscilloscope is on the order of one megohm, and the small input condenser in a low-capacitance probe is shunted by a high value of resistance, the total series input resistance can be raised to 10 megohms. The combined resist-



WG-264 rectifying probe disassembled to show the various component parts.

Table 1. Quick reference chart for selecting proper probe for the job at hand.

MEASUREMENT	CLASSIFICATION	RCA TYPE	LOADING FACTOR	VOLTAGE LIMITATIONS
D.C. Voltage (V.T.V.M.)	Isolating	WG-217	11 megohms*	1500 v. d.c. max.
High-Voltage D.C.	Multiplying	WG-289	1100 megohms*	50 kv. d.c. max.
Low-Frequency A.C.	Direct	WG-218	70 $\mu\mu$fd., 1 megohm*	1500 v. r.m.s.; 4200 v. peak-to-peak sine wave*
High-Frequency A.C. or Complex Wave	Low-Capacitance	WG-216B	9 $\mu\mu$fd., 10 megohms	2000 v. peak-to-peak; 500 v. d.c.*
Rectified R.F. or A.C.	Rectifying	WG-264	1.75 $\mu\mu$fd., 6000 ohms at 200 mc.**	20 v. r.m.s., 28 v. peak; 250 v. d.c.
Modulated R.F.	Rectifying and Demodulating	WG-291	2.25 $\mu\mu$fd., 2500 ohms at 200 mc.**	20 v. r.m.s., 28 v. peak; 250 v. d.c.

* Approximate values which vary with instrument
** Approximate values which vary with frequency

ance divider and capacitance divider form an *RC* divider having both flat frequency response and minimum circuit-loading characteristics.

The WG-216B probe input condenser is adjustable and it is made accessible by unscrewing the contact tip. This condenser is adjusted by the manufacturer to obtain best square-wave response.

The WG-216B probe is designed for use with *RCA* WO-56, WO-57, and WO-88 series oscilloscopes. Its voltage input ratings are consistent with the input ratings of these instruments.

The two-fold purpose of a low-capacitance probe is to reduce the capacitive and resistive loading effect on the circuit being tested and to pass all frequency components in the circuit to the test instrument. The use of such a probe can in no way extend the frequency response of the test instrument. Some distorted waveforms seen on an oscilloscope, therefore, are unimproved by the addition of a low-capacitance probe. The full value of the probe can only be realized when the response of the instrument is not the limiting factor.

The low-capacitance probe used in conjunction with an oscilloscope gives that instrument a marked advantage which is readily observed when it is desired to examine the waveform in a sensitive circuit as, for example, a television horizontal oscillator. With a probe that does not have low capacitance, the waveform will change its slope and the picture will usually tear out when the oscillator is detuned by application of the probe. With the low-capacitance probe, the waveform will have a straight horizontal appearance between start and finish peaks and the TV picture is not likely to tear out during probe contact.

Isolating Probes

The *RCA* WG-217 d.c. probe is fitted with a one-megohm resistor in its housing to isolate the circuit under test from the test instrument and cable and to keep high-frequency a.c. out of the vacuum-tube voltmeter with which it is used.

When this probe is applied to the grid of an i.f. amplifier, for example, the distributed capacitance across the one-megohm isolating resistor is the only path for high-frequency loss. Because that capacitance is negligible, no discernible detuning problem exists. Although the value of the resistor is too high to pass any appreciable high frequency, it results in perfect combination with the high internal 10-megohm input resistance of the "Volt-Ohmyst" for indication of d.c. grid bias. The total resistance of 11 megohms is great enough to allow bias reading without serious loading error.

When it is desired to read a.c. from a source which also contains d.c., a blocking condenser is necessary. This condenser may be located either in the probe or in the test instrument. Good low-frequency response requires the use of a fairly large condenser and it is normally found in the instrument simply because it would be too cumbersome to house in a probe.

Rectifying Probes

The primary function of a rectifying probe is to extend the high-frequency range of a test instrument. Used at the point of test contact, such a probe performs the function of a detector and delivers rectified output voltage proportional to the r.f. input voltage being detected. Because of the usual sine-wave composition of high-frequency voltages, rectifying probes are generally of the half-wave type capable of developing either r.m.s. voltages for vacuum tube voltmeter measurements or peak voltages for oscilloscope indication.

Depending upon whether the probe is to be used with a voltmeter or oscilloscope, its output circuit has a long or short time constant. A probe designed for use with a vacuum tube voltmeter delivers filtered d.c. output proportional to the amplitude of the r.f. wave. A probe designed for use with an oscilloscope delivers d.c. output which fluctuates according to the amplitude modulation of the r.f. wave.

Because the circuitry differs with the output requirements of rectifying probes, it is necessary to have special probes for particular applications. The two most popular types, therefore, are described separately in the following paragraphs.

Crystal Diode Probes

The *RCA* WG-264 crystal diode probe contains a germanium crystal diode which, by proximity to the point of test, produces rectified output with a minimum of signal loss. It is a half-wave rectifier of the peak-reading type and develops a d.c. output which is indicated as a negative d.c. voltage across the input resistance of a "Volt-Ohmyst." The probe is calibrated for use with "VoltOhmysts" so that the measured d.c. output is equivalent to the r.m.s. value of the sine-wave voltage at the input of the probe.

When intermediate-frequency to v.h.f. signals are measured, r.m.s. voltage readings are normally sufficient. The measurement of video and sync signals in peak-to-peak values is not a function of the WG-264 type of probe. These values are better measured with a direct probe and a peak-to-peak reading vacuum tube voltmeter such as the *RCA* WV-97A "Senior Volt-Ohmyst."

The WG-264 crystal diode probe has an input frequency range from 50 kc. to 250 mc. and an input capacitance of 1.75 $\mu\mu$fd. Its input voltage ratings are sufficient for applications in the r.f. and i.f. sections of TV sets and other low-level electronic devices.

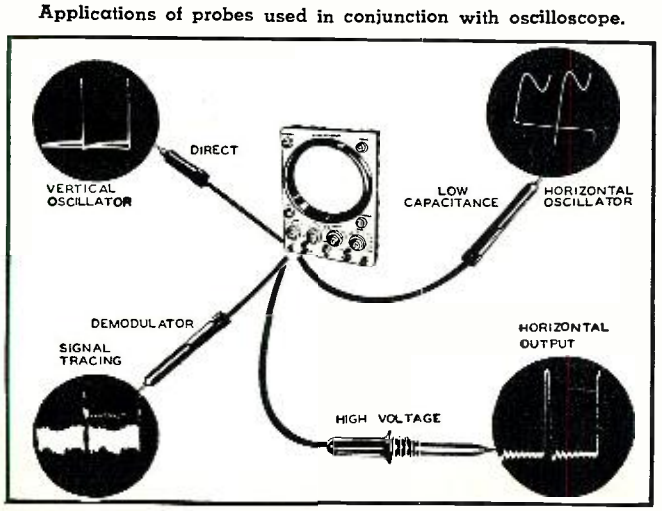
When quantitative measurement of r.f. (and i.f.) is the sole consideration, the crystal diode probe is excellent for checking stage gain, tracing signals, locating spurious oscillations, and detecting and measuring r.f. output from oscillators and signal generators.

Demodulator Probes

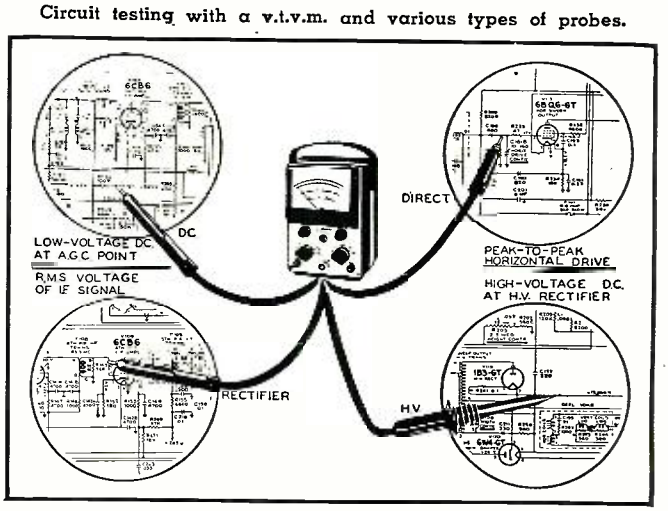
Another in the family of crystal-diode rectifier probes, the demodulator probe *RCA* WG-291 serves to perform certain functions beyond the basic requirement of furnishing d.c. output. Although the demodulator probe will rectify r.f. input and produce d.c. equivalent to the peak value of the input voltage, it differs from the WG-264 in that it is not calibrated and

(*Continued on page* 132)

Applications of probes used in conjunction with oscilloscope.

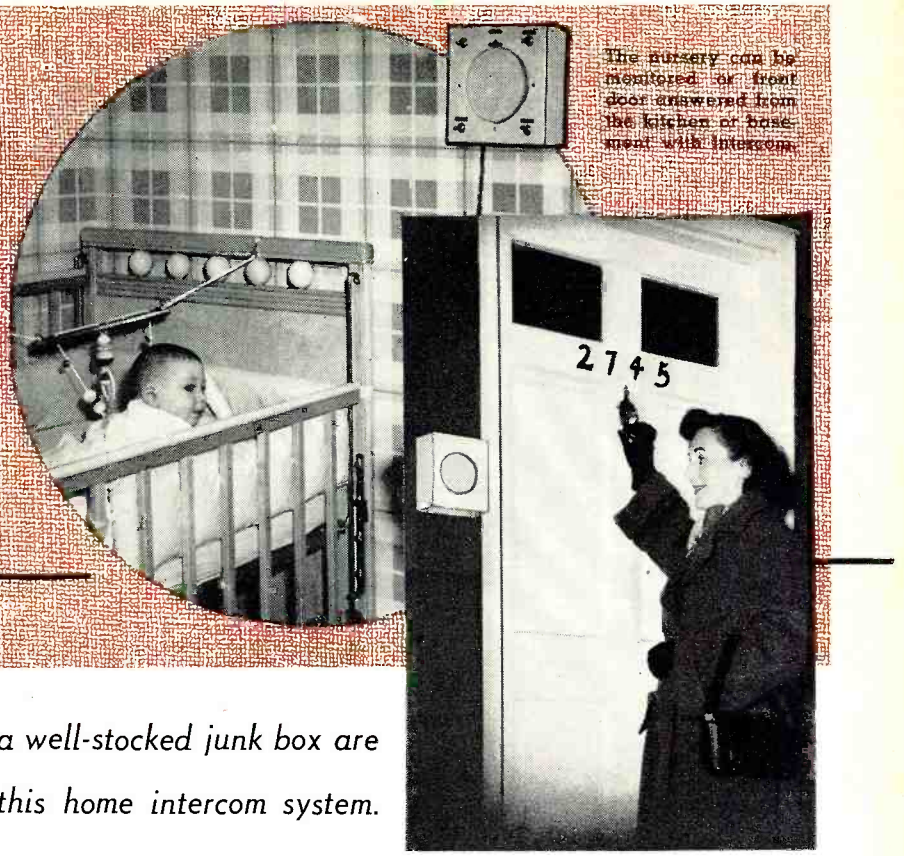


Circuit testing with a v.t.v.m. and various types of probes.



ELECTRONIC "BUTLER AND BABYSITTER"

By SIDNEY LIPMAN



The nursery can be monitored or front door answered from the kitchen or basement with intercom.

A few cents a month for power and a well-stocked junk box are the only requirements for building this home intercom system.

ANY intercom for the home must be inexpensive to build and to operate and must be useful enough to warrant the cost. As the name implies, the two most important functions of the system to be described are answering the door and keeping in touch with the "King" or "Queen" in the nursery. Initial cost, if every item is bought new, and the junk box can not provide any help, will be about fifty dollars and the running costs are about as much as running an electric clock—a few cents a month.

The installation described consists of three master stations and one slave station, all powered from the same amplifier. Additional stations may be added or some of the stations eliminated, depending upon the requirements of the individual home, without altering the efficiency of the system. Because of the very low power requirements, the author runs the amplifier continuously day and night and after a number of months of operation not a single component, including tubes and rectifier, has overheated.

The amplifier is a high-gain, three-stage unit built on a standard 5 x 7 x 2 inch deep aluminum chassis. The tubes selected require less than three watts for heater power and the selenium rectifier power supply requires about the same wattage. To prevent shocks from the amplifier chassis, a polarized plug was used to insure that the chassis is always at ground potential. If a polarized plug and socket are not available, only the hot side of the line should be connected to one prong of the plug and the chassis connected to a water pipe ground by a single wire. In the event the plug is not inserted properly the heaters will not light up when the switch is turned on and it will only be necessary to turn the plug over to obtain proper operation.

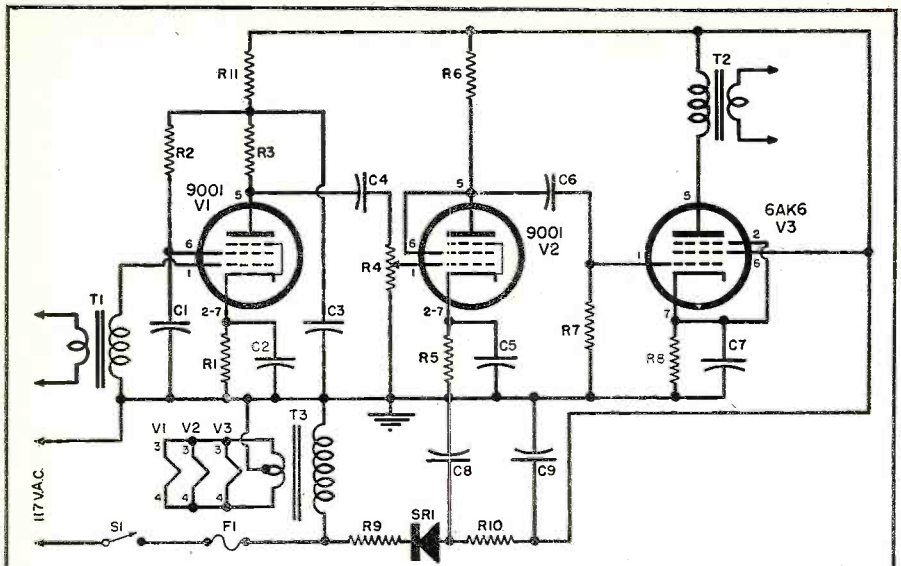
In the amplifier shown in the photographs a number of the resistors pictured are of greater wattage than those specified in the diagram. This is because the unit was built from junk box parts. All values shown on the diagram are for minimum wattages but no harm can be done by using a resistor of a higher wattage rating if it is more readily available. The electrolytic condensers, in some cases, are of a larger capacity and higher voltage rating than those called for in the diagram. Again the diagram values should be taken as minimum values and higher capacity or voltage ratings may be substituted if more readily available.

The biggest problem to overcome is hum pickup. The amplifier pictured uses the point-to-point wiring technique to minimize hum, with a single row of tie points to support the ground and voltage supply ends of the resistors. The decoupling and screen dropping resistors are mounted on the tie point strip. The power supply components are all arranged at one end of the chassis and the signal components at the other. On top of the chassis are placed the filament transformer and the output transformer. The heater pins of the tubes (pins 3 and 4 in all cases) face the power end of the chassis. Two leads are run to the heaters and the center tap of the transformer is grounded, to minimize hum. The transformer mounted on the edge of the chassis is the input transformer and was mounted in this spot to—you guessed it—reduce hum. It is a standard output transformer.

The input to the amplifier uses a shielded lead with the hot wire connecting to one end of the input transformer voice coil winding at the two-terminal board and the shield connecting to the other voice coil lead. The output from the amplifier is handled in the same manner. No connection is made to the chassis and the shields are connected together only at the central terminal board mounted centrally in the cellar on a ceiling beam. The amplifier is located on a storage shelf a few inches away from the terminal board.

Each station is wired to a barrier strip connection block, and crimp-on lugs are used on all leads. This eliminates the necessity for chasing all over the house with a soldering iron and simplifies troubleshooting or the addition of more stations. Provision was made for a fifth station which will probably remain unused until a garage is built.

The station in the nursery is located between the crib and the bathinette and the pickup is sensitive enough to allow the smallest whimper to be heard. If someone rings the doorbell while baby is being bathed, the controls are within easy reach of Mother to tell the visitor to "return later" or "wait a moment" or "we do not want any." After interviewing half a dozen storm window salesmen, Mother found it gratifying to be



R_1, R_5—1000 ohm, ½ w. res.
R_2, R_3—100,000 ohm, ½ w. res.
R_4—1 megohm pot.
R_6, R_{11}—47,000 ohm, ½ w. res.
R_7—470,000 ohm, ½ w. res.
R_8—470 ohm, 1 w. res.
R_9—47 ohm, ½ w. res.
R_{10}—1000 ohm, 2 w. res.
C_1—.1 μfd., 400 v. cond.
C_2, C_5, C_7—4 μfd., 25 v. elec. cond.
C_3—4 μfd., 150 v. elec. cond.
C_4, C_6—.01 μfd., 400 v. cond.
C_8, C_9—8 μfd., 150 v. elec. cond.
S_1—S.p.s.t. switch
F_1—1 amp. line fuse
T_1, T_2—Output trans. 5000 ohms to 6 ohm v.c.
T_3—Fil. trans., 6.3 v. @ 1 amp.
SR_1—65 ma. selenium rectifier
V_1, V_2—9001 tube
V_3—6AK6 tube

Complete schematic of intercom station. Any number of units can be used in system.

able to send the others away without subjecting baby to a draught in the middle of her bath.

The master stations are equipped with a separate double-pole, double-throw, center-off switch for each other station. The switches of all stations are normally left in the center-*off* position. When a call is to be initiated, the switch for the station being called is put in the "up" position and the message delivered from any distance away from the speaker, up to four feet or more. The switch is then pushed to the "down" position to hear the answer. When the conversation is over the switch is returned to the middle position. The person at the station being called need do nothing more than answer the question put to him from any point in the room being called.

When the lady of the house is busy in the kitchen, which is a good part of the day, she is but a step away from the baby's room at the far end of the house *via* the speaker mounted over her work space. When supper is ready it requires only a softly spoken word with the basement switch in the "up" position to bring Father up from his various hobbies. A special dish need not be spoiled by having to be left alone at a critical moment in order to answer the front door when a few well chosen words into the "Butler" will keep the *Fuller Brush* salesman on the front porch until the crisis is past.

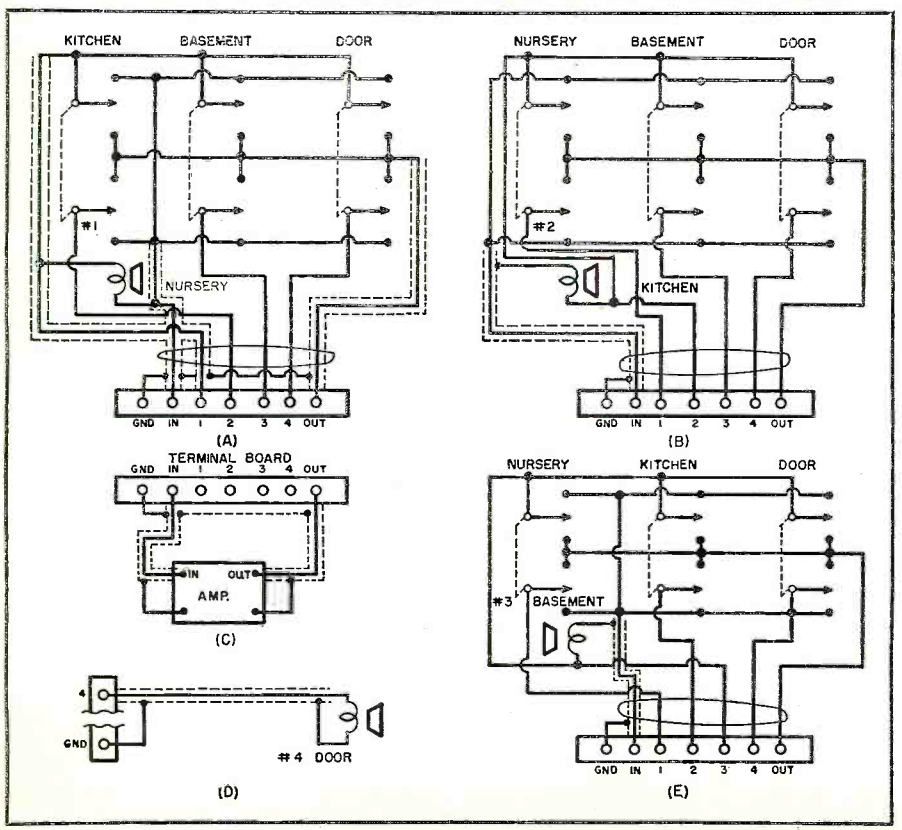
The kitchen station is mounted under the metal cabinets with self-tapping screws. There is a double bottom to the cabinets so the screws do not extend through. The leads run inconspicuously along the bottom of the cabinets, down the edge of the tile and through a small hole in the floor behind the refrigerator. The station in the nursery is mounted against the wall with wood screws that go through screw eyes screwed along the top and bottom of the cabinet. The cable runs down the wall and along the baseboard until it snakes its way down a hole in the corner of the room under the crib. Standard insulated staples are used for holding the cable.

The front door speaker was treated with *Walltex* before being installed in the cabinet. This is a material that waterproofs the cone and is designed for treating wall paper to make it washable. It has a wax base. All the speaker cabinets were home-made of 3/16" plywood and painted to match the walls upon which they are mounted. The front door and kitchen units are painted white and the nursery unit is a cream color. After the paint is dry a thick coat of paste wax, such as *Johnson's* floor wax, is applied. This makes the cabinets easy to clean as well as making them waterproof.

All speakers are protected by a piece of copper window screen with a piece of an old sheet in front of it. The holes for the speakers were cut in the plywood with a fly cutter before the cabinets were assembled. By cutting half way through from each side, a neat hole is produced. The cabinets are butt joined and glued with *Stanley* glue. In addition a few small nails, similar to those found in cigar boxes, were used to hold the pieces together until the glue dried.

The cables running from the various stations to the central terminal board are run along the rafters. A small hole through the wood shingles where they meet the concrete foundation was used to bring the single shielded lead into the cellar from the front

Different methods for hooking up intercom system. See text for complete details.

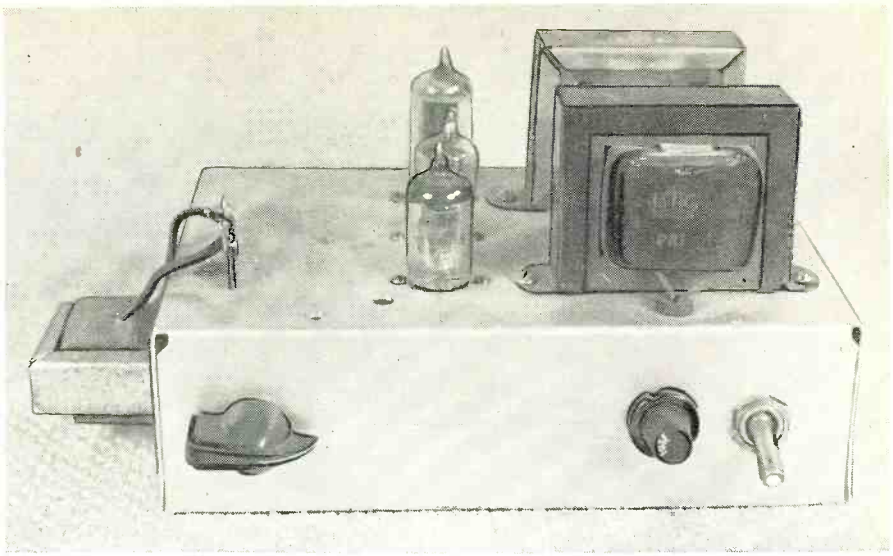


door station. The wires were strung one at a time and were held in place by finishing nails crossed with about a quarter-inch spacing between the two nails. Wires can be installed by twisting them at right angles to their normal position, putting them between the heads of the nails and then taking up the slack, which puts the wire under both nails. This system allows more wires to be added any time.

The shields of the cable going to the nursery are grounded to a water pipe at a convenient spot. There should be only one ground in the cable of all the stations. If a ground wire is used for a return of the amplifier chassis it should be separate and go to the nearest cold water pipe. The basement station, which is not illustrated, is built slightly differently. The switches for calling other stations were mounted on an inch and a half strip of aluminum which is screwed along the edge of the work bench. The speaker has a three foot wire on it so it can be set at any convenient spot on the bench, or on the floor when a big job is undertaken. There were no walls convenient to hang the speaker on. The first installation was a direct line from the nursery to the basement and was responsible for the author having a chance to complete the other stations while Mother was out. The slightest whimper brought Father up armed with bottle, safety pins, and so on. Another labor saving convenience is the ability to tell the door-to-door salesmen "we do not want any" without running up the stairs and halfway through the house to open the door.

Some trouble may be encountered if any of the cables exceed twenty feet in length. Oscillation may occur due to coupling between input and output circuits. If the wires in the cable can be spaced an inch or more from each other, this will not occur. Simpler, but more expensive is shielded wire. The author found it necessary to shield only one cable, that going to the nursery. Three wires are all that must be shielded: The input, output, and the wire that is connected directly to the speaker of the distant station. The author found it convenient to run a single shielded lead to all stations for the input circuit in order to minimize hum pickup from those stations not used during a particular conversation. The shield is also used as a return, saving wire. If possible, color coded wire should be used to simplify servicing. If this is not convenient, tag the leads so that, at a later date, you will know which is which.

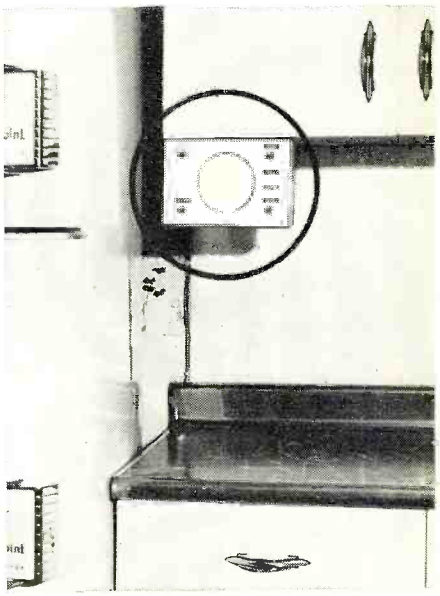
As in a railroad telegraph system, the worst offense an operator can commit is to leave a switch in the wrong position. However; with this system all is not lost as is the case with the telegraph. If, for instance, Mother has left her switch for the basement station in the "down" or "listen" position and Father puts his switch in the basement to the kitchen "talk" position, oscillations will be reproduced at the two stations. This will indicate to Mother that she left her switch in the wrong position and that it should be returned to its neutral position since someone is trying to call her. It also indicates to Father in the basement that his message was not received.



A station unit. Any cabinet appropriate to decorative scheme may be employed.

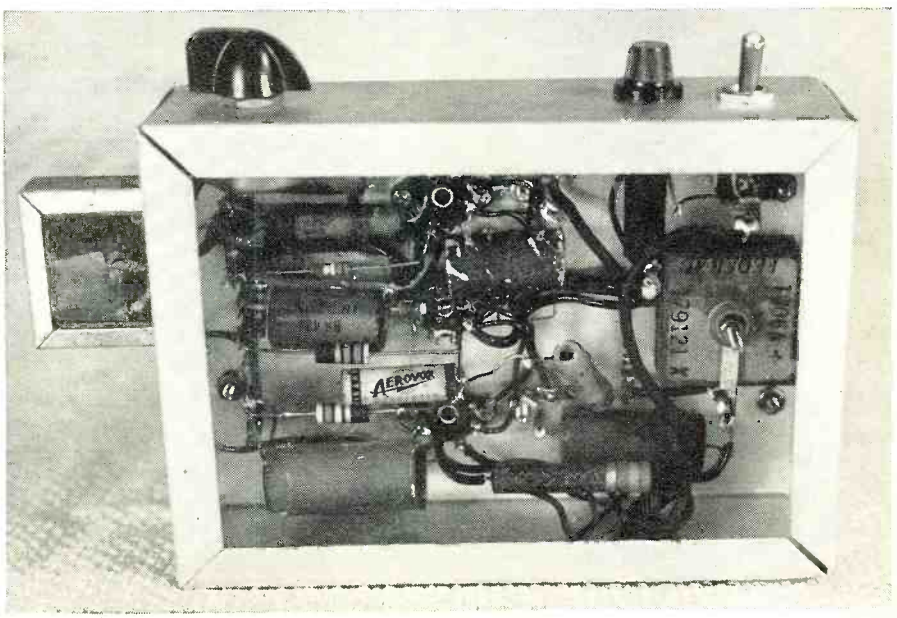
While the author claims no startling innovations for this set-up, this intercom system works well, is virtually foolproof, costs little to build, and even less to operate—all desirable features for any home intercom installation to have. In addition, it is easy to build and install.

In the few months that the electronic "Butler and Babysitter" have been working for the family, untold numbers of steps have been saved. It has also been gratifying to know that Mother need not answer the door when alone in the house without first knowing "Who's calling please?" —30—

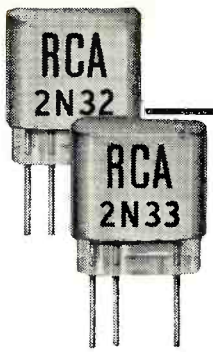


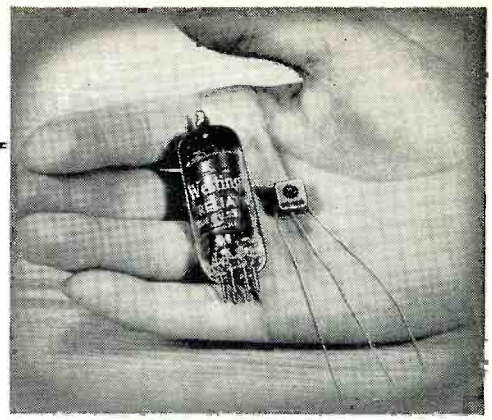
Kitchen intercom mounted on metal cabinet.

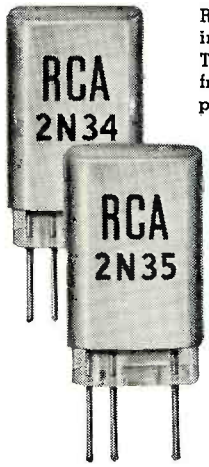
Under chassis view of station. This layout prevents overheating of components.



TRANSISTOR PHYSICS *Simplified*







RCA's 2N32 point-contact type designed for large-signal pulse or switching operations. The 2N33 for oscillator applications in 50 mc. region. The 2N34, a "p-n-p" junction type audio amplifier for low-power, low-frequency applications. RCA's 2N35, an "n-p-n" junction type audio amplifier for low-power, low-frequency use. (Above) Westinghouse's WX-4813.

By

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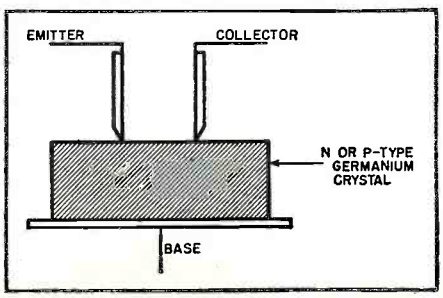
Part 2. Concluding article covers point contact type transistors, their design, construction, and circuit applications.

IT WAS pointed out in the previous article (July) that in a junction transistor the emitter, base, and collector connections to the crystal are low-resistance (large area) connections. In the point-contact transistor the emitter and the collector connections to the crystal are point-contact (relatively high-resistance, small area) connections. Fig 10 is a line drawing cut-away view of the transistor. The base connection, however, is a low-resistance (large area) connection. It was mentioned in previous paragraphs that the emitter current is slightly larger than the collector current in the junction transistor and that the base current is extremely small. It has been found by experiment that in the point-contact transistor the collector current (unlike the collector current of the junction transistor) is substantially larger than the emitter current, and that the base current is relatively large. In the following paragraphs an attempt will be made to explain these differences between the junction transistor and the point-contact transistor.

Although the point-contact transistor employs what is considered to be either an n-type germanium crystal or a p-type germanium only, experimental investigation has shown that in the n-type point-contact transistor, p-type layers occur, and that in the p-type contact transistor, n-type layers occur. Fig. 11A shows an n-type point-contact transistor. It is seen that under the emitter point is a very thin layer of p-type germanium (P_1), and under the collector point is a thin layer of n-type germanium (N_2), followed by a thin layer of p-type germanium (P_2). By observation it can be seen that the emitter-base section is biased in the forward direction. Current flow consisting mainly of holes in the P_1-type germanium and mainly of electrons in the N_1-type germanium will occur. However, an increase in emitter current causes a large increase in collector current and a decrease in emitter current causes a large decrease in collector current. The following paragraph will attempt to explain the current amplification of the transistor. Fig. 11B is an enlarged view of the collector-base circuit. The potential energy diagram for electrons in the crystal portion of this circuit is shown in Fig. 11C. Under steady-state conditions (no signal applied), very few electrons climb the potential energy hill between N_2 and P_2. However, those that do climb the hill do not combine with the holes in the P_2 region because it is a thin region. These electrons fall quickly down the potential hill between P_2 and N_1. When the emitter-base region conducts, some of the holes which leave the P_1 region of the emitter, drift into the P_2 region of the collector. With holes in the P_2 region from the emitter, the potential energy diagram for electrons between the collector and base conforms to that in Fig. 11D. Note that the potential energy hill between N_2 and P_2 has been substantially reduced, and electrons in the N_2 region can climb readily into the P_2 region. Most of these electrons do not combine with holes in this region, but fall very rapidly into the N_2 (base) region. For every hole that enters the P_2 region from the P_1 region, many electrons flow from the N_2 region through the P_2 region down into the N_1 region. Thus, it is seen that large current amplification may be effected. This amplification of current is expressed as α (alpha) and is equivalent to mu (the voltage amplification factor of a vacuum tube). Mathematically, $\alpha = \Delta I_c / \Delta I_e$, where ΔI_c equals a small change in collector current, and ΔI_e a small change in emitter current.

Fig. 10. Line drawing of a cutaway view of a transistor of the point-contact type.



Point-contact transistors have been made with p-type germanium as the main body. The theory explaining the operation of this type point-contact transistor is similar to that explaining the operation of the n-type point-contact transistor. The difference, of course, is that the main current carrier consists of holes instead of electrons. The explanation in the previous paragraph coupled with the information in Fig. 12 will enable the reader to understand the theory of operation of p-type point-contact transistors. Note that the polarities for the emitter with respect to the base, and the collector with respect to the base have, of necessity, been changed.

The operation of a point-contact transistor can be compared to the operation of a triode vacuum tube. The emitter is equivalent to the grid, the base to the cathode, and the collector to the plate. The base current is relatively large, and the major por-

tion of it goes to the collector. Unlike the grid of a vacuum tube, the emitter draws a continuous current. The input (emitter) impedance is low and the output (collector) impedance is high. In a vacuum tube the input (grid) impedance is high and the output (plate) impedance is low. For a comparison of transistors and vacuum tubes see Tables 1 and 2.

Bias Voltages

In a vacuum tube the grid is usually biased negatively with respect to the cathode, and the plate is made positive with respect to the cathode. With the transistor the collector may be positive or negative with respect to the base, and the emitter may be positive or negative with respect to the base. These are illustrated in Fig. 13. The bias polarities depend on whether the transistor is an *n-p-n* or *p-n-p* junction type, or a *p* or *n* point-contact type. To simplify the problem for the technician, the diagrams of Fig. 13 have been prepared, which indicate bias polarities required for the various types of transistors. If one remembers that the *n*-type point-contact transistor is, by stretching the imagination a bit, actually, a *p-n-p* type transistor, and the *p*-type transistor, is an *n-p-n* transistor, bias polarities can be remembered easily by the following simple rule. The emitter is biased in a foward direction with respect to the base and the collector is biased in the reverse direction with respect to the base, in any transistor.

Conclusion

These articles have presented in purely descriptive, non-mathematical terms the fairly complicated physics of transistors. Although this type of treatment is inadequate for those interested in a quantitative presentation, it is hoped that the average radio-television technician will have a greater understanding and appreciation of those circuits employing transistors in the place of vacuum tubes. It may be mentioned here briefly that major differences occur in transistor circuits compared with the corresponding vacuum tube circuits. This is a study in itself and since this article was designed to be merely an introduction to the large number of transistor circuits which will make their appearance on the radio-television horizon, no attempt has been made to discuss specific circuitry.

Many articles have been written about the theory of transistor physics; however, these articles explained mainly the mathematical concepts, and as a result, to coin a phrase, "did not hit home" as far as the technician or engineer who is not directly concerned with transistor application. In this article the authors have attempted to provide the theoretical justification for a different method of practical transistor physics presentation.

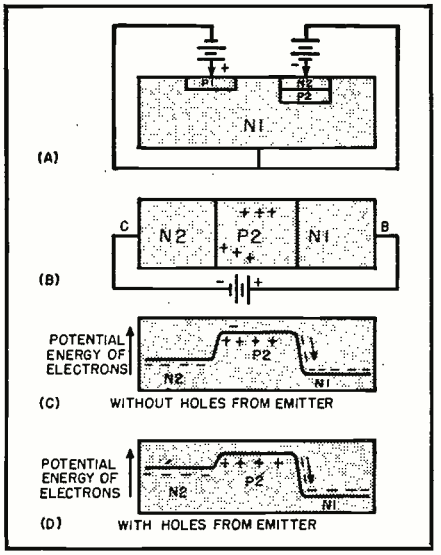


Fig. 11. An "n" type point-contact type of transistor. See text for complete details.

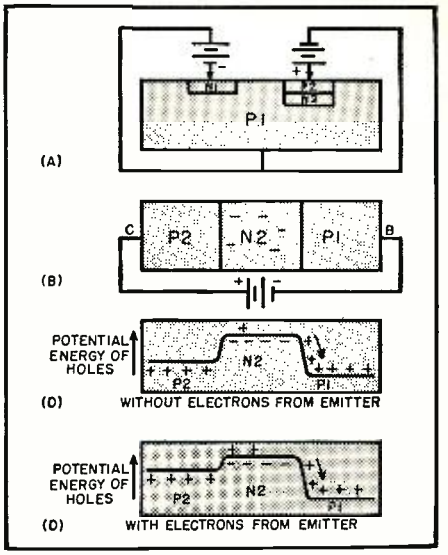


Fig. 12. A "p" type point-contact transistor. Note differences from Fig. 11, left.

VACUUM TUBE	TRANSISTOR
Cathode	Emitter
Plate	Collector
Grid	Base
$\mu = \triangle E_p/\triangle E_g$	$\alpha = \triangle I_c/\triangle I_e$
Voltage Amp.	Current Amp.
High Input Imp. (grounded cathode)	High Input Imp. (grounded emitter)
Low Output Imp.	Low Output Imp.
High Power Consumption	Low Power Consumption
Fragile	Rugged
Large in Size	Small in Size

Table 1. Comparison of characteristics between vacuum tube and a junction transistor.

VACUUM TUBE	TRANSISTOR
Cathode	Base
Grid	Emitter
Plate	Collector
Voltage Amp.	Current Amp.
$\mu = \triangle E_p/\triangle E_g$	$\alpha = \triangle I_c/\triangle I_e$
High Input Imp.	Low Input Imp.
Low Output Imp.	High Output Imp.
I_p	E_c
E_p	I_c
I_g	E_e
E_g	I_e
Constant E Supply	Constant I Supply
Capacitance	Inductance
Large in Size	Small in Size
High Power Consumption	Low Power Consumption
Fragile to Shock	Rugged
Reverse Bias	Forward Bias

Table 2. Comparison between point-contact type transistor and standard vacuum tube.

Although the transistor is only five years old, much is expected of it in the near future. Many electronic units will be freed from the vacuum tube's limitations, namely, fragility, bulkiness, and short life. To think that in such a short time since its inception, the combined production of transistor makers has resulted in an output of 50,000 units a month. Before the end of 1953, output is expected to exceed 250,000 units a month. Is it any wonder that they call transistors the miracle of the Twentieth Century?

From the outset of radio it has been known that semiconductors, such as galena, have the ability to rectify alternating current signals. In fact, the "cat whisker" galena crystal was a standard part of the early radio set. But the fundamental reason why some substances conduct and others do not had to be investigated by some of our leading physicists before the transistor became a reality.

Transistors have been introduced successfully in such units as the phono amplifier, radio and television receiver, hearing aid, "walkie-talkie" set, radar spotting device, computer, and other devices which employ, at present, vacuum tubes. No theoretical limitations are placed on transistor applications. The experts are optimistic about the possibility of overcoming present transistor limitations, *i.e.,* the higher noise level and the effects of heat and humidity upon its operation. Because the transistor is still in its infancy, it is undoubtedly just a matter of time until these problems are ironed out.

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———: *Proceedings of the IRE, November 1952.*

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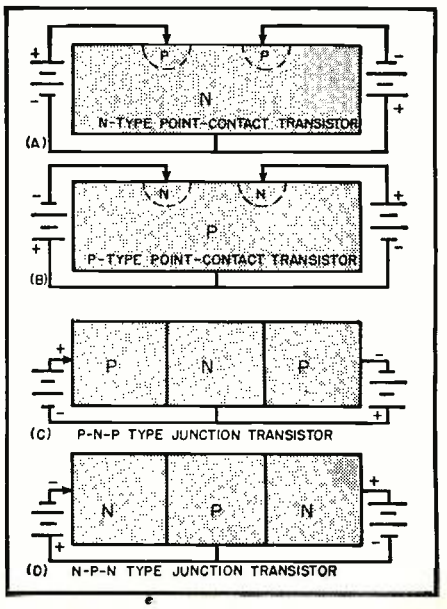
Fig. 13. Emitter and collector bias voltages for different types of transistors.



TV TROUBLESHOOTING

HIGH-VOLTAGE SUPPLIES

By
MILTON H. LOWE

Flyback type high-voltage circuits: how they operate, and hints for time-saving receiver troubleshooting.

A FEW years ago, before 19 and 21 inch picture tubes made their appearance, 9 or 10 kilovolts were all that were required to operate the average "kine." Nowadays, 15 kilovolts is quite common, and the high voltage required increases as picture tubes get larger. You have probably noticed that the physical size of components, such as the flyback transformer and high-voltage rectifier tube, have not kept pace with the demands placed upon them. If anything, the tendency is towards smaller and smaller parts whose values must be calculated critically in order to obtain the desired results. Replacing these parts without regard to tolerances and characteristics may cause troubles that did not exist before the repair was made. The best way to avoid these additional bugs is by being careful while troubleshooting, and by using correct replacement parts.

In an effort to improve the performance of the high voltage power supply, some 1953 television receivers utilize a flyback transformer of new design. It has a number of extra primary taps to which the damping diode is connected, in contrast to the older types where the damper is connected across the secondary. The principal advantage of this design is the reduction of transformer leakage inductance and distributed capacity, thus extending the high frequency response of the transformer. This results in a lower horizontal retrace time and, ultimately, reduces the problem of horizontal foldover due to lack of transformer response.

Typical varieties of the newest types of high-voltage supplies are shown in Figs. 1 and 2. Fig. 1 is the partial schematic diagram of the parts that comprise the high-voltage supply of *Admiral* chassis 19H1. The operation of this type flyback circuit is similar to the older types. The output of the horizontal oscillator is applied to the 6BQ6 horizontal output tube where it is amplified. The "Horizontal Drive" condenser and the 680 $\mu\mu$fd. coupling condenser comprise a voltage divider for the grid input signal. For proper operation of the circuit, the "Horizontal Drive" control is adjusted so that the saw-tooth shaped grid signal has a peak-to-peak amplitude of 65 volts. The 68-ohm grid loading resistor minimizes the tendency toward Barkhausen-type parasitic oscillations. A negative grid potential of approximately 24 volts is developed across the grid-leak network consisting of the 1-megohm grid return and the "Horizontal Drive" condenser (in series with the 68-ohm resistor). This potential, in conjunction with 5 volts of self bias developed across the 47-ohm cathode resistor, results in a total of approximately 30 volts of grid bias. This is a convenient number to remember when troubleshooting most horizontal output grid circuits, because one measurement from *grid-to-cathode* will indicate if the drive and bias are approximately correct. The amplified plate signal is applied to the horizontal deflection coils; stepped-down to produce the 1.5-volt filament potential for the 1B3; and stepped-up to produce the high voltage pulse, which is rectified and filtered to produce the high voltage output.

During the horizontal retrace, or flyback time, the horizontal output tube stops conducting, and a large pulse of voltage is developed across the flyback transformer due to the rapidly collapsing flux lines. This pulse would induce transient oscillations in the yoke were it not for the damping diode, which is driven into conduction at this time, reducing the magnitude of the voltage across the coils and causing the oscillations to decay quickly. The "pi" network, consisting of the linearity coil and the two .047 μfd. condensers, filter this rectified pulse to produce the "B+" boost voltage (approximately 470 volts). A good point to remember about "pi" networks is that the input leg has the greatest effect on the amplitude of the network's output voltage, whereas the output leg has the greatest effect on the phase shift through the network. Thus, the .047 μfd. input condenser should be suspected if the boost voltage is too low, and the output .047 μfd. condenser should be suspected if the linearity of the picture is unsatisfactory.

The linearity and width coils are both tunable to provide for shaping the horizontal deflection current by shifting its phase with respect to the applied voltage. These controls are interacting and must be adjusted alternately to obtain the desired picture width and shape. The width coil is split into two parts so that a given minimum of inductance shorts the lower portion of the flyback transformer irrespective of the setting of the width control.

Defects in the grid and screen circuits of the output tube produce symptoms similar to those obtained in any grid-leak biased audio amplifier. For example, if the 1-megohm grid return should increase in value, there is a strong possibility that the high voltage would be intermittent in a fashion that would be the visual counterpart of the aural motorboating effect. If the .047 μfd. screen bypass should become slightly leaky, the width would be reduced somewhat. If this condenser should become very leaky, the brightness and/or width would be noticeably affected.

Fig. 2 is a simplified schematic of a flyback circuit that is a modified version of the type shown in Fig. 1. This circuit is used in the *Crosley* chassis 387, *Motorola* chassis TS-410A, and many other receivers, and is a beautiful example of simplified design. Its principal difference, compared to the circuit of Fig. 1, is the noncontinuous flyback primary. A 50-ohm potentiometer, used for horizontal centering, separates the upper and lower portions of the flyback primary. Notice that a portion of the upper half of the primary is tunable by means of an adjustable slug. This provides a means for adjusting picture width by changing the high voltage by a small amount (the picture width is a function of two variables, namely the sweep and high voltage, with the high voltage having the greater effect).

RECEIVER CHASSIS No.	OUTPUT TUBE GRID	GRID TO CATHODE BIAS
EMERSON 120168-D 120166-D	120V.	-20V.
MOTOROLA TS-395 TS-400 TS-410	70V.	-29V.
SYLVANIA 1-437-3 1-507-1	105V.	-30V.
DU MONT RA-147	60V.	-28V.
ADMIRAL 22C2 23A1	90V.	-36V.
CBS-COLUMBIA 817 820	100V.	-35V.
OLYMPIC 217	75V.	-35V.

Table 1. Signal waveshape and the bias at the grid of the horizontal output tubes of some commercial TV receivers.

The apparent brightness is not affected, because the change in high voltage is very small, about 30 volts. Yet with a change of this order, the width is visibly affected. Notice, also, that the grid-leak bias is 27 volts, a value close to that of the circuit in Fig. 1. The boost potential, approximately +490 volts, is applied through the horizontal centering control and the output transformer to the plate circuit of the horizontal output tube. A parallel *LC* network is used to decouple the horizontal deflection coils from the damping circuit. The 2.2-ohm high-voltage current limiting resistor is used instead of a 4.7-ohm resistor to change the load that the filament winding presents to the primary.

An older type flyback circuit using a high efficiency ferrite core in the transformer is shown in the simplified schematic of Fig. 3. The 500 $\mu\mu$fd. condenser connected from the 1B3 filament winding to the high side of the secondary is the principal factor that permits a 14-kilovolt output to be obtained from this type of circuit. It applies a 3-kilovolt negative pulse, that is developed at the high side of the secondary at the same instant that the positive high-voltage pulse is developed across the primary, to the 1B3, and thus boosts the over-all potential across the high-voltage rectifier. The 550-volt boost voltage developed across the .22 μfd. damper-cathode filter is applied to the horizontal output plate circuit and to the CRT first anode. The deflection coil is connected across the output transformer secondary to obtain an optimum impedance match between the 6BQ6 and the yoke, so as to minimize the tendency towards high-frequency ringing, which would appear as alternate light and dark vertical lines or bars on the raster. The potentials developed in this circuit are much the same as those in the previous two.

A word of caution is necessary before discussing the troubleshooting procedures. The most dangerous stages to troubleshoot are the horizontal output, damper, and high-voltage rectifier. Especially dangerous is the plate circuit of the horizontal output tube. This is due to the fact that the plate cap of this stage has a "B+" potential of from 400 to 600 volts in addition to an r.f. pulse of some 3 to 5 kilovolts. Thus, you have the combined dangers of the very lethal "B+" supply, and the possibilities of a "burn" from the r.f. Many technicians can attest to the fact that the plate cap of the output tube is far more "shocking" than the plate cap of the rectifier. Also, most test equipment is not designed to handle the high potentials found in these circuits. Therefore, specially insulated test leads, high voltage probes, and voltage dividers should be resorted to in order to obtain a proportional indication of the voltages and waveshapes present.

Troubleshooting

Assume that the trouble symptom is a black CRT (sound normal). Only two possible troubles exist: either the CRT is dead or the high voltage is missing. A quick, though inconclusive, check of the CRT is to see if the heater is lit. If so, the trouble is probably in the high-voltage circuit, unless the customer has described symptoms that may lead you to believe that the CRT has gone. To check the high-voltage circuits, turn off the power and disconnect the lead to the CRT high-voltage button. Place the lead within ¼" of the chassis and turn the power on again. An arc should be drawn if the high-voltage circuits are operating. If the arc is drawn, either the CRT is defective, or the CRT biasing circuits, including the brightness control, should be checked for a condition that would prevent the CRT beam current from flowing. Do not allow the arc to be drawn for more than a few moments as the current-limiting resistor in the rectifier filament circuit may be damaged.

If the arc is not drawn, use a well insulated screwdriver to pull an arc from the plate cap of the rectifier. It should be about ⅜" long for a 15-kilovolt potential. If an arc is obtained at this point, but not at the end of the high-voltage lead, the high-voltage rectifier tube is probably defective. Also, check the high-voltage filter condenser, if a physical one is used. If the arc is appreciably less than ¼", the high voltage is too low and the CRT may not be bright for this reason. This point is discussed more in detail a little later. If an arc *is* obtained, touch the screwdriver to the plate cap of the horizontal output tube. Listen for a "click" in the speaker, and look for a very small spark at the point of contact. If both are obtained, the chances are that the output stage is OK. In this case, check the flyback transformer. (When the power is on, do not short the plate of the output tube to the chassis as this will cause either the low voltage fuse or low voltage rectifier tube to blow.)

A crude indication of the relative condition of the flyback can be obtained with an ohmmeter. The resistance from the plate cap of the output tube to the plate cap of the rectifier will range from 200 to 600 ohms, depending upon the type of flyback used.

(*Continued on page* 118)

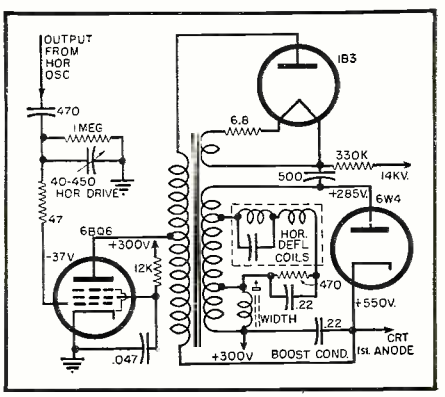


Fig. 3. Capehart TV chassis CX-37 high voltage circuit furnishing 14 kilovolts.

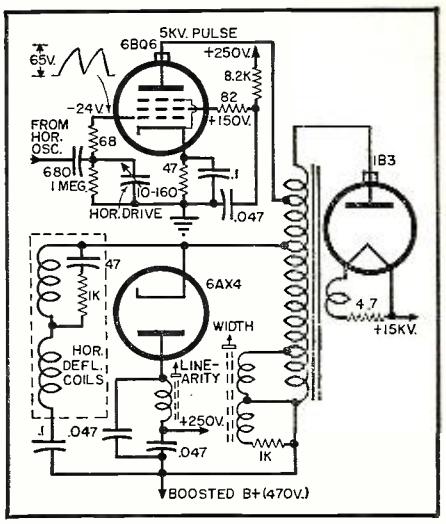


Fig. 1. Partial schematic of the high voltage circuits of Admiral 19H1 TV chassis.

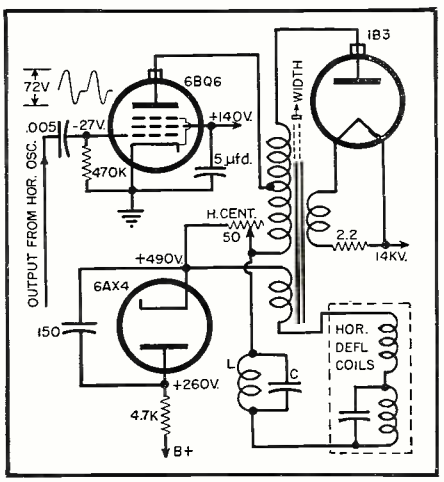
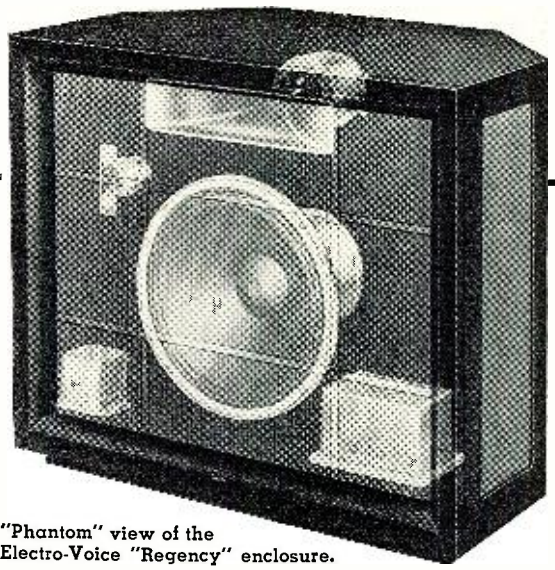


Fig. 2. Flyback transformer circuit of the Motorola TS-410A and Crosley 387.

BUILDING THE E-V Regency

By
HOWARD SOUTHER
Electro-Voice, Inc.



"Phantom" view of the Electro-Voice "Regency" enclosure.

Design details on a commercial folded horn enclosure which can be used with any high-quality 15" loudspeaker system.

THE SEARCH for better bass response in loudspeaker systems proceeds apace. In the design of an enclosure for promoting superior reproduction in the lower octaves, certain practical considerations often enter into the choice of construction.

For instance, a room corner is not always available. This design includes an operational as well as functional styling which allows wall or corner placement. The height of the unit is sometimes important, because a window sill, picture, or series of shelves may intrude. Accordingly, the unit described is designed to standard lowboy height of approximately 29 inches, just missing the usual window sill and matching the height of other contemporary furnishings.

For the widest choice of driver complement, the acoustic loading permits a higher, more economical crossover point by allowing front radiation from the large driver cone. Thus, a high-frequency horn of small dimensions (the *E-V* Model 8-HD) can be housed within the structure with ease.

A horn is conceded to be the very best coupling medium for a high quality system. When this horn uses the corner of the room to extend the mouth opening, we have what is called a *folded corner horn*.. These horns call for a very low crossover and the use of multiple components when they are of the indirect radiator type, such as the *Klipsch* "K" design. A more compact and economical system with 800 cps crossover must include front radiation from the driver cone for the frequencies above 300 cps. This is because the higher frequencies experience difficulty in following the circuitous path of the folds.

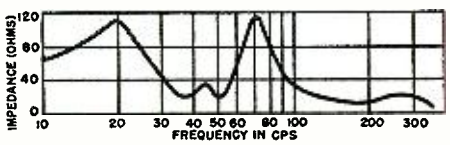


Fig. 1. Impedance curve of the "Regency" with E-V 15-inch driver of 37 cps free-space resonance. See text for details.

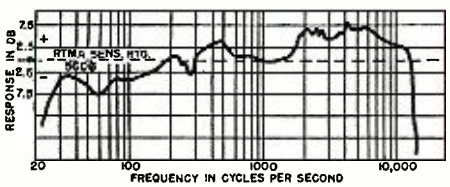


Fig. 2. "Regency" frequency response with 114-A 800 cps separate two-way system.

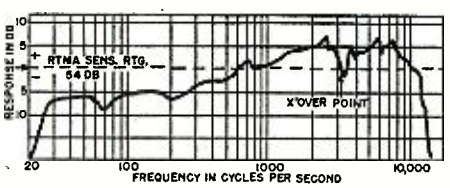


Fig. 3. Frequency response of the "Regency" with the SP15 "Radax" coaxial driver.

Fig. 4. Intermodulation distortion with 114-A 800 cps separate two-way system.

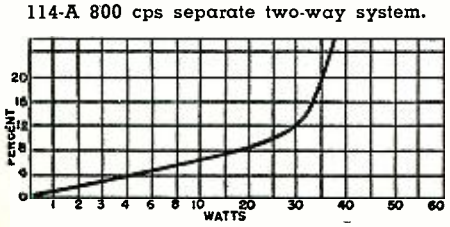
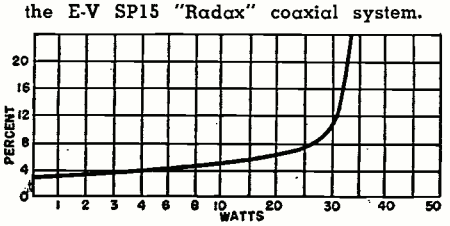


Fig. 5. Intermodulation distortion with the E-V SP15 "Radax" coaxial system.



The "Regency" is an acoustic system of the latter type, permitting direct radiation of the frequencies above 225 cps and efficiently horn loading the back of the cone for the tones below this point.

Because the "Regency" has its own integrally "built-in" corner with a low taper-rate, it may also be employed against a flat wall. In this case, the extended bass range is preserved, but at a slightly lower efficiency than when used in a corner. The two sides of the cabinet, along with the floor and adjacent wall, form a complete horn, only the cabinet side of which is slightly compromised. Thus, very satisfactory extended bass is achieved at good levels. The listening results are supported by the impedance characteristic (Fig. 1), showing a very high reactive component in the 10-30 cps region.

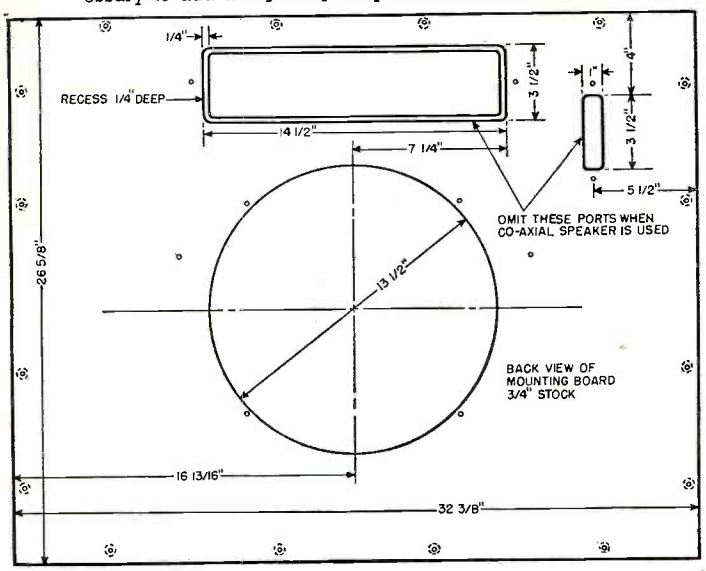
Performance

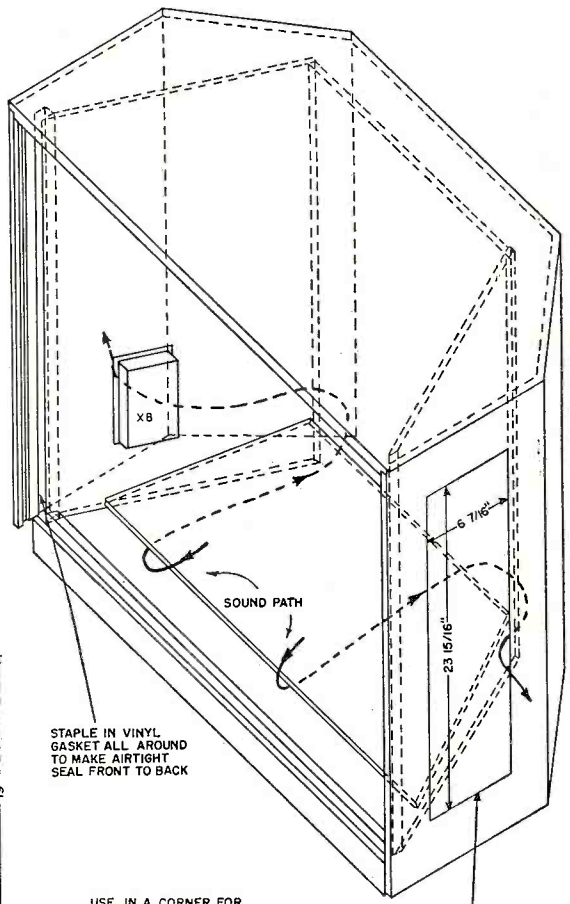
Performance with the *Electro-Voice* 114-A and 114-B two- and three-way systems using the 15W-1 15" cone driver, indicates unusual efficiency in the 30 cps region (Fig. 2). Harmonic distortion at the usual low room-playing levels is on the order of 2%.

A 15" coaxial driver (the *E-V* SP15) shows no less than 3% distortion at low levels. Remarkably enough, at the higher levels around 10-15 watts input, this driver shows less distortion than the multiple-way 114 series systems. This is true because the 114 systems are more sensitive, or efficient, and are being driven harder by the same power input. At the same listening levels they have appreciably less distortion than the coaxial unit.

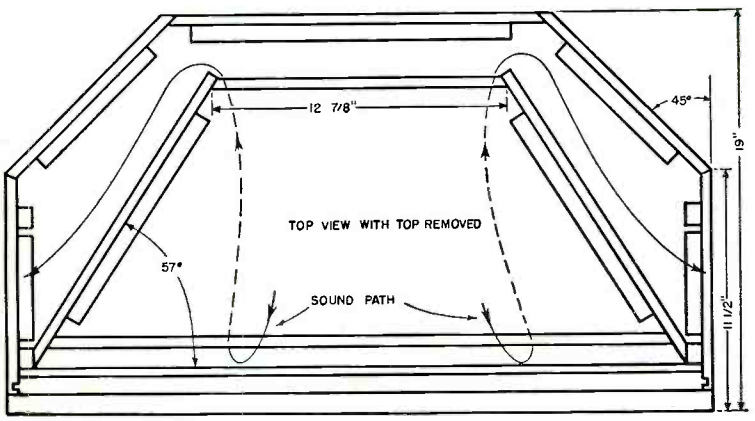
Where extended high-frequency response is desired as a pleasing balance to the bass efficiency, the *E-V* T-35 "Super-Sonax" very-high frequency driver may be added as shown on the facing page. This is the equivalent of the 114-B three-way system, and requires the supplementary X-36, 3500 cps network and AT-37 high-frequency level control. —30—

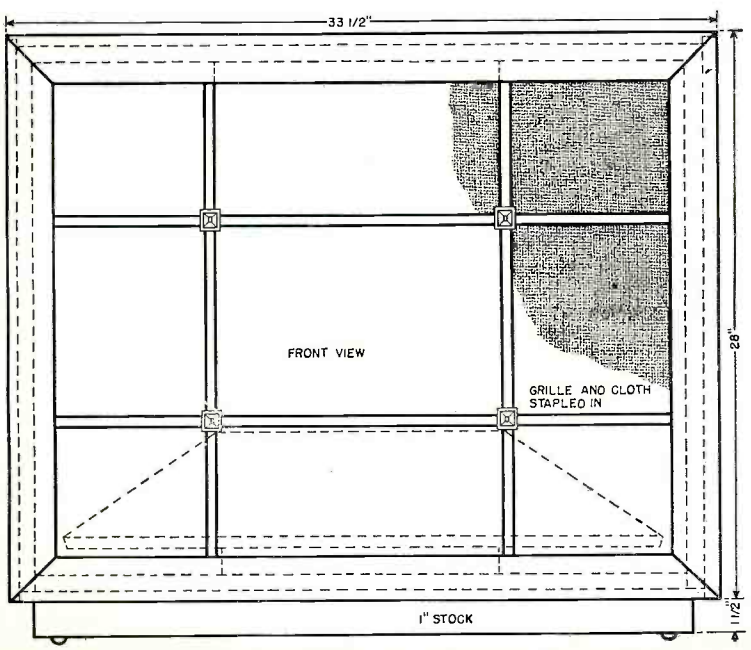
Mechanical details for constructing the Electro-Voice "Regency" loudspeaker enclosure. This housing is designed to accommodate a single 15" speaker, a 15" coaxial unit, or two- or three-way systems. For a two-way system it is necessary to add a high-frequency diffraction horn and with a three-way system a very high frequency tweeter is used.

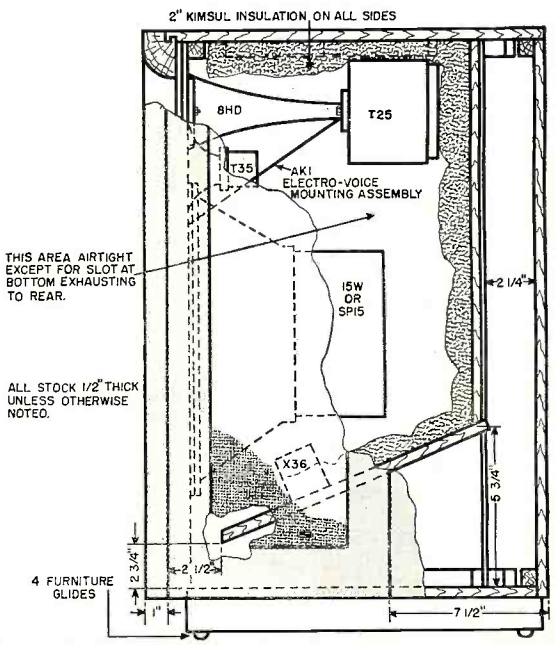




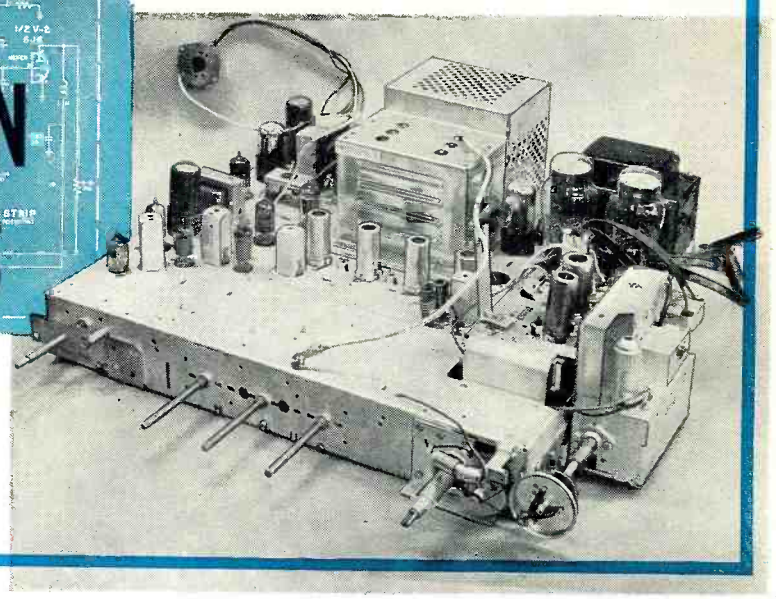
VIEW WITH FRONT MOUNTING BOARD REMOVED







KNOW YOUR 1953 EMERSON TV RECEIVERS



Front view of the Emerson chassis 120174B showing the u.h.f. tuner at the lower right.

By
BRON KUTNY
Educational Director
Emerson Radio & Phonograph Corp.

Complete circuit explanation of the new Emerson u.h.f. tuner and u.h.f.-v.h.f. receiver with servicing data.

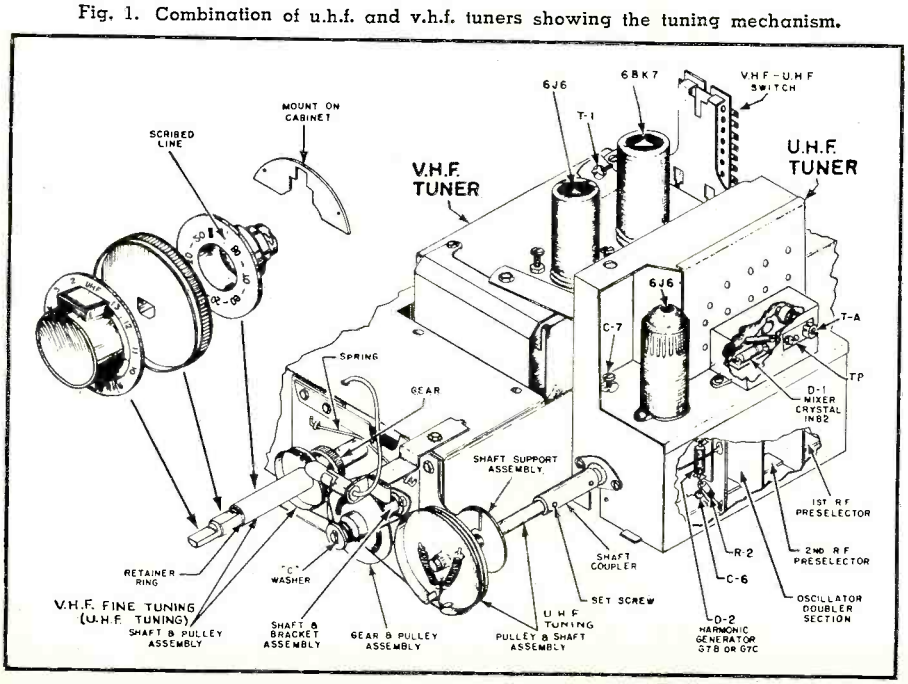
WITH more television stations going on the air daily, and with more communities being served by u.h.f. or v.h.f. stations, or both, *Emerson's* new line of TV receivers contains models suitable for all types of reception.

Ultra-High Frequency Tuner

In the all-channel chassis 120174B, a continuous tuner is used in order to receive Channels 14 to 83. For the v.h.f. Channels 2 to 13, a cascode amplifier turret tuner is used. Tuning is accomplished by means of a two-part concentric control for both v.h.f. and u.h.f. so as to reduce the number of knobs necessary for the customer to handle, and also to simplify the appearance of the receiver. With this arrangement, the customer uses the channel selector and fine tuning controls for v.h.f., and only a single control, the v.h.f. fine tuner, for u.h.f. The fine tuning control is connected through a gear and dial cord arrangement to the u.h.f. tuner control shaft (Fig. 1).

Conventional balanced-to-ground 300-ohm input is provided for the u.h.f. tuner by two loops of wire fed through the tuner housing and fastened to the tuner chassis. (See Fig. 2.)

Fig. 1. Combination of u.h.f. and v.h.f. tuners showing the tuning mechanism.



The v.h.f. tuner uses the standard input coil arrangement.

The u.h.f. tuner consists of two r.f. preselector tuned circuits which are equivalent to shorted-end resonant lines. These lines are shorter than a quarter wavelength for all u.h.f. channels and, therefore, appear as inductances whose electrical length can be varied by the variable condenser at the open end. The plates of this variable condenser are sometimes bent and may seem to be out of shape. *Absolutely no attempt should be made to straighten these plates.* They are bent to maintain proper tracking over the entire tuning range. The r.f. resonant lines are coupled through their respective shields, either by loops fed through openings, or by slots in the shields.

A 6J6, operating as a push-pull oscillator using lumped constants, oscillates at one-half the desired frequency. This push-pull arrangement and its operation at a lower frequency contributes to stable operation. To obtain the second harmonic frequency which is needed in the mixing action, the tank of the oscillator is coupled to a harmonic generator G7B or G7C crystal. The second harmonic frequency output from the crystal is coupled to a harmonic selector tuned line. The signals from this harmonic selector line, and the second r.f. preselector, are fed through coils L_5 and L_6 to a 1N82 mixer crystal (D_1 in Fig. 2). The 40-mc. output is then applied to the 13-position v.h.f. turret tuner, where the 6BK7 r.f. amplifier is now used as a low-noise 40-mc. i.f. ampli-

fier. (See Fig. 3.) The 6J6, V_2, which is the v.h.f. mixer and local oscillator, receives no oscillator plate voltage in the u.h.f. position and, therefore, the oscillator section is completely inoperative during u.h.f. reception. The mixer portion of the 6J6 has a negative voltage applied to its grid from a negative tap on the power supply through the u.h.f.-v.h.f. switch and v.h.f. tuner test point, and it becomes another low-noise triode i.f. amplifier. The output from the i.f. preamplifier is then fed to the standard 40-mc. i.f. amplifier on the main chassis. In the v.h.f. position, when u.h.f. oscillator operation is not required, the plate voltage is reduced but not eliminated. This is done to prevent cathode poisoning.

All u.h.f. tuners are pre-aligned at the factory and will not normally require adjustment in the field. However, if the 6J6 u.h.f. local oscillator is replaced, the tracking on the u.h.f. band may be off slightly. Under these conditions, it would be best to try several 6J6's until one with similar characteristics to the original is found. If another tube is not available, it may be necessary to compensate for the minor difference by adjusting C_7 (see Fig. 1) slightly for the highest channel received.

A combined u.h.f.-v.h.f. antenna can be connected to the receiver through a common 300-ohm lead-in, or separate u.h.f. and v.h.f. antennas can be connected through independent lead-ins. An internal connector is provided for use with the common lead-in, and connects the antenna into the u.h.f. or v.h.f. tuner when the channel selector is rotated to the desired position. If separate antennas are used, this connector can be removed from the outside of the cabinet and requires no internal adjustments.

The u.h.f.-v.h.f. switch, shown in the upper left of Fig. 4, is automatically operated by a cam located on the v.h.f. tuner shaft. This cam changes the switch from its v.h.f. position (as in Fig. 4) to its u.h.f. position (slides one step down) whenever the v.h.f. tuner is set for u.h.f. operation. In the v.h.f. position, the antenna is connected through switch contacts 8-9 and 17-18 to the high-pass filter L_5, and thence through switch contacts 2-3 and 11-12 to the v.h.f. tuner. "B+" is supplied to the u.h.f. tuner through the 100,000-ohm resistor R_6, preventing the 6J6 in the tuner from oscillating but allowing some current flow through the tube to prevent its cathode from being poisoned during long periods of v.h.f. reception when it is inoperative.

With the switch in the u.h.f. position, the v.h.f. antenna, or combination u.h.f.-v.h.f. antenna, is disconnected from the v.h.f. tuner and connected through switch contacts 7-8 and 16-17 to the input of the u.h.f. tuner (terminals 3 and 4 on the connector TS-1 in Fig. 4). If a separate lead-in is used for u.h.f., it should be connected directly to the u.h.f. tuner

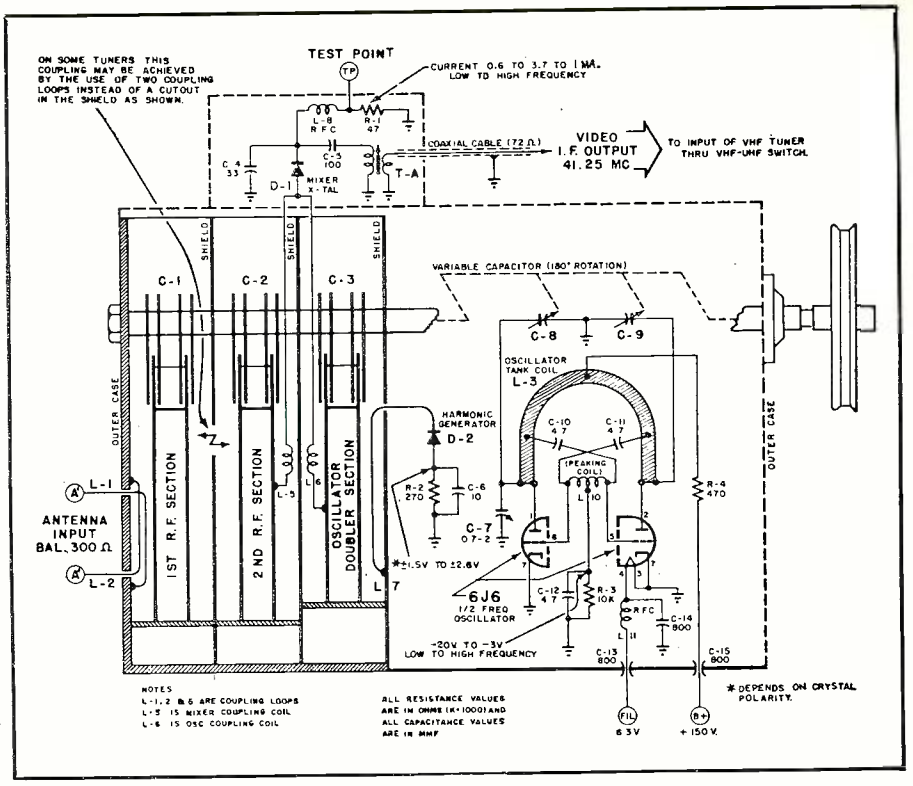


Fig. 2. Schematic diagram of the Emerson u.h.f. tuner showing test points.

antenna terminal; terminals 3 and 4 on the connector strip should be disconnected. The single-ended output of the u.h.f. tuner is fed through switch contacts 1 and 2 to the input of the v.h.f. tuner. The 100,000-ohm resistor, R_6, is shorted out by the switch through contacts 14 and 15, so that full "B+" (150 volts) is applied to the u.h.f. tuner. To enable the v.h.f. mixer tube to function as a 40-mc. amplifier when tuned to u.h.f., fixed grid bias is applied to the mixer through switch contacts 5 and 6 and the v.h.f. test point. Of course, the high-pass filter is switched completely out of the circuit for u.h.f. operation.

The i.f. amplifier is of conventional design, using three 6CB6's in three stagger-tuned stages. (See Table 2 for alignment of the i.f. amplifiers.) The first and second i.f. amplifiers are controlled by an a.g.c. line that is independent of the r.f. a.g.c. For this intercarrier receiver, the sound is taken from a 4.5-mc. take-off in the second detector output circuit and fed to the sound i.f. amplifier. The signal is limited by a 6AU6, detected by a *Foster-Seeley* discriminator, and then fed to a conventional audio output circuit. Table 2 contains alignment instructions for the sound section of the receiver.

Delay in Tuner A. G. C.

A subject worth going into is the a.g.c. because of its deviation from the common types of a.g.c. found in most receivers. To appreciate the

Fig. 3. Schematic diagram of the Emerson v.h.f. tuner described in the text.

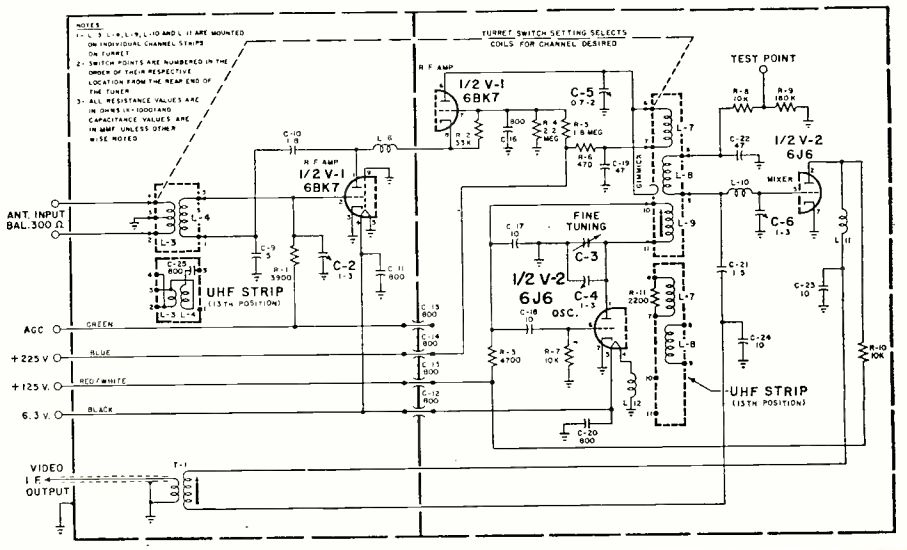
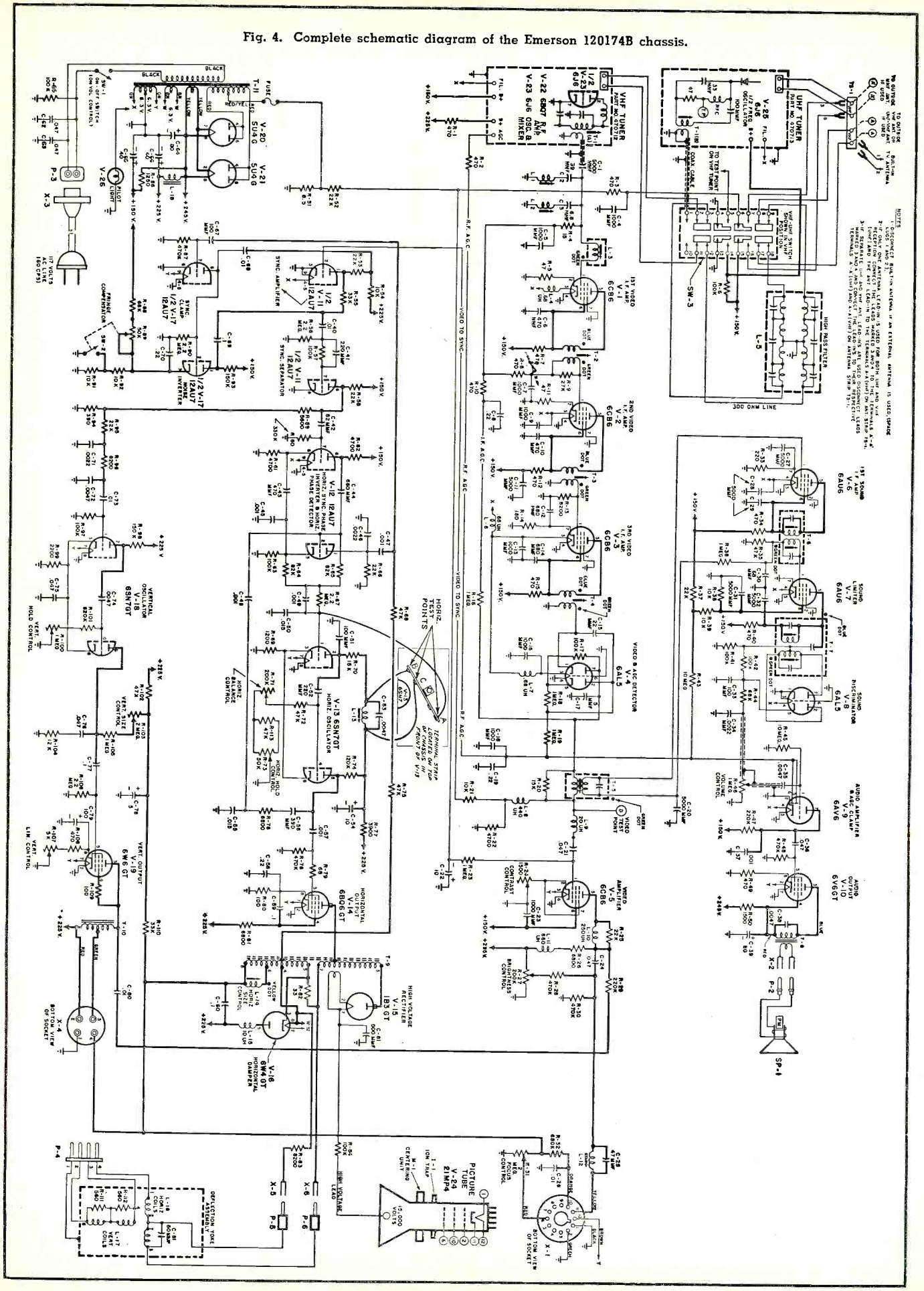


Fig. 4. Complete schematic diagram of the Emerson 120174B chassis.



variation, the need for it must be understood.

Early television receiver a.g.c. systems fell into one of three general categories:

1. No a.g.c.
2. Simple a.g.c., where the control voltage is obtained from the negative d.c. component developed across the video detector load resistor. (Fig. 5A.)
3. Voltage-doubler a.g.c., using a separate diode to rectify the composite video signal at the output of the i.f. amplifier, and adding it in series with the simple a.g.c. developed by method 2. (Fig. 5B.)

The requirements for a good a.g.c. has, no doubt, been seen by many television technicians but, more often than not, not understood. To give examples of two extremes, when a technician installed a receiver in a strong signal area, the picture would become extremely contrasty and, on some receivers, there would be a complete loss

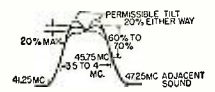
(*Continued on page* 114)

COMPONENT	CHECK POINT	VARIATIONS LOW TO HIGH FREQUENCY	POSSIBLE TROUBLE (If voltage readings are not normal)
6J6	"B+"	+150 v.	C_{10}, C_{15}, C_{11} shorted, the v.h.f.-u.h.f. switch.
	Filament	6.3 v.a.c.	L_{11} open, C_{14}, C_{13} shorted.
	R_3	−20 v. to −3 v.	R_3 open, C_{12} shorted. L_{10} open or shorted.
D_2 Harmonic Gen. Crystal	R_4	±1.5 v. to ±2.6 v.	Crystal defective, L_7 shorted to chassis, C_7 shorted. Voltage polarity depends upon crystal polarity.
D_1 Mixer Crystal	Current through R_1. Insert milliammeter	0.6 through 3.7 to 1 ma.	D_1 defective, C_4 shorted, L_8 open.

Table 1. Troubleshooting data for the Emerson u.h.f. tuner.

Table 2. Alignment procedure for the video i.f. and sound circuits of the Emerson 120174B chassis.

VIDEO I. F. ALIGNMENT

STEP	SIGNAL GENERATOR FREQUENCY	SIGNAL GENERATOR CONNECT TO	OUTPUT INDICATOR	CONNECT TO	ADJUST	REMARKS
1	45.75 mc. unmodulated	Floating shield of converter tube V_{23} (6J6)	V.T.V.M.	Video test point D	T_4 for maximum reading	Adjust output of signal generator so that maximum response does not produce more than −2 v. d.c. on V.T.V.M.
2	43.2 mc. unmodulated	Same as above	Same as above	Same as above	T_3 for maximum reading	
3	42.0 mc. unmodulated	Same as above	Same as above	Same as above	T_2 for maximum reading	
4	45.0 mc. unmodulated	Same as above	Same as above	Same as above	L_3, T_1 for maximum reading	
5	41.25 mc. unmodulated	Same as above	Same as above	Same as above	L_2 for minimum reading	Increase output of signal generator
6	47.25 mc. 400 cycles amplitude modulated	Same as above	Oscilloscope gain near maximum; horizontal sweep at 400 cycles	Same as above	L_1 for minimum vertical deflection	Set signal generator at maximum output
7	44 mc. center frequency. 10 mc. sweep. Marker generator at 45.75 mc.	See Fig. 8	Oscilloscope	Same as above	T_4 for waveform below 	Set signal generator output as low as possible

SOUND ALIGNMENT

8	4.5 mc. unmodulated or tune to on-the-air TV channel	Pin 7 of V_4 (through .01 μfd. condenser)	V.T.V.M. (through 10,000-ohm resistor)	Junction of C_{30}, R_{35}, and R_{36}	T_5 top or bottom for maximum reading. T_6 top and bottom for maximum reading	Adjust signal generator output (or antenna coupling) to produce a 1-volt d.c. rise on meter. If using signal generator short pin 1 of V_3 to chassis
9	Same as above	Same as above	Same as above	Junction of R_{44} and C_{34}	T_7 secondary for maximum negative reading	T_7 secondary adjustment is on top for part #708018, #708151; on bottom for part #708017
10	Same as above	Same as above	Same as above	Same as above	T_7 primary for maximum negative reading	
11	Same as above	Same as above	Same as above	Same as above	T_7 secondary for zero d.c. reading	

4.5 MC. VIDEO TRAP

12	4.5 mc. unmodulated	Pin 2 of V_5 (through .01 μfd. condenser)	V.T.V.M. (negative scale)	Junction of R_{34}, T_6, and C_{29}	L_8 for minimum negative reading	Short pin 1 of V_3 to chassis. Set contrast control completely counterclockwise. Repeak T_5

SIX-METER EMERGENCY TRANSCEIVER

By

ROBERT L. HANKEY, W3OBC

and

MAURICE P. JOHNSON, W3TRR

WAAM (TV) Engineering Dept.

Above, the six-meter transceiver with its antenna. Controls are "tone-voice" switch, regeneration, and battery "on-off." Small hole is for receiver tuning. At right, one of the transceivers is shown in operation.

The six-meter amateur band has advantages in equipment and performance over both "ten" and "two" for CD and other portable-emergency work.

THE DESIGN of most emergency amateur equipment, portable gear intended to be carried by hand in particular, is necessarily a compromise dictated by the unyielding demands for lightweight, small size, and low battery drain. Naturally this results in simple receivers and low power transmitters. To obtain any degree of reliable communication between such units, the choice of operating frequency warrants careful consideration.

Persons aware of current trends in emergency equipment probably already realize that the six-meter band is being favored as the band best suited to this type operation. Six meters gives satisfactory coverage, yet is not cluttered with the QRM so typical of the more active lower frequencies. Reasonably efficient designs for six-meter gear are possible with conventional components and without complex circuitry, since the band is within the frequency ratings of most miniature tubes. Another point of amateur interest is the antenna efficiency which can be obtained with reasonable antenna lengths.

For these and other reasons the FCDA prefers six meters for *RACES* (Radio Amateur Civil Emergency Service) use rather than the more popular ten-meter band. Local coverage is likely to be more reliable because "six" is less frequently bothered by DX interference, which can be a serious factor. The FCDA's plan for "matching funds" to supplement community expenditures for CD radio does not allow for the setting up of new ten-meter systems, although it does allow for replacement and growth in existing systems. A community about to set up a *RACES* system, or an existing system wishing to add a network of hand-carried portables, would do well to consider six meters.

The six-meter, hand-held transceiver discussed here is the first of several equipment designs being undertaken to provide a complete portable and emergency service, and is thus well suited to Civilian Defense needs. This transceiver meets the demands for a compact, lightweight, battery-powered unit, entirely self-contained, intended for use at locations that would be inaccessible to mobile or other equipment.

As six meters had been selected as the most promising band for the equipment, considerable effort was directed toward an efficient transceiver design. Previously published material was carefully perused, and several worthwhile ideas gleaned, but no design was encountered which completely met our requirements. It was therefore decided to establish our own design criteria, and make trial constructions and tests to check the various circuits examined.

Ordinary modulated oscillators and superregenerative receivers were combined in some of the simplest transceiver designs and a test of such a circuit was made. A two-tube set was constructed, one tube for the oscillator and detector, the other as modulator and audio amplifier. The circuit adapted itself to extremely compact construction and low battery drain, but the faults inherent in its simplicity did not permit the unit to meet our specifications. The transmitter proved to be much too unstable for dependable fixed-frequency reception, and the superregenerative detector produced excessive radiation. Body-capacity effects on the antenna affected stability to a great degree, which was considered especially undesirable in a hand-held transceiver.

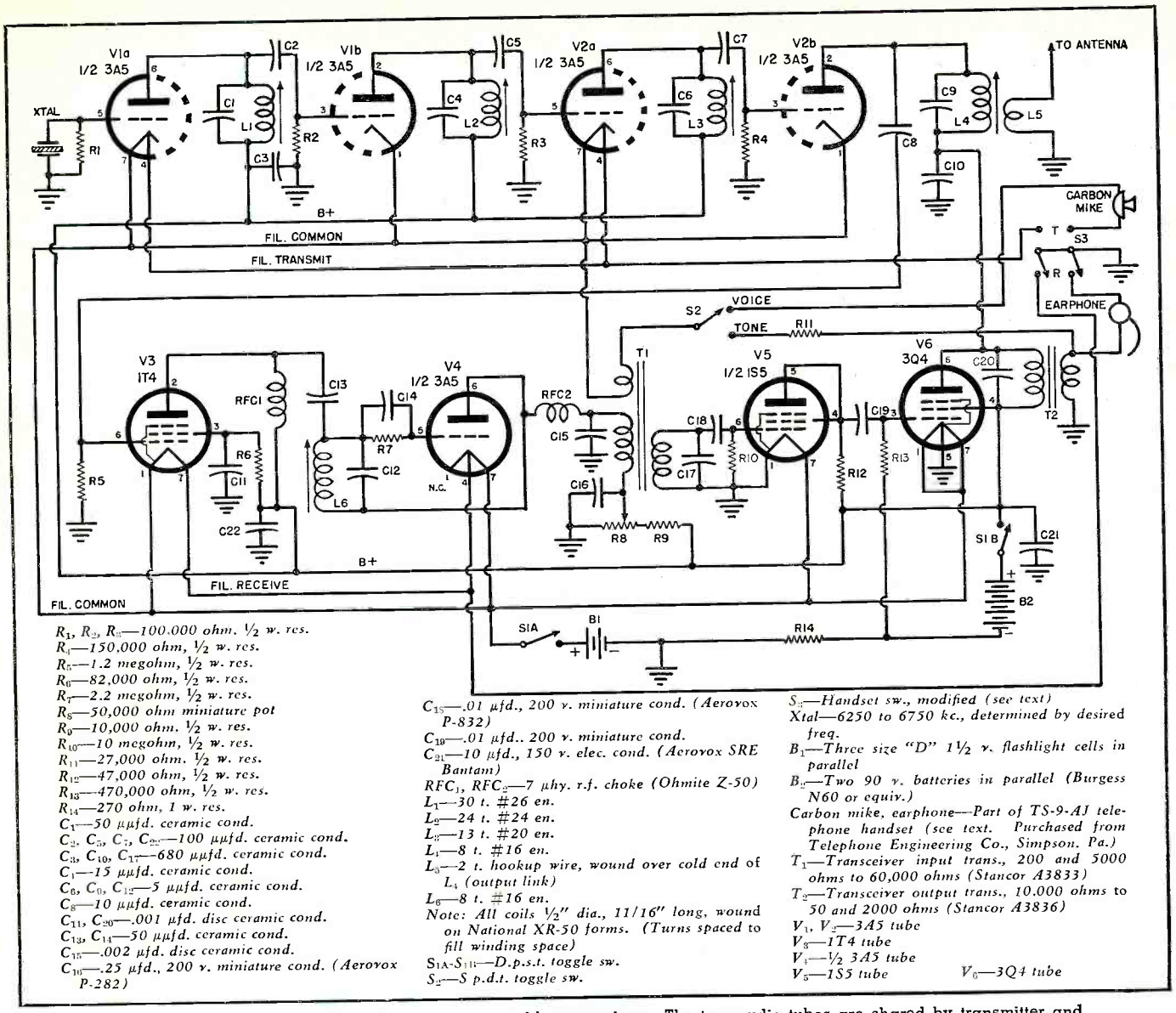
These tests of the simplest transceiver circuits indicated that somewhat more refined circuitry would be necessary if any degree of reliability was to be obtained.

The circuit which finally evolved after considerable study, test, and discussion is a carefully balanced choice of the features needed to provide the desired stability and dependability without undue weight or battery drain. As the design of the prototype units progressed, every effort was made to avoid special, subminiature, or surplus parts, so that duplication could be more easily accomplished.

Our contemplated six-meter project is based upon single-frequency network-type operation, with transceivers intermingled with other mobile-portable and fixed station equipment, and with the majority of receivers intended for fixed-frequency operation. Therefore, crystal control of the transmitter became almost mandatory in the interest of frequency stability. Harmonic-type oscillator circuits were rejected in favor of a conventional triode oscillator with multiplier stages, since the latter was considered somewhat less difficult to adjust and tune.

Four stages in the r.f. lineup make use of two dual-triode tubes, multiplying the crystal frequency eight times to produce the six-meter carrier. The oscillator plate circuit tunes to the crystal frequency, with each following stage functioning as a doubler. Operating the final amplifier as a doubler admittedly reduces the efficiency, but this slight sacrifice avoids the necessity of neutralization.

A receiver of comparable perform-



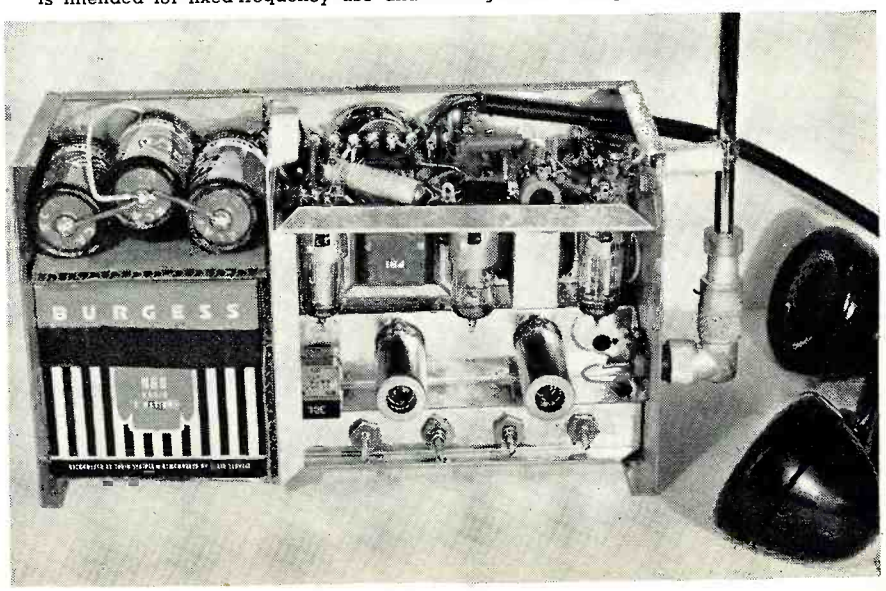
R_1, R_2, R_3—100,000 ohm, ½ w. res.
R_4—150,000 ohm, ½ w. res.
R_5—1.2 megohm, ½ w. res.
R_6—82,000 ohm, ½ w. res.
R_7—2.2 megohm, ½ w. res.
R_8—50,000 ohm miniature pot
R_9—10,000 ohm, ½ w. res.
R_{10}—10 megohm, ½ w. res.
R_{11}—27,000 ohm, ½ w. res.
R_{12}—47,000 ohm, ½ w. res.
R_{13}—470,000 ohm, ½ w. res.
R_{14}—270 ohm, 1 w. res.
C_1—50 μμfd. ceramic cond.
C_2, C_5, C_7, C_{22}—100 μμfd. ceramic cond.
C_3, C_{10}, C_{17}—680 μμfd. ceramic cond.
C_4—15 μμfd. ceramic cond.
C_6, C_9, C_{12}—5 μμfd. ceramic cond.
C_8—10 μμfd. ceramic cond.
C_{11}, C_{20}—.001 μfd. disc ceramic cond.
C_{13}, C_{14}—50 μμfd. ceramic cond.
C_{15}—.002 μfd. disc ceramic cond.
C_{16}—.25 μfd., 200 v. miniature cond. (Aerovox P-282)
C_{18}—.01 μfd., 200 v. miniature cond. (Aerovox P-832)
C_{19}—.01 μfd., 200 v. miniature cond.
C_{21}—10 μfd., 150 v. elec. cond. (Aerovox SRE Bantam)
RFC_1, RFC_2—7 μhy. r.f. choke (Ohmite Z-50)
L_1—30 t. #26 en.
L_2—24 t. #24 en.
L_3—13 t. #20 en.
L_4—8 t. #16 en.
L_5—2 t. hookup wire, wound over cold end of L_4 (output link)
L_6—8 t. #16 en.
Note: All coils ½" dia., 11/16" long, wound on National XR-50 forms. (Turns spaced to fill winding space)
S_{1A}-S_{1B}—D.p.s.t. toggle sw.
S_2—S p.d.t. toggle sw.
S_3—Handset sw., modified (see text)
Xtal—6250 to 6750 kc., determined by desired freq.
B_1—Three size "D" 1½ v. flashlight cells in parallel
B_2—Two 90 v. batteries in parallel (Burgess N60 or equiv.)
Carbon mike, earphone—Part of TS-9-AJ telephone handset (see text. Purchased from Telephone Engineering Co., Simpson, Pa.)
T_1—Transceiver input trans., 200 and 5000 ohms to 60,000 ohms (Stancor A3833)
T_2—Transceiver output trans., 10,000 ohms to 50 and 2000 ohms (Stancor A3836)
V_1, V_2—3A5 tube
V_3—1T4 tube
V_4—½ 3A5 tube
V_5—1S5 tube
V_6—3Q4 tube

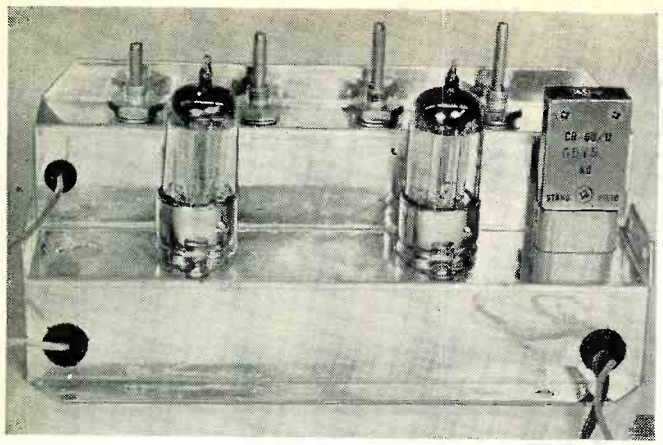
Schematic of the six-meter CD and emergency portable transceiver. The two audio tubes are shared by transmitter and receiver; the transmitter output tank coil doubles as an input coil for the receiver r.f. stage, thus eliminating antenna switching. Otherwise the transmitter is distinct from the receiver, unlike the usual tube-sharing "transceiver" circuit.

ance was the next objective. Examination of the superheterodyne circuit indicated that the inherent complexity for even moderate sensitivity would not be justified in this application. The excellent sensitivity of the superregenerative detector makes it worthy of consideration. It posseses a degree of a.v.c. action in itself, and its slightly broad bandpass characteristic is not particularly objectionable for a fixed-tuned receiver on an uncrowded band. Furthermore, its simplicity lends itself admirably to a compact construction such as this.

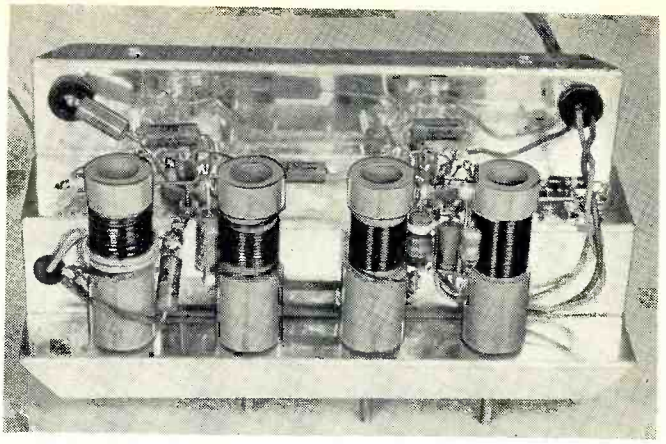
A triode circuit was found to produce the smoothest performance in this particular unit. One-half of a 3A5 was finally used as about the only tube available. Control R_8 is the regeneration control, made variable to allow adjustment for battery voltage changes, and to permit optimum detector operating adjustments. The values of C_{14}, R_7, and C_{15} all affect the operation and the listed values were those which gave best results in this circuit.

A view of the transceiver with the cover removed and antenna attached. The transmitter and receiver occupy separate chassis, simplifying construction. The receiver is intended for fixed-frequency use and is slug-tuned through a hole in the case.





The transmitter chassis, showing small size and simplicity of the unit. Grommet at upper left carries the antenna lead; the other is for receiver input. Modulator is on receiver chassis.



Under-chassis view. Oscillator at right operates on crystal fundamental; all other stages, including final, are doublers. Parts are standard. Chassis is cut from a transcription disc.

The primary objections to the super-regenerative detector, namely oscillator radiation and antenna loading effects, were remedied in this receiver by incorporating an r.f. stage to isolate the detector from the antenna. A pentode amplifier is used which helps to increase the sensitivity of the receiver.

The use of an antenna changeover relay or switch was avoided in a practical and convenient manner. Coil L_4, together with C_9, serves the dual role of tank circuit for the transmitter final and also tuned input for the receiver. Condenser C_8 and R_5 form the receiver coupling, and by proper choice of values very little energy is lost when transmitting.

The requirements of the modulator and receiver audio amplifier were easily combined in a common circuit using two tubes. One winding of a dual-purpose input transformer couples the detector to a pentode voltage amplifier. The other primary introduces the single-button carbon mike when transmitting. The button current is drawn from the filament string. Contact bias on the voltage amplifier produces excellent gain in the stage, which is *RC*-coupled to the power output tube. The output transformer secondary matches the tube to the receiving earphone, and the primary is used for the Heising modulator.

The selector switch S_2 injects a sidetone which makes a very convenient modulating signal for alerting or tuning the receiving station. Proper phasing of the windings in the feedback loop is essential to generate the tone.

The power changeover for "transmit-receive" switching is accomplished by S_3. Half of this d.p.d.t. switch completes the ground path for the filaments of each section as required, while the other half completes the mike or earphone circuit, depending upon the use. The dual-purpose audio section operates continuously as it functions during both reception and transmission.

The advantages of having this push-to-talk changeover incorporated as a switch in the handset were obvious. Several TS-9-AJ handsets with butterfly switches were available, and these were carefully rebuilt as d.p.d.t. switches by using thinner insulating spacers and adding two switch leaves. The "receive" contacts were adjusted to be normally closed. A length of four-wire cable with a shield for the ground return was connected from the handset to the transceiver proper.

Should this handset revamping be considered too laborious to the constructor, the same electrical results can be accomplished by mounting a spring-return switch on the transceiver within easy reach of the carrying handle.

The handset clips into the carrying handle when not in use. This handle is a U-shaped bracket which was folded from 1/16-inch aluminum stock in such a manner as to grip the handset snugly.

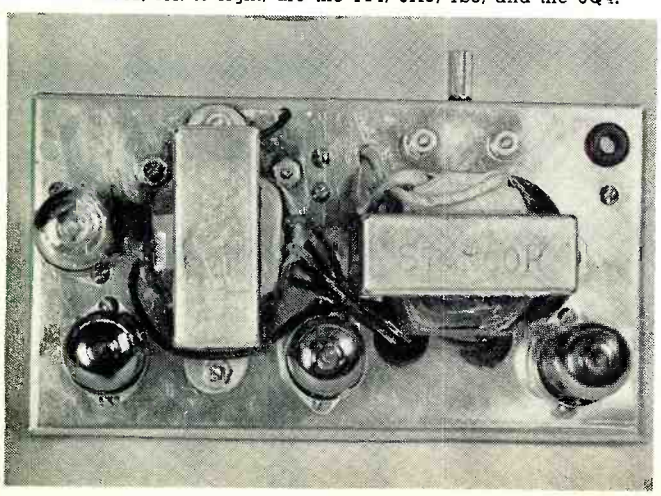
The controls on the front panel are the regeneration control, the "tone-voice" switch, the battery "on-off" switch, and an access hole for tuning the receiver slug. The antenna mounts on the front end of the cabinet and, if desired, a terminal strip can be included for external battery connections.

It is suggested that a careful study of the schematic, photographs, and sketches be made before duplication of the transceiver is undertaken. The parts layout and method of construction will be evident from the photos. Careful adherence to the layout and listed parts is suggested to circumvent unnecessary complications in assembly.

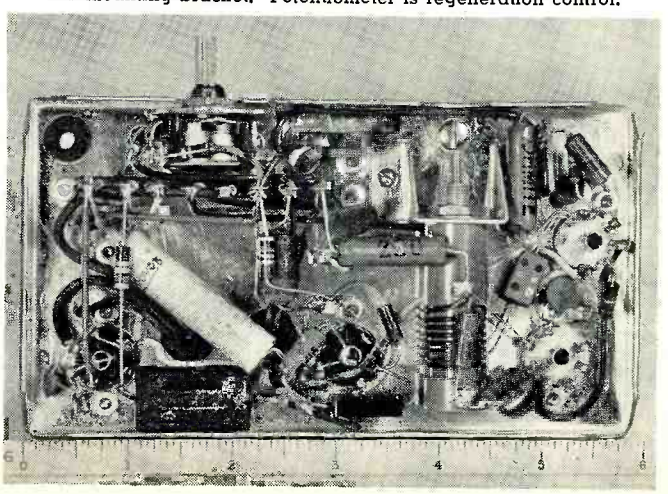
The entire rig is fitted into a *Bud* CU-2110 "Minibox," measuring 6"x10"

(*Continued on page 77*)

Top view of the receiver and audio section. The transceiver transformer is at left; output/modulation transformer at right. The tubes, left to right, are the 1T4, 3A5, 1S5, and the 3Q4.



Receiver and audio section under-chassis view. Ceramic sockets are used for the r.f. amplifier and detector tubes. Note the coil-mounting bracket. Potentiometer is regeneration control.



ADAPTING V.O.M. AS A FIELD STRENGTH METER

By **ELBERT ROBBERSON**

A common volt-ohm-milliammeter is quickly converted to a sensitive field-strength meter by connecting a crystal diode across the input terminals by a simple adapter. Meter leads plug through the adapter, securing it and providing an antenna.

This simple adapter converts a transmitter technician's v.o.m. into a field-strength meter for on-the-spot checks.

TRANSMITTER workers, both amateur and professional, have long known that the *field strength meter* is better for tuning up output and antenna circuits than antenna ammeters, plate milliammeters, or any other single instrument. All too often, however, it is not used—either because one is unavailable for some reason, or because it would represent just one more bulky object to be added to the already heavy load of instruments and tools to be carried to the field.

The photograph at right above shows an adapter which will convert the conventional volt-ohm-milliammeter normally carried by a technician, into a sensitive field strength meter which will give accurate relative measurements of actual radiated power on any frequency up to thousands of megacycles.

The sensitivity may be judged from the fact that the pointer of the instrument in the photograph is being deflected ⅔ of full scale, or about 68 microamperes, by the relatively feeble amount of power being generated (in this case on 50 megacycles) by a grid-dip oscillator in the same room.

The adapter requires no power source, weighs only one-half ounce, can be tucked away in the meter-lead compartment of the instrument, and, best of all, it can be made in minutes from surplus and scrap.

Its general aspect is shown in the photo above (left). The heart of the adapter is a 1N21 radar crystal, used as a detector. The mechanical design of the adapter connects the crystal across the meter input, in parallel with the normal leads, which are used as a pickup dipole antenna. Since the length of the leads determines the resonant frequency of the detector, a special pair may be used for any particularly important frequency, or they may be tuned by rolling them up, or clipping onto other nearby metallic objects to add length to the antenna.

The simplest mounting base is one of the Bakelite fuse strips found in about every major surplus equipment item. One of the pairs is sawed off, leaving enough Bakelite on one side so that it will cover the input jacks.

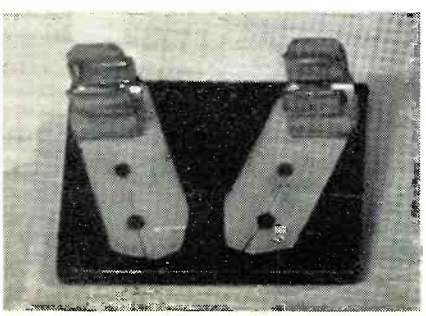
Two strips of thin brass stock (photo right) are cut to the approximate shape shown, and fastened under the fuse clips. Two holes *one size smaller* than the exact diameter of the meter-lead plugs are drilled through the brass and the Bakelite, and the brass pieces slit as shown so they form spring contacts. The holes in the Bakelite are reamed slightly so the plugs fit snugly. The hole spacing should be exactly the same as that in the meter, so the plugs will fit through the adapter holes and into the meter jacks.

The cartridge-like rim on the end of the surplus crystal is then filed off, and a piece of ¼" rod, either brass or aluminum, is then cut to make up the length between the fuse clips, and is drilled in the end to take the crystal tip. The extension is slipped onto the tip, and the assembly is clipped into the holder, just like a fuse.

Of course the crystal must be clipped in with the correct polarity to make the meter read properly.

If it is desired to make use of the later model crystals with pigtail leads, solder lugs may be substituted for the fuse clips, and the crystal mounted between them.

The fuse clips and brass contact strips are mounted as shown. Strips are slit for "spring" effect for positive contact.



In the field, the test leads and the adapter are plugged into the meter, the selector switch set on the microampere position, care being taken, if transmitter power is high, not to "pin" the meter. If pickup is too great for safety to the meter, the leads may be shortened or rolled up. If insufficient pickup is obtained, the leads may be connected to other metal objects.

The meter should be placed as far away as working area and vision permit so that movements of the operator will not affect the indications and in order that direct pickup from the transmitter is minimized. An example of correct placement would be the case of tuning a small boat transmitter, with the meter placed in sight of the operator on the stern of the boat or preferably, on the dock. With transmitters located on dry land the possibilities for placement of the meter are virtually unlimited, and fences, automobiles, trees, etc., may be used to support or augment the antenna.

With correct placement and a proper pickup circuit, excellent comparisons may be made for tuning transmitters of as little as five watts' output. The adapter can be used with any instrument having a microampere or sensitive low-voltage scale. —30—

A HOME SECURITY RADIO

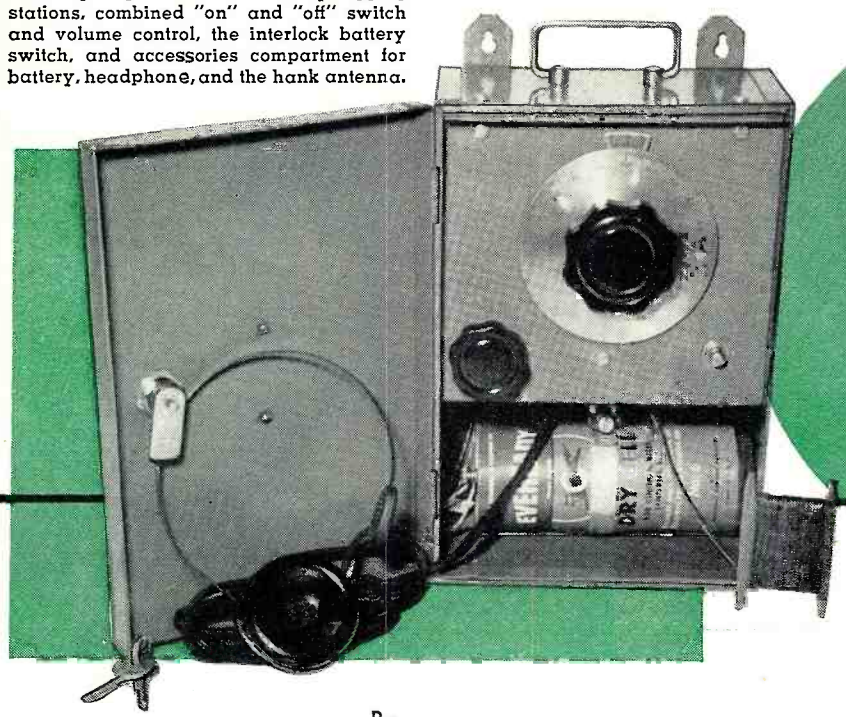


Fig. 1. External view of the security radio showing large dial for accurately logging stations, combined "on" and "off" switch and volume control, the interlock battery switch, and accessories compartment for battery, headphone, and the hank antenna.

By
H. G. BOURNE and **E. J. CORDIER**
Ohio Department of Health

A rugged, four-tube superhet which combines good sensitivity with long battery life—insuring reliable emergency service.

"THE fear reaction of military personnel who were not acquainted with the technical details, atomic bomb, was appalling at Bikini and Eniwetok. The fear reaction of the uninitiated civilian is ever evident. It is of such magnitude that it could well interfere with an important military mission in time of war." So states the Army Medical Department in the publication "What You Should Know About the Atomic Bomb."

One of the major causes of panic is fear. Terror of the unknown promotes disorganized behavior. By predisaster education and training, the threat of unknown or fantastic dangers may be diminished. During the emergency or danger situation itself, and for several hours to a day or more thereafter, other factors such as rumor, suggestibility in contrast to critical judgment, imitative behavior (people run when others run), and tension and insecurity will continue to operate to produce panic.

Civil defense authorities may inform the individual, stimulate leadership, dispel fear, and explain the procedure one must follow to satisfy basic needs such as hunger and safety if a means is available for communication with each household. How can this panic-decreasing information be conveyed to the individual in the absence of telephone service and failure of conventional broadcast receivers subject to community electric service?

There are those who have counseled that aircraft, taxis, and police cars already equipped with radio receivers be provided with a public address system to soundcast information and instruction. Such a procedure limits the broadcast information to short disconnected phrases such as "Boil water!" "Stay indoors!" "Keep off the roads!" Such brief pronouncements containing a modicum of truth in the absence of explanation may be elaborated, distorted, misinterpreted, mangled, and constantly magnified with each retelling until they contribute to hysteria.

Moreover, loud noise as from a public address system may, in conjunction with other sounds, directly contribute to panic. Caldwell *et al*[1] state "In a disaster people may hear the loud noise, smell objects burning, and see people running. These sensory stimuli heighten excitement and contribute to panic behavior." Schmidberg[2] in describing British experience has stated "Auditory impressions in war exercise the strongest effect of all on nerves. The whistling of falling bombs, the sounds of their explosions, and the boom of the antiaircraft guns mingle in the inferno of noise with shattering effects on the nerves."

Others have recommended battery-operated portable broadcast-band receivers of the vacation type or automobile radios as a means of communicating with householders. In each household, however, unless leadership is maintained, the collective behavior of the group will be panic in type. To maintain leadership, civil defense communications affecting the family unit should be directed exclusively to the family head. This privacy of communication is defeated by a speaker-equipped vacation or automobile receiver. Moreover, World War II recollections suggest in the event of future conflicts the majority of vacation receivers will be inoperative because batteries are unobtainable. An automobile receiver is a heavy drain on the car storage battery. And, a dead battery is poor preparation for flight if evacuation is ordered. If the car engine is run to maintain the battery charge, the usual caution to avoid running internal combustion engines in closed garages is likely to be disregarded in time of mental stress and more deaths can be anticipated from carbon monoxide poisoning than lives saved by radio-acquired information. Hence neither personal-type, battery-operated radios nor the automobile receiver provide a satisfactory solution.

A special-purpose, home-security radio of improved sensitivity and powered by a universally available battery is proposed by the authors. One receiver believed to be suitable is described in the hope it may stimulate further development and eventual commercial manufacture for public service.

There are now available to the public portable radios that are inexpensive and of simple operation; such features pose no special problem. Reli-

ability may be secured through the use of quality components adequately protected from the destructive forces of man and nature. Two features of the emergency home receiver, however, require special study, *i.e.*, source of power and sensitivity.

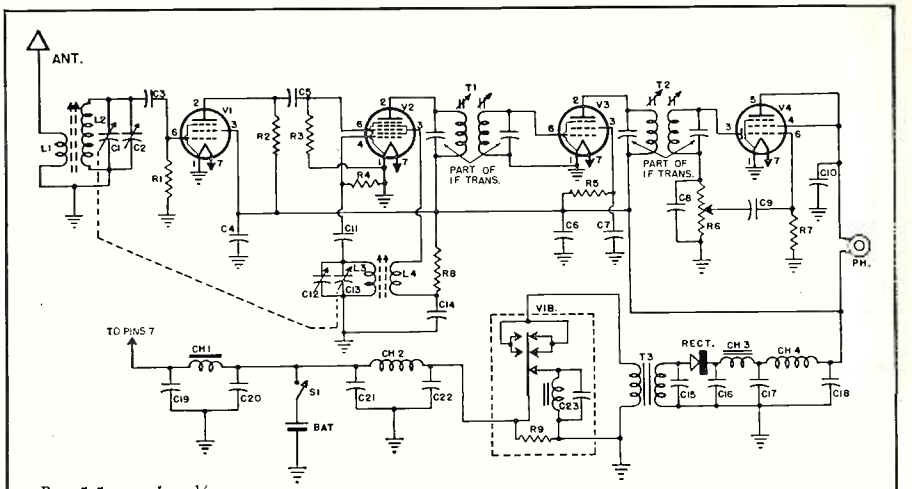
Energy Source

The ideal source of energy for a home-security receiver would be a single battery of sufficient capacity and infinite shelf life which could be energized by the addition of tap water or urine. Furthermore it should be of convenient size and weight, commercially available everywhere, low priced, and nonspillable. Since no such battery was known to the authors a single No. 6 dry cell was selected as a compromise. The standard No. 6 dry cell will deliver 80-90 per-cent of its original power when placed in use at the end of one year and 50 per-cent even at the end of two years. It may be replaced for less than $1.00 and otherwise appears to satisfy the requirements of an ideal battery.

The useful life of a No. 6 dry cell would obviously be too brief to operate any radio expected by the public to provide entertainment; however, in the event of disaster, a receiver would give emergency service if it was capable of maintaining a schedule of 10 minutes "on," 20 minutes "off" for 8 hours (daylight) and then after an overnight rest the same schedule repeated for a total of three days. The power pack was therefore designed to adapt the energy from a single No. 6 dry cell to the operation of a receiver for three days on this timetable. It remained to construct a receiver to combine minimum battery drain with high sensitivity.

The circuit and components of a vibrator power supply which proved satisfactory are shown as part of Fig. 2. Although commercially available parts were utilized wherever possible, it was necessary to make special chokes and to readjust the standard 2-volt vibrator driver contacts to secure dependable starting and maximum output voltage and current when operating on 1.5 volts. If the vibrator fails to start on 1.5 volts or the "B" voltage is too low due to poor vibrator action, open the vibrator by carefully sawing around the can about ½" above the base. Turn the driving contact adjustment screw until optimum operation is obtained. Replace the can and hold in place with plastic vinyl tape.

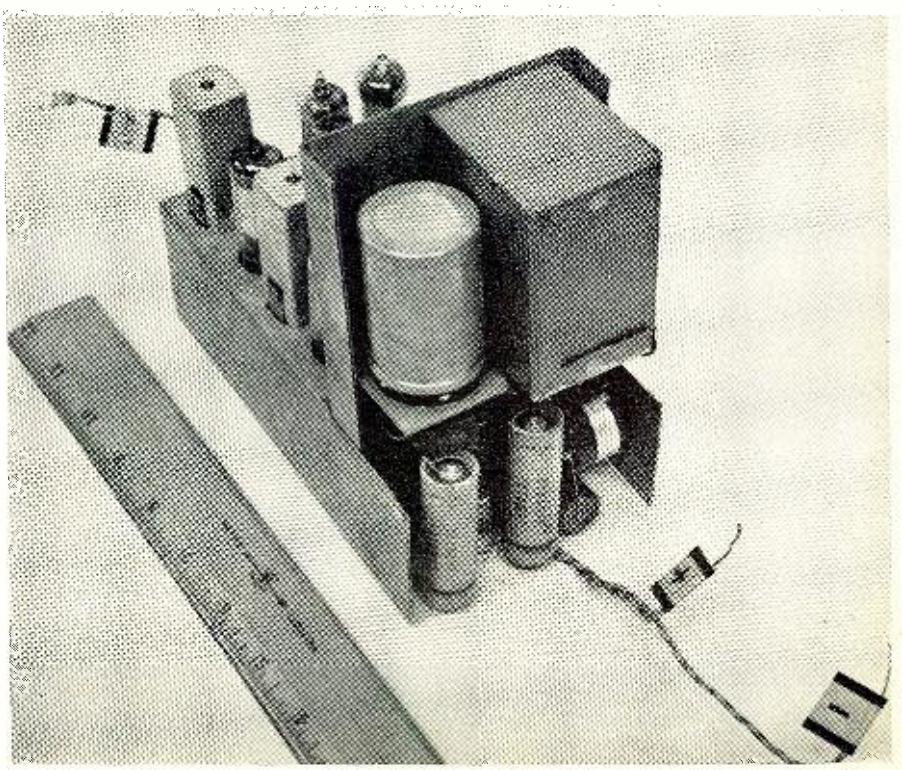
The audio frequency choke, CH_1, deserves special attention. The core was that of a standard output transformer similar to that used as the vibrator output transformer (*Knight* 8000/3 ohms—*Allied* No. 62-093). Any small transformer core will do. It is only necessary to remove the "I" section of the core which opens the "E" section. The winding will then slip off easily. First wrap one or two layers of vinyl plastic tape on the core, then wind No. 24 d.c.c. enameled wire about the cen-



R_1—5.5 megohm, ½ w. res.
R_2—10,000 ohm, ½ w. res.
R_3, R_7—3.3 megohm, ½ w. res.
R_4—100,000 ohm, ½ w. res.
R_5—27,000 ohm, ½ w. res.
R_6—500,000 ohm pot with sw.
R_8—17,000 ohm, ½ w. res.
R_9—220 ohm, ½ w. res.
C_1, C_{13}—2-gang var. cond. 8.7-170.7 μμfd., 11-431 μμfd.
C_2, C_{12}—2-17 μμfd. trimmers (on C_1, C_{13})
C_3, C_5, C_{11}—400 μμfd. mica cond.
C_4—.002 μfd., 600 v. cond.
C_6, C_{14}—.05 μfd., 400 v. cond.
C_7, C_9—.01 μfd., 600 v. cond.
C_8, C_{23}—.002 μfd. mica cond.
C_{10}—.005 μfd., 600 v. cond.
C_{15}—.003 μfd., 1600 v. cond.
C_{16}, C_{17}, C_{18}—10 μfd., 250 v. elec. cond.
C_{19}, C_{20}—500 μμfd., 6 v. elec. cond.
C_{21}, C_{22}—.5 μfd., 100 v. cond.
L_1-L_2—Adj. iron core ant. coil (Meissner #14-1071)
L_3-L_4—Adj. iron core osc. coil (Meissner #14-1074)
T_1, T_2—455 kc. iron core i.f. trans. (Meissner #16-6758)
T_3—Vibrator trans. 8000/3 ohms (Knight—Allied #62-093)
CH_1—32 mhy. audio freq. choke (see text)
CH_2—.3 mhy. r.f. choke. Closewind 3 layers, 15 t. each, No. 16 d.c.c. enameled wire on ¼" wood core. Held in place by black vinyl plastic tape
CH_3—1.5 hy., 10 ma. filter choke, 95 ohms res. (Merit C-2973)
CH_4—2.5 mhy., 50 ma. r.f. choke (National R-50)
VIB.—2 volt vibrator (Mallory type T-4003-2, Radiart 5469-2, or Allied 56-128. See text for modifications)
Rect.—35 ma. selenium rectifier (Sarkes Tarzian Type 35)
BAT.—No. 6 dry cell (see text)
PH—Single 1500 ohm headphone
S_1—S.p.s.t. interlock switch, normally closed. Wired in series with "on-off" sw. which is integral with volume control pot, R_6. S_1, closed when cover is open.
V_1, V_3—1U4 tube
V_2—1R5 tube
V_4—1S5 tube

Fig. 2. Complete schematic diagram of the battery-operated "security" radio receiver.

Fig. 3. Internal view showing vibrator power supply mounted on the vertical chassis and receiver proper located on the horizontal chassis. See text for details.



ter leg until the "window" area is full. Replace the "I" section, being careful to make good contact with the "E" section. One must also exercise caution against shorting the wire to the core. The "I" and "E" sections are then held firmly in place by bending the mounting bracket lugs into their former position.

Upon completion of the receiver and its included power pack, trial runs were made to determine the plate potential and current as well as the battery terminal potential as the 10 minutes "on," 20 minutes "off" schedule progressed. After four days of operation the terminal potential of the No. 6 dry cell dropped to approximately 1.2 volts and the vibrator ceased to start.

Sensitivity

The home security radio was designed upon the premise that it must receive, during daylight hours, stations 25 miles or more distant having 1000 watts or less power. Furthermore, the reception must be accomplished with no more antenna than could be located in a cellar or bomb shelter. These specifications are based upon the assumption that metropolitan and suburban transmitters will be silent following an attack for one or more of the following reasons: station destroyed, no power, personnel dead. Elsewhere, silence will be imposed for security reasons except for previously designated transmitters located in the nearest supporting communities. The power output of these outlying stations will be restricted to the minimum necessary to reach the devastated area effectively. Transmissions will proceed during daylight hours in order that the information broadcast can be converted by the family head into appropriate action.

A four-tube superheterodyne utilizing one stage of untuned r.f. amplification was found to be most capable of achieving high sensitivity with low battery drain, portability, operational simplicity, and moderate cost. A similar conclusion was arrived at by Passow[3] who also had the problem of obtaining more sensitivity from loop-operated receivers so that they could be used in isolated communities throughout the country rather than only in metropolitan areas.

Portability and Cost

Sufficient portability to permit the receiver being easily moved from the owner's house to a neighbor's, to the automobile, bomb shelter, or garage is desirable. "Pocket size" is considered unnecessary since the family which may be required to evacuate its home will wisely choose to burden itself with no more than food, extra clothing, money, and valuable papers.

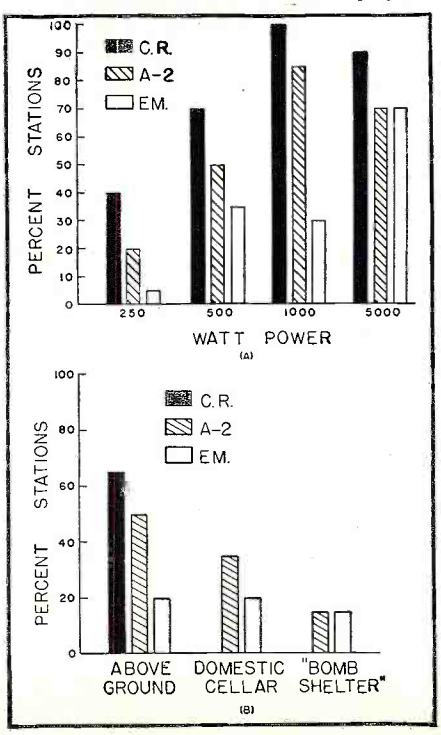
The total net retail cost of the components of the single receiver constructed was $42.50. Quantity buying, construction simplification, and manufacturing "know how" could be expected to reduce the cost very considerably. However, it is believed that it is far better that many foresighted families make a financial sacrifice to purchase an adequately built unit rather than to have every household be induced by cheapness to buy a worthless product.

General Description

The receiver circuit is a standard superheterodyne employing a 1U4 in an untuned r.f. stage, a 1R5 as oscillator-mixer, another 1U4 in the i.f. stage and a 1S5 as diode-detector and audio-amplifier. Automatic volume control has been omitted and audio-amplification is limited to that of the 1S5 triode since its output is sufficient to operate the headphone. The untuned r.f. stage represents a compromise between the greater sensitivity of a tuned r.f. stage and the necessity of a large 3-gang condenser and other components which would have increased the size, weight, and cost of the receiver.

The chassis consists of two sections as may be seen in Fig. 3. The horizontal receiver member contains on the topside tubes, i.f. cans, and variable condenser while directly beneath are located the usual fixed condensers, resistors, tube sockets, volume control, safety switch, etc. The vertical power supply chassis is inset into and attached to the receiver unit. On the upper portion of the vertical chassis is mounted the vibrator and a minican containing the high voltage transformer, rectifier, choke, and filter condensers. Underneath are placed the low voltage filtering chokes and high capacity condensers needed to remove r.f. hash and audio-hum produced by the vibrator. This construction and the use of steel chassis material was found necessary to reduce internal noises to an acceptable level.

Fig. 4. (A) Comparative performance of a communications receiver (C.R.), the home security radio (A-2), and a commercial four-tube personal portable (E.M.). "Percent stations" represents the per-cent of b.c. stations within 100-mile radius of test locations which were received in each of four power classifications: 250, 500, 1000, and 5000 watts. (B) Similar comparison with b.c. stations of 1000 watts power or less made at three sites as indicated on graph.



An external view of the complete receiver is shown in Fig. 1. The sturdy metal box housing the receiver is 10 5/16 inches high, 7 1/8 inches wide, 4 1/2 inches deep and is provided with two mounting ears and a carrying handle. The cover when closed and locked insures against unwarranted use of the radio by inquisitive members of the family. The weight of the entire receiver and accessories is 10 pounds, 6 ounces.

Certain other external features merit special mention. An interlock switch is provided which automatically shuts off the battery when the cover is closed. The battery is intentionally conspicuous to remind the set owner that it must be replaced periodically and to facilitate its change. Moreover since one instinctively associates a limited output with a single battery, its prominent location tends to temper the receiver's use. A hank antenna is provided in place of the more usual built-in loop to add a certain inconvenience to operation, thereby discouraging the radio's use as a casual "plaything." The large dial with vernier enables one to log stations accurately in advance, thereby obviating the necessity of station hunting during an emergency.

Performance

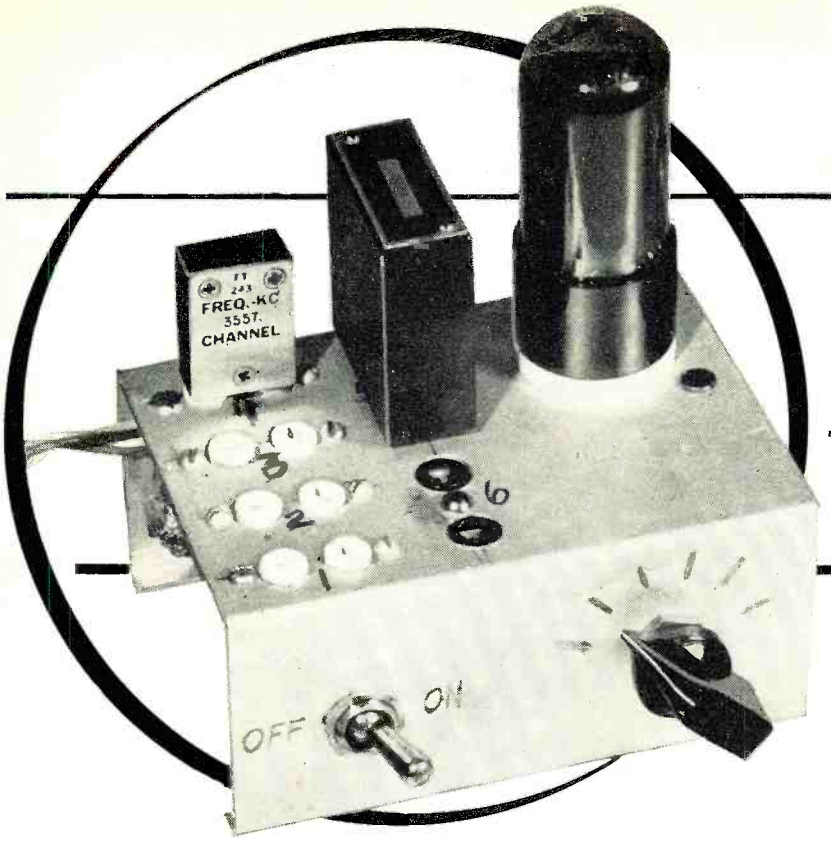
In the absence of suitable laboratory equipment to measure absolute sensitivity, it was necessary to resort to a comparison method in order to evaluate the emergency receiver's performance. In the first test the security receiver (A-2), with 25-foot hank antenna placed in a horizontal position six feet above ground, was compared for sensitivity with a commercial communications receiver (C.R.) employing a suitable outside doublet antenna and with a commercial four-tube personal portable radio (E.M.) provided with the usual built-in loop. To make this comparison, every broadcast station within a 100 mile radius of the test location was noted and placed in one of four power groups: 250, 500, 1000, and 5000 watts. The number of stations in each power group which each of the three receivers was able to "bring in" during the daytime was recorded and the per-cent of the total in each power group calculated. The results are presented in Fig. 4A. This bar graph shows that the A-2 radio could receive considerably more stations than a commercial four-tube vacation portable but less than a commercial communications receiver having a sensitivity of ap-

(*Continued on page* 107)

A LOW-COST CRYSTAL CALIBRATOR

By **G. L. COUNTRYMAN, W3HH**

Crystal calibrators can be expensive, but versatile junior models can be put together at surprisingly little expense.



Six-frequency crystal marker assembled from junk-box parts. The circuit will oscillate at almost any frequency. Over-all cost is low.

CRYSTAL calibrators for modern receivers are a "must," especially for operation on net frequencies, but at 25 dollars a copy, they become a luxury item. Their use is even more important if older or more moderately priced receivers are used, as the calibration of these sets is seldom too accurate and varies as the components "age." Most receivers will drift several kilocycles in the first 20 or 30 minutes and, if a schedule is to be kept on a spot frequency, it is nice to be able to come up "on the nose" even if you have forgotten to warm up the receiver in advance.

One "calibrator" or marker unit built by the author is constructed on a small aluminum open-end chassis 4½" long x 3½" wide x 2" high and contains six crystal sockets, four small ones for ½" holders and two for ¾" holders. The tube is a 6V6, but any pentode or beam power tube, regular or miniature, will be equally satisfactory. No power supply is included as there is invariably a source of power in the shack, and any receiver can supply the low heater current and the few ma. of high voltage required.

If the calibrator is to be used with an *HRO*, a unit with one crystal can be built into a *Vector* C12-M #3 miniature plug-in turret, using a 6AG5, 6AQ5, or 6AK5 tube, and the turret plugged into the calibrator socket of the *HRO*. One such unit is shown in the photograph on this page. With this type of construction, turning the *HRO* switch to either the 100- or 1000- kc. position will operate the marker, as the *HRO* switch is in the high voltage lead. The heater supply and high voltage come from the *HRO*. Many receivers have an accessory socket from which power is available.

A simple, foolproof circuit is utilized, one that will oscillate with a crystal of any frequency. Your old friend, the modified Pierce with unnecessary "frills" removed, is shown in the schematic. If only one crystal is used, the socket can be wired in place and the selector switch eliminated. It is not too much trouble to plug in different crystals for different frequencies, anyway. A 100-kc. crystal makes it a true calibrator; other crystals provide calibrated marker points.

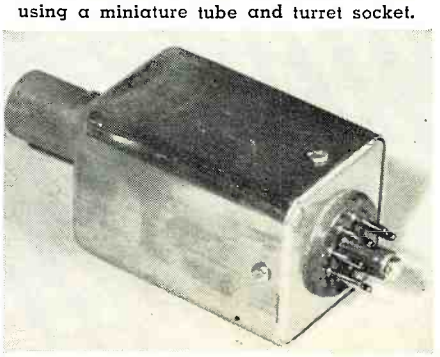
The cost is very close to the zero point. Most amateurs will have no difficulty in finding the required parts in their junk boxes: a small chassis, any convenient size; a pentode and socket; one or more crystals and sockets; two 50,000-ohm, ½-watt resistors; three mica or ceramic condensers, .01 and .001 μfd., and .0001 μfd.; a 2.5 mhy. r.f. choke; and a toggle switch are all the parts required. A 2-circuit, 6-position selector switch may be added for extra crystals. A one-watt dropping resistor may be needed if the "B-plus" supply is much higher than 150 volts.

That's all it takes! The high voltage lead in the author's copy was brought to a 2-terminal tie point so that the terminals could either be jumpered, or an appropriate series resistor added, depending on the high-voltage source to be used. With the present high voltage source (a 275-volt supply that operates the monitor) a 30,000 ohm, 1 watt resistor is used to keep the voltage down to the minimum required to insure stable oscillation of the crystal.

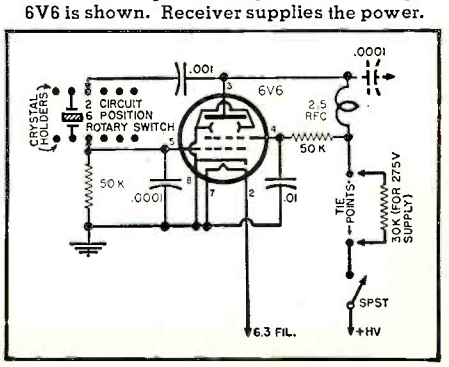
It is easy to begin. First look over your crystals, the lower the frequency

(*Continued on page* 133)

A one-crystal version, using same circuit but eliminating selector switch, was built using a miniature tube and turret socket.



Schematic of the low-cost calibrator. It will work with any common pentode, although 6V6 is shown. Receiver supplies the power.



HIGH-QUALITY RECORD REPRODUCTION AT LOW COST

By **FRANCIS H. YONKER**
Electronics Lab., Pennsylvania State College

Construction data on a low-cost amplifier that will match variable reluctance, crystal, and Brush PL-20 type pickups.

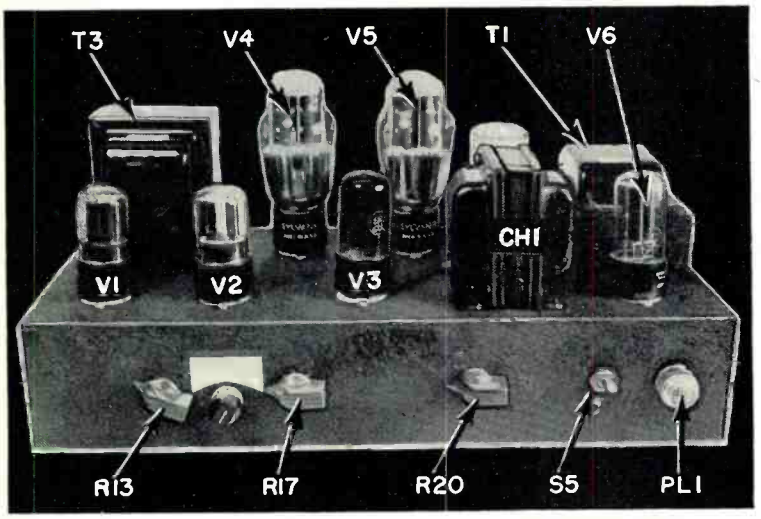


Fig. 1. Over-all view of the home-built amplifier which was especially designed to handle various type phono pickups.

THE components sold for use in today's new high-fidelity circuits cost so much that the average experimenter or music lover can't afford the parts to build the equipment he has read about or seen. The twenty- to thirty-dollar output transformers and the one-hundred-dollar loudspeakers shoo the builder right back to his old equipment.

Fig. 2 is the schematic diagram of an audio amplifier that will match the hi-fi enthusiast's phono pickup whether it be the magnetic reluctance, regular crystal, or the old favorite *Brush* PL-20, which the author uses for 33⅓ rpm broadcast transcriptions.

The magnetic pickup preamplifier consists of V_1, the 6SL7 tube, and its component parts which form a circuit almost identical to the *General Electric* preamplifier. The required compensation for record equalization is built into this circuit but by varying the 6800 ohm input resistor to higher or lower values the frequency response will change.

The next input, "Crystal Pickup," is for those regular phono-arms found on the typical record player. By experimentation and curves obtained using the *RCA* constant tone record #84522-A, the equalizer consisting of a 5 megohm resistor and 67 $\mu\mu$fd. condenser was employed.

The final input, "*Brush* PL-20," was added because so many music lovers have proven in the past that this pickup and the 16-inch broadcast transcriptions equalized by the *Brush* filter cartridge, afford much enjoyment in the way of varied programs of radio broadcast recordings.

Each of these inputs is switched to the amplifier by the rotary switch S_1-S_2-S_3. The first half of V_2, 6SL7, is necessary for amplification of inputs except for the reluctance pickup, whose preamplifier output is sufficient to drive the second half of V_2 directly *via* the tone control circuit. The treble control, 100,000 ohms, and bass control, 200,000 ohms, with their associated condensers, introduce considerable loss but the preamplifiers have sufficient gain to overcome this attenuation.

The second half of V_2 is an ordinary amplifier with negative feedback incorporated by omitting the cathode by-pass condenser.

V_3, a 6N7, is a straight-through amplifier and phase inverter which also contains negative feedback of the same form described previously. The 6N7 tube characteristics allow a greater voltage swing output without distortion than other smaller tubes such as the 6SN7, and also allows operation on the more linear portion of its characteristic curve.

The push-pull output stage, consisting of two 6B4 tubes, gives that preferred triode low plate resistance with less distortion and smaller transformation ratio to the low loudspeaker impedance. The output transformer is a low-cost *Thordarson* 25-watt T-22S70 unit. The transformer does not have a flat response curve up to 20,000 cycles but why care too much about its high-frequency efficiency when adjustment of the tone controls will allow greater signal input to the output transformer at the "fall off" frequency to make up for the transformer loss.

The beauty of this amplifier lies in the availability of bass and treble tone control. Reference to Fig. 3A shows the actual frequency response when the controls are set as indicated.

It's possible to make the recording sound like accentuation of high or low frequencies, complete loss of one or the other, or a combination near the middle range of controls allows a small adjustment to satisfy the individual ear. Any way, the next fellow to hear your "set-up" is going to like some other combination of tone controls. Pointer knobs and dial plates will aid in setting controls for exact reproduction of the many different phonograph record characteristics.

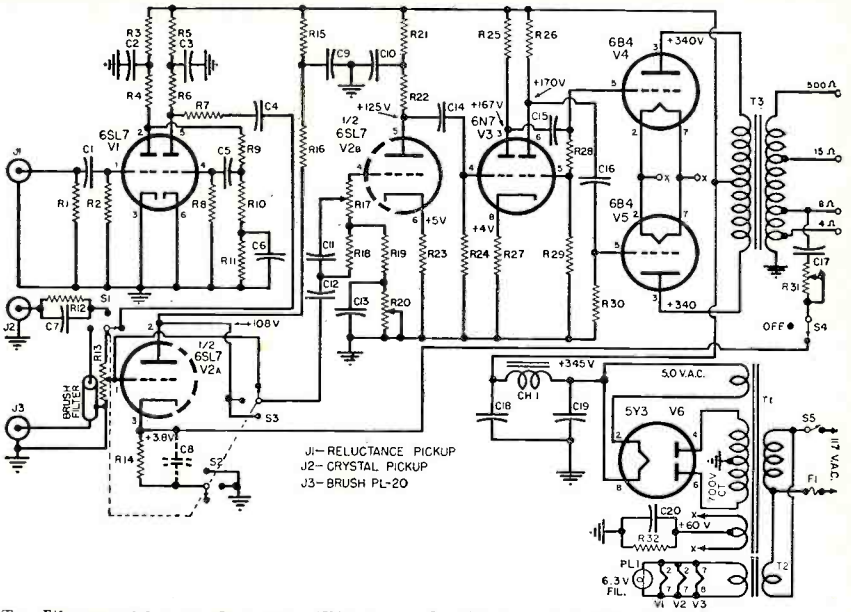
It's true one can make much more elaborate amplifiers with switch-in-equalizers for every type record on the market but since each individual likes music to suit his own taste, it can be adjusted by this tone-control combination to satisfy the conditions.

Switch S_4 is added for those who like to experiment with feedback voltage direct from the loudspeaker winding. The frequency response curves of Fig. 3A and 3B were obtained with this feedback switch in the "Off" position. By adjusting R_{31} throughout its range, where oscillation or motor-boating does not occur one will find much in the way of hi-fi entertainment by listening to the tone combinations that are produced.

The builder used a 25-watt, 12-inch speaker as a woofer and installed a separate 5-inch tweeter directly above it. The speaker combination was mounted in a bass reflex cabinet built to specifications given in "Data-Print 2" in the June 1952 issue of RADIO & TELEVISION NEWS.

EDITOR'S NOTE: In order to keep the cost of this unit low, the author has built a preamp, amplifier, and power supply on a single chassis. Where cost is no object, readers are referred to "The RADIO & TELEVISION NEWS *Preamp" (Nov. 1952) and "Improving the Williamson Amplifier" (Feb. 1953) for circuits capable of excellent performance.* —30—

R_1—6800 ohm, ½ w. res.
R_2, R_8—3.3 megohm, ½ w. res.
R_3, R_4—68,000 ohm, 1 w. res.
R_5, R_6—33,000 ohm, 1 w. res.
R_7—68,000 ohm, ½ w. res.
R_9, R_{11}—180,000 ohm, ½ w. res.
R_{10}—27,000 ohm, ½ w. res.
R_{12}—5 megohm, ½ w. res.
R_{13}—2 megohm pot. ("Volume Control")
R_{14}, R_{27}—1500 ohm, 1 w. res.
R_{15}, R_{21}—22,000 ohm, 1 w. res.
R_{16}, R_{22}—56,000 ohm, 1 w. res.
R_{17}—100,000 ohm pot. ("Tone Control")
R_{18}—100,000 ohm. ½ w. res.
R_{19}—4700 ohm, ½ w. res.
R_{20}—200,000 ohm pot. ("Tone Control")
R_{23}—1800 ohm, 1 w. res.
R_{24}—270,000 ohm, ½ w. res.
R_{25}, R_{26}—130,000 ohm, 1 w. res.
R_{28}, R_{30}—240,000 ohm, ½ w. res.
R_{29}—10,000 ohm, ½ w. res.
R_{31}—50,000 ohm pot. ("Feedback Control")
R_{32}—750 ohm, 10 w. wirewound res.
C_1, C_5—.05 μfd., 400 v. cond.
C_2, C_3—.2 μfd., 600 v. cond.
C_4—.02 μfd., 400 v. cond.
C_6—.01 μfd., 400 v. cond.
C_7—67 μμfd. ceramic cond.
C_8—20 μfd., 25 v. elec. cond. (used only if feedback is eliminated)
C_9, C_{10}, C_{12}, C_{13}, C_{14}, C_{15}, C_{16}—.06 μfd., 600 v. cond.
C_{11}—124 μμfd. ceramic cond.
C_{17}—.25 μfd., 400 v. paper cond.
C_{18}, C_{19}—40 μfd., 450 v. elec. cond.
C_{20}—30 μfd., 150 v. elec. cond.
T_1—Power trans. 350-0-350 v. @ 200 ma.; 5 v. @ 3 amps.; 6.3 v. c.t. @ 6 amps. (Thordarson T-22R07 or equiv.)

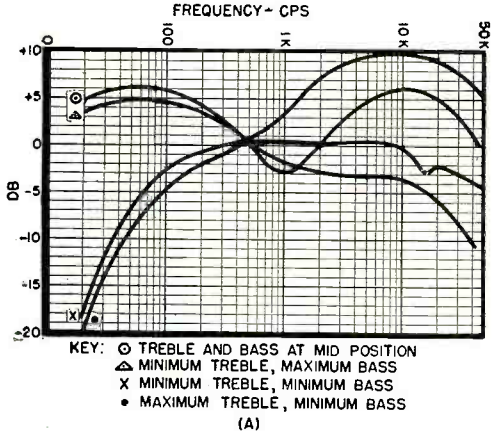


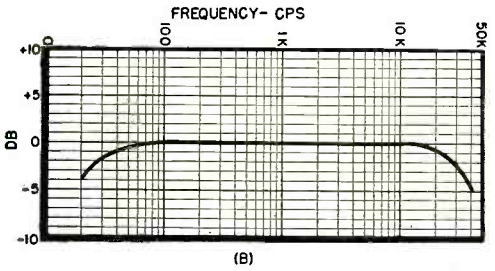
T_2—Fil. trans. 6.3 v. c.t. @ 3 amps. (Thordarson T-21F10 or equiv.) Ground one side of secondary.
T_3—Output trans. 5000 ohms plate-to-plate (Thordarson T-22S70 or equiv.)
CH_1—12 hy., 100 ma. filter choke (Thordarson T-20C53 or equiv.)
F_1—Line fuse
S_1-S_2-S_3—3-pole, 3-pos. rotary wafer switch
S_4—S.p.d.t. switch ("Feedback")
S_5—S.p.s.t. switch ("Power")
PL_1—6.3 v. pilot lamp
1—Brush filter unit (for Brush PL-20 pickup)
J_1, J_2, J_3—Closed circuit phono jack
V_1, V_2—6SL7 tube
V_3—6N7 tube
V_4, V_5—6B4 tube
V_6—5Y3 tube

Fig. 2. Circuit diagram and parts list covering a low-cost audio amplifier which uses standard, easily-available components.

★

Fig. 3. (A) Amplifier response with various positions of tone controls. Note particularly that where "maximum" and "minimum" is shown reference is made to the physical position of tone controls and not to response. In operation there is an interaction between bass and treble circuits. (B) Over-all amplifier response with tone control circuit out. Input is at the crystal phono jack. Power output is 9.3 watts.





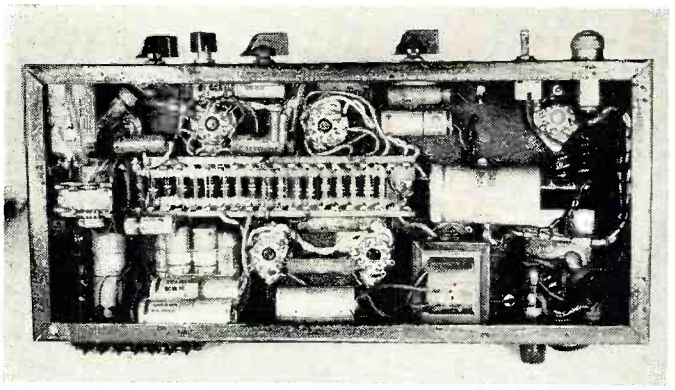
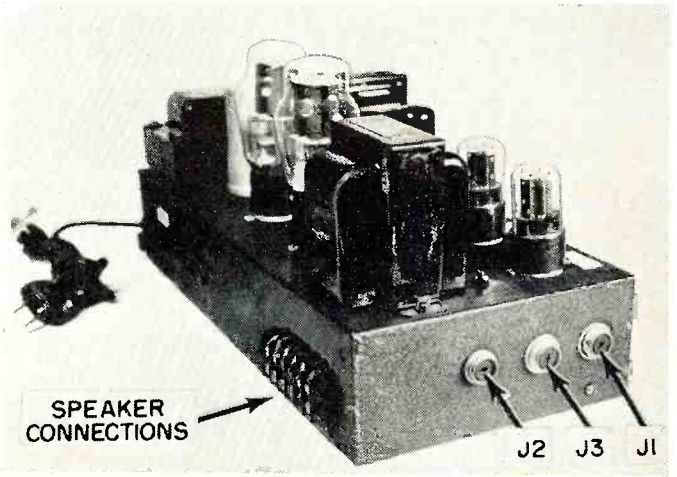


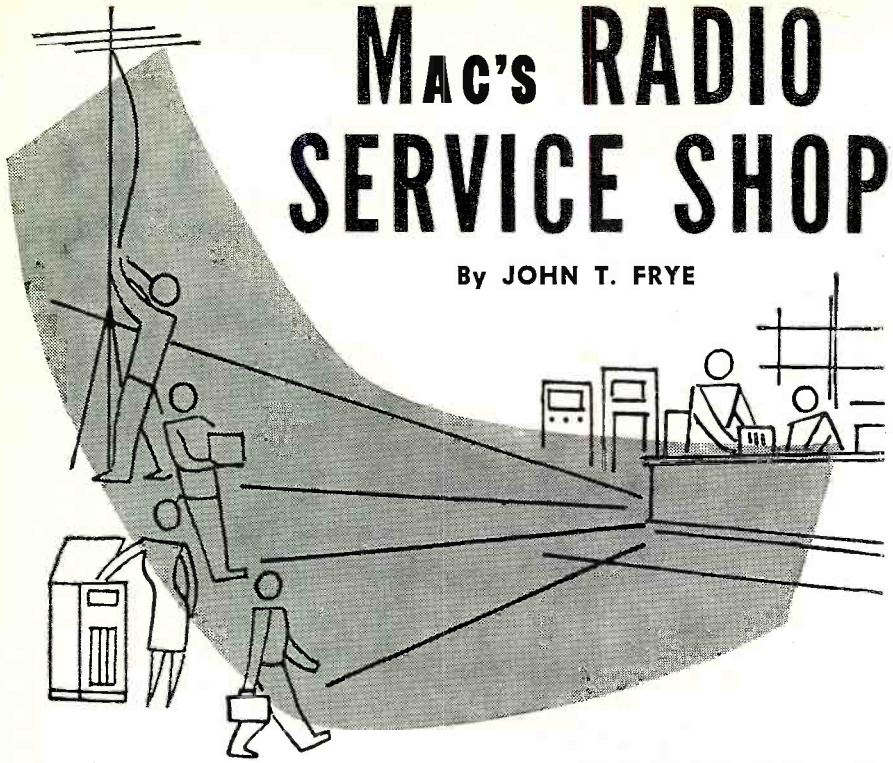
Fig. 4. Under chassis view shows terminal-board construction of unit.

Fig. 5. Side view of amplifier showing location of phono pickup jacks.



MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE



THE FIELD STRENGTH METER

"THAT DOES IT!" Barney suddenly snapped as he threw down the tools he had been using in an attempt to adjust the linearity of a TV set. "I'm going to find what's causing that interference or know the reason why!"

Mac, his boss, cocked a sympathetic eye at the face of the picture tube. The test pattern on it was moving steadily downward. By adjusting the vertical hold control the boy could make the picture frame correctly for a few seconds at a time, and then a dark, inch-wide band of interference could be seen moving slowly from the bottom to the top of the pattern. When this line reached the top, however, it replaced the blanking bar there, and then the picture started sliding down again.

"It'll be a good trick—if you can do it," Mac commented skeptically. "That thing has been hanging around for two days now."

"Just watch Uncle Barney; he's got it all planned," the youth boasted.

He was already connecting a hot-shot battery to the inverter normally used in the service truck to supply small amounts of 117 volt a.c. from the car battery when needed. This combination went into a knapsack on his back. The leather shoulder strap of the shop's *Simpson* field strength meter was adjusted so that the meter was carried in front of him. This instrument was plugged into the inverter, and a folded dipole fashioned from twin-lead and supported on a T-frame made of plaster lath was connected to the meter's 300-ohm binding posts. A pair of phones on the boy's head was plugged into the jack of the field strength meter.

He switched on the instrument, carefully manipulated its fine-tuning control, and swished the probe antenna about as he listened intently.

"Contact!" he shouted triumphantly. "I can hear it fine, and it reads thirty microvolts on the meter. Open the back door and let old bring-em-back-alive-Barney out. If you don't hear from me in a couple of days you'd better send out a search party."

"I'll not wait that long," Mac shouted back so Barney could hear him with the phones on. "Neither your legs nor that hot-shot battery will last very long with the load they are carrying."

Barney sallied forth into the alley and Mac, still chuckling at the ludicrous figure his assistant made with all the paraphernalia, went back to the bench and picked up what Barney termed "Mac's idea of a thrilling whodunit book." It was Milton Kiver's *"TV Servicing Shortcuts"* and really was as fascinating to Mac as any collection of detective stories; for it was not made up of just rare service problems but was composed of actual cases encountered in routine servicing of a wide variety of sets. He became so engrossed in reading about the symptoms and then trying to guess the trouble before reading ahead to see if he was right or wrong that he did not note the passage of time. When he did look up it was to see the test pattern standing perfectly still with no sign of interference. At the same time there was a lusty kicking at the back door to indicate the interference sleuth had returned.

"Mission accomplished!" Barney announced triumphantly as soon as Mac opened the door. He lumbered inside and waved an old-fashioned sharp-pointed light globe under Mac's nose. "I just watched the meter and kept moving toward where the antenna's directional pattern and the changing meter reading pointed, and I walked right up to this relic in a socket over a loading platform down the alley. When I told the store owner about it and offered to buy him a new bulb for this one, he said I was welcome to it for it had been fouling up a TV set in the store for a couple of days, too. Said he couldn't imagine where the maintenance man ever found the thing in the first place. Anyway, it puts out a mean 5000 microvolts on Channel 6 when you put the antenna right up against it."

"Anyone comment on your appearance?" Mac asked with a grin as he helped Barney out of his rigging.

"No, but a gang of little boys gave me a hard time. They called me 'Flash' and kept wanting to hear me talk to my space ship. Finally I had to tell them that if they didn't scram I was going to melt them down with my atomic disintegrator pistol."

"Guess we've got to rack up another victory for the good old field strength meter," Mac commented as he fondly patted the gray enamel case of the instrument. "This thing has more uses than a piece of twine."

"Yet quite a few technicians try to get along without one," Barney pointed out. "They argue that all a field strength meter is good for is to tell if a signal is coming down the feed line and to help point the antenna at the station when you install it. They say they can tell all this just by watching the set itself."

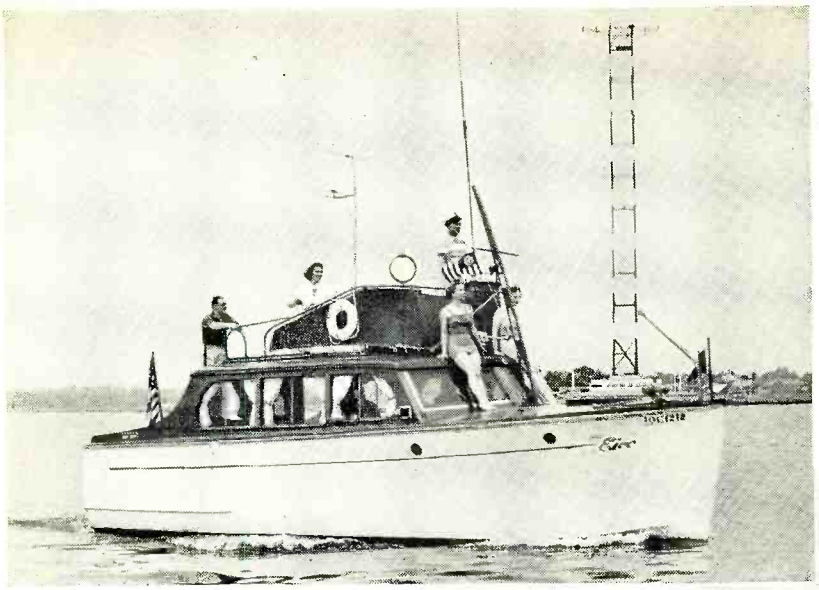
"Then they've got a better eye than I have. We found out from experience with the meter that as soon as you get past 200 microvolts of signal it takes a tremendous increase to show much effect on the picture. The a.g.c. circuit does its best to hold the signal delivered to the picture tube at the same value no matter how the signal at the antenna terminals changes. If you line up an antenna with just a picture for an indicator, you get the impression the main receiving lobe is much, much wider than it really is. With the meter, since it responds to the slightest change in signal strength, you can point the antenna right on the button. However, I'll not argue a signal strength meter will do a lot of jobs that cannot be done by any other means; I'm simply convinced it does these jobs quicker, easier, and more accurately."

"Know what you mean," Barney agreed. "When I run up against a set with a normal raster but with weak picture and sound or none at all, my first move is to hook the field strength meter to the antenna. If a good signal is coming in, I know I can concentrate on the set; if not, I know I'm in for some roof scampering. A funny thing, too, is how much that meter impresses the average customer."

(*Continued on page* 124)

ELECTRONICS FOR THE YACHTSMAN

By **HARRY R. ASHLEY**
Pres., Electronic Instrument Co., Inc. (Eico)



Over-all view of the motor yacht "Miss Eico" showing radio and TV antennas and direction finder loop. Station WCBS' transmitting tower at New Rochelle, N. Y. may be seen at right rear.

Add to the pleasure and safety of your cruises by using modern marine electronic equipment.

THE longing which prompted Masefield to declaim "I must go down to the sea again", has obviously gripped large segments of the American populace as literally thousands are joining the ranks of small boat owners each year. Whether the "sea" is the Atlantic Ocean, Lake Michigan, or some quiet inland lake or riverway, the lure is proving irresistible to many a weekday "landlubber".

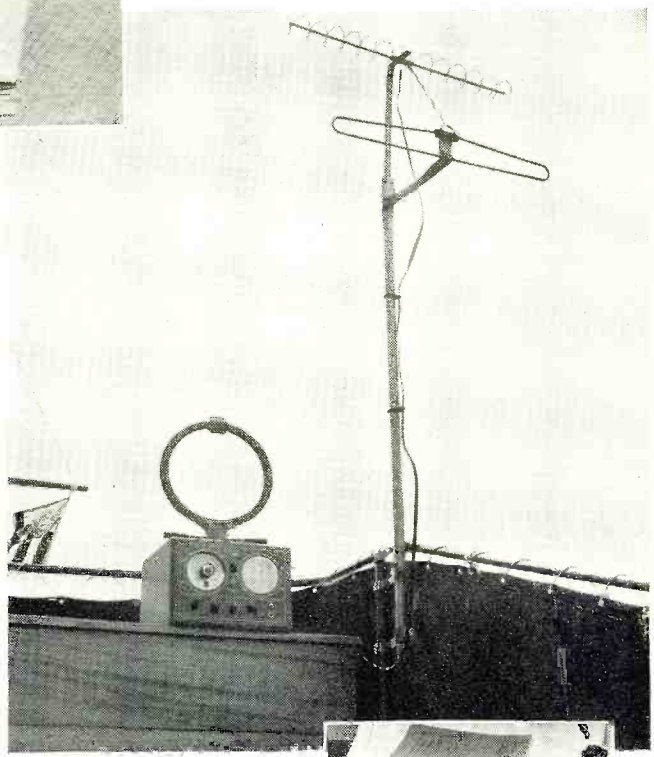
The questions foremost in the minds of the average present or prospective boat owners are what electronic equipment should I have and what will it cost? Since the War, many marine electronic items have been made available to the small boat owner through simplification, miniaturization, and price reduction. Today even the most modestly priced bottom can boast of a radio receiver capable of tuning the marine bands. From such minimal equipment the electronic gear a boat may carry will range all the way up to an elaborate installation worthy of an ocean-going liner.

Should the boat be a small one which is to be operated exclusively in charted channels or within sight of land, electronic equipment is not essential. Any gear which is installed, however, adds to the operating convenience of the craft but falls more or less into the "luxury" category.

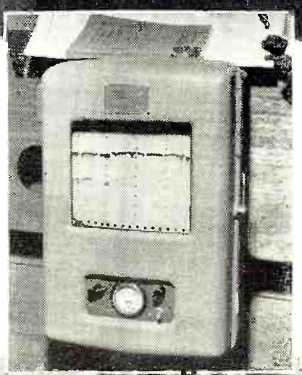
For craft operating in open waters out of sight of land, a two-way radiotelephone is virtually a "must" for the safety of those aboard. Radiotelephone can be readily used from any near-shore location and, should an emergency arise, the Coast Guard can be summoned. This same equipment may be used for ship-to-ship contacts for the friendly exchange of information ranging all the way from navigational tips to the latest dope on where the fish are running. Because of the shared enthusiasm for boating, many friendships have been formed as a result of such informal ship-to-ship radio contacts—reminiscent of the friendships begun on the ham bands.

If you are a good seaman, one that can navigate with confidence by compass alone, perhaps you will not require the second piece of "must" equipment for the deep-water sailor. If, however, you are dubious about your seamanship or will be navigating in totally unfamiliar waters, a radio direction finder is a handy item to have aboard. Needless to say when the fog rolls in the direction finder becomes the yachtsman's "best friend".

(*Continued on page* 108)

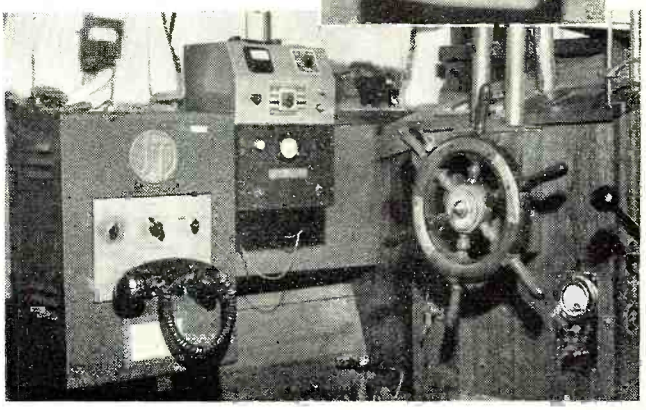


The Bludworth Marine direction finder which covers beacon, broadcast, and marine bands for widest protection and surest results.

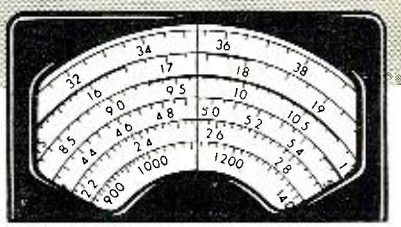


Bendix recording depth finder aboard the "Miss Eico."

Jefferson Travis radiotelephone. Surrette battery charger, Eico battery eliminator and charger, transmitter output meter, and the charge indicator (on panel).



International SHORT-WAVE



Compiled by KENNETH R. BOORD

THE Japanese Standard Frequency Station, JJY, can be heard on 4.000 (error: $5x10^{-8}$) daily 1900-0900 and on 8.000 (error: $5x10^{-8}$) at 1600-0600; QSL's by card; QRA is Radio Regulatory Commission, Standard Frequency Section, Engineering and Monitoring Division, Minato-ku, Aoyama, Tokyo, Japan. (Ishikawa, Takemi, Japan)

* * *

This Month's Schedules

Albania—Radio Tirana now operates on *announced* 6.570, 7.853 with *English* 1415, French 1330, German 1400, Italian 1315, 1500. (WRH)

Anglo-Egyptian Sudan—Radio Omdurman noted near 7.655 at 1330 with call, then talk or news in Arabic, followed by Arabic music. (Pearce, England)

Angola—Luanda, 9.472A, noted with music 1505; Portuguese announcements; weak to fair. (Cox, Dela.)

Argentina—LRY1, 9.760, Buenos Aires, noted mixing with TGWA, Guatemala, around 2350. (Cox, Dela.) Strong in Tokyo around 0600. (Ishikawa) *Radio El Mundo,* 6.120, heard 2000-2030, fair level; all-Spanish. (Borne, Sweden) LRA, 15.345, noted with news to North America 1815, strong. (Zerosh, Pa.)

Australia — Radio Australia has been moving around in its 0700-0845 beam to Eastern North America, due to QRM; by this time may be using 11.840 or may have moved to the 31-m. band (try 9.540 or 9.615). Dexter, Iowa, notes VLA15, 15.200, very good around 2200.

Bolivia—CP38, 9.497, La Paz, noted opening 2030 at good level. (Ferguson, N. C.) Heard opening 1756 with "Onward, Christian Soldiers." (Pearce, England)

Borneo (USI)—The Home Service of *Radio Republic Indonesia* is heard on 5.030 from Bandjermasin, with 1 kw., until 1030 closedown. (Japanese Short-Wave Club)

Brazil — Radio Relogio Federal, 4.905, Rio de Janeiro, noted 1730 relaying "A Voz do Brasil." (de Mesquita e Sousa, Portugal) ZYK2, 15.145, Recife, noted in Sweden 0930-1010 with QRK4 signal. (Borne) *Radio Tamoio,* ZYC8, 9.610, good level 1915-1930. (Oestreich, Wash. State)

British Honduras — Radio Belize, 4.950, noted with news 1800; identifying 2130, followed by commercials, then light music; has trouble with *Radio Dakar,* Fr. West Africa, prior to 1800. (Cox, Dela.)

British New Guinea—VLT6, 6.130, now used *exclusively* by Port Moresby, noted 0600 with ABC news relay. (Ferguson, N. C., others)

Bulgaria—Radio Sofia, 9.700, lately has had *English* 1800-1815. (Zerosh, Pa., others) Now has news for Europe 1500 and 1615 on 6.070, 7.671A. (Pearce, England)

Cape Verde Islands—Praia, 5.890A, noted daily 1530-1700. (de Mesquita e Sousa, Portugal)

Ceylon—Commercial Service, 15.120, noted opening 2030; BBC news relay 2100. (Ferguson, N. C., others) Good on 11.975 at 0830. (Riggs, Calif.) Noted parallel on 9.520 at 1000-1230 closedown. (Gay, Calif.)

Chile—CE766, *Radio Yungay,* Santiago, noted on 7.660 fair level 1550 with music. (Cox, Dela.) Schedule is 0630-0130. (WRH) *Radio Sociedad Nacional de Mineria* has been varying lately around 11.945-11.957; noted to around 2200. (Stark, Texas) Schedule is 0630-2300 and outlets are listed CE622, 6.220, 5 kw., and CE1198, 11.985, 2.5 kw. (WRH)

Colombia—A *new* station of *Radio Cadena Nacional* has been heard on *announced* 4.935 signing off between 2230-2300; HJFV, *Radio Neiva,* 4.855, is now on the air until 2300 weekdays, to *after* 0100 Sun. (Radio Sweden) HJFK, 6.098, Pereira, fair level 2010; slight QRM. (Norman, N. C.)

Costa Rica—TIHV, San Jose, is a *new* station heard on 6.008A; announces "Radio Cristal;" strong *after* 2230 when is in clear; suffers QRM earlier from HJCH, 6.009, and CJCX, Rome, and YSS on 6.010. (Robbins, Ind.)

Cuba—COCQ, Havana, is now using 9.675 on an irregular schedule (moved from 8.825). (Robbins, Ind.)

Cyprus—Sharq-al-Adna sent schedule of 2225-0130 daily, 0130-0330 Fri. and Sun., 0330-1500 daily on 635 kc., 6.120, 6.170, 6.790, 9.650, 11.720. (Scheiner, N. J.)

Czechoslovakia—Prague, 9.95, heard with *English* to North America 2300-2330A. (Hyson, Md., others)

Denmark—OZF, 9.52, Copenhagen, noted with improved signal in North American beams 2030-2130, 2200-2300. (Jim Smith, Mich.; Saylor, Va., others)

Dominican Republic—HI2A, Santiago de los Caballeros, has moved from 9.680 to 4.840; signal peaks in Ind. around 2000, then fades to a lower level and mixes badly with YVOX, Venezuela, same channel. (Robbins)

Dutch New Guinea — Radio New Guinea soon is to be returned to Biak from Hollandia; will have a *new* studio, a 5 kw. transmitter. (NNRC, others)

Ecuador — Summer schedule of HCJB, Quito, includes *English* to North America 2100-2400, 9.745, 11.915, 15.115, and 2300-2400 also on 6.05; *English* to North and South America 0630-0730 on 9.745, 11.915; *English* to Europe 1600-1700, 17.89, 15.115, 11.915, and 1700-1730, 17.89, 15.115; *English* to Pacific 0130-0500 on 15.115, 11.915, 9.745; *off the air Mon.* (Matherly, Ohio)

Egypt—Current schedule of Cairo, 11.815, is 1320-1600 (Sat., Sun. to 1700); news 1330. (Bellington, N. Y., others) Noted on 9.750 lately as early as 1035 with call in Arabic. (Pearce, England) Heard on this channel 2345 with Arabic Service in news and Western music. (Sanderson, Australia, and others.)

Ethiopia—Radio Addis Ababa, 15.040A, noted 1330 in *English.* (Mast, N. Y.)

Fiji—Some months ago, the Posts and Telegraphs Department experimented on 6.100 parallel with regular 5.995 at Suva; latter has ABC news relay 0400; operates around 0030-0500. (Cushen, N. Z., others) More recently has *tested* on 3.980. (Radio Australia)

Finland—Helsinki, 15.19, noted in *English* around 1430-1440. (Golden, Mass., others)

France — Paris noted opening in French on 15.24 at 0730, excellent level. (Golden, Mass.) Heard parallel on 9.55, 6.200 at 1745 tune-in with *Paris-Inter* session in French. (Bellington, N. Y.) The *English* Service to Great Britain now is daily 0145 on 7.240, French Lesson; daily 1345 on 11.970, French Lesson; daily 1500-1600 on 6.050 with varied programs; answers to listeners' letters Wed., Sun. (Catch, England) Noted in French 1830-2000 on 9.680, 11.700. (Dexter, Iowa)

French Equatorial Africa—Brazzaville, 9.44, 11.970, noted with news

(*Continued on page* 86)

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

TAKE YOUR PICK

EITHER OF THESE VALUABLE SERVICING ITEMS...YOURS AT NO EXTRA COST...with purchases of Federal Picture Tubes!

1 THIS TOOL and TUBE CADDY or...

CADDY FACTS: An attractive convenience — for tools and tubes—you'll be proud to carry on all service calls.

Sturdy wood construction . . covered with simulated alligator leather (blue). Over-all size: 18¾ inches long, 13¼ inches high, 9 inches wide.

Brass-finished lock, hinges, catches and corner guards. Compartments hold approximately 75 receiving tubes of various sizes. Opens into three separate, easily-accessible sections. $9.50 value! (A $14.95 list value).

2 THIS 135-WATT WELLER SOLDERING GUN

GUN FACTS: Weller Model WD-135 (135 watts). Ideal for all types of soldering and dozens of household jobs.

Instant heating. Dual heat increases tip life. High or low heat as desired. Exclusive tip-fastening feature—full, constant heat. Low-cost, replaceable tips. Pre-focused spotlight. Longer reach—perfect balance. Shatter-proof plastic housing. $10.95 value! (A $14.90 list value).

We want you to know the Quality, Long-Life Performance and Replacement Profits in

Federal PICTURE TUBES

TV SET MANUFACTURER TEST SHOWS OVER

99% HIT THE BULL'S-EYE FOR QUALITY!

Here's proof that it pays to replace with Federal. Here's assurance of customer satisfaction . . . of less time wasted on call-backs . . . of more dollars of profit.

Join the trend to Federal "Best-in-Sight" Picture Tubes . . . outstanding for *quality*, because they are made by a world leader in broadcast tubes.

Federal's line of popular-size tubes will take care of over 90% of all TV replacements!

How to get your choice—

With every purchase of a Federal "Best-in-Sight" Picture Tube, your participating Federal Distributor gives you one Federal Certificate. There are no restrictions on type of tube. You may buy one tube at a time, or as many as you need.

As soon as you have accumulated 10 certificates, deliver them to the distributor from whom you purchased your Federal Picture Tubes and he will exchange them for the Combination Tool and Tube Servicing Caddy OR the Weller Soldering Gun. (If you wish, both Caddy and Soldering Gun will be given in exchange for 20 Federal Certificates.)

See your Federal DISTRIBUTOR For Federal Tubes and Certificates!

This offer is void wherever prohibited or wherever any tax, license or other restriction is imposed.

(This offer expires August 31, 1953)

Start Ordering Federal Picture Tubes—Start Saving Federal Certificates!

Federal Telephone and Radio Corporation

FEDERAL TELEPHONE & RADIO — FTR — AN IT&T ASSOCIATE

VACUUM TUBE DIVISION • 100 KINGSLAND ROAD, CLIFTON, N. J.

In Canada: Federal Electric Manufacturing Company Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

Technical BOOKS

"RADIOTRON DESIGNER'S HANDBOOK" edited by F. Langford-Smith. Reproduced and distributed by the *RCA Victor Division* of *Radio Corporation of America.* 1423 pages. Price $7.00. Fourth Edition.

Those who are familiar with the earlier editions of this handbook will be both surprised and pleased by the encyclopedic proportions it has assumed in this newest and most complete version.

This well-known "bible" of the industry is four times larger than the Third Edition published in 1940, reflecting the great strides made by the electronics industry in the past decade or so.

The text material is prepared with the engineer, student, and experimenter in mind and covers thoroughly the design of radio and audio circuits and equipment. The information on circuit design and application is presented not only mathematically but practically so that those with limited engineering experience can profit from the exposition. For the engineer who wants to know "why" and "how" such circuits function—that information is also provided.

The book itself is divided into seven major sections and covers such topics as radio tubes; general theory and components; audio frequencies; radio frequencies; rectification, regulation, filtering, and hum; complete receivers; and an impressive array of tables, graphs, charts, bibliographies, references, etc.

For a compact and ready-reference source of a veritable gold mine of pertinent information, this book will be hard to beat.

* * *

"TV MANUFACTURERS' RECEIVER TROUBLE CURES" edited by Milton S. Snitzer, Published by *John F. Rider Publisher, Inc.,* New York. 113 pages. Price $1.80. Paper bound. Volume 3.

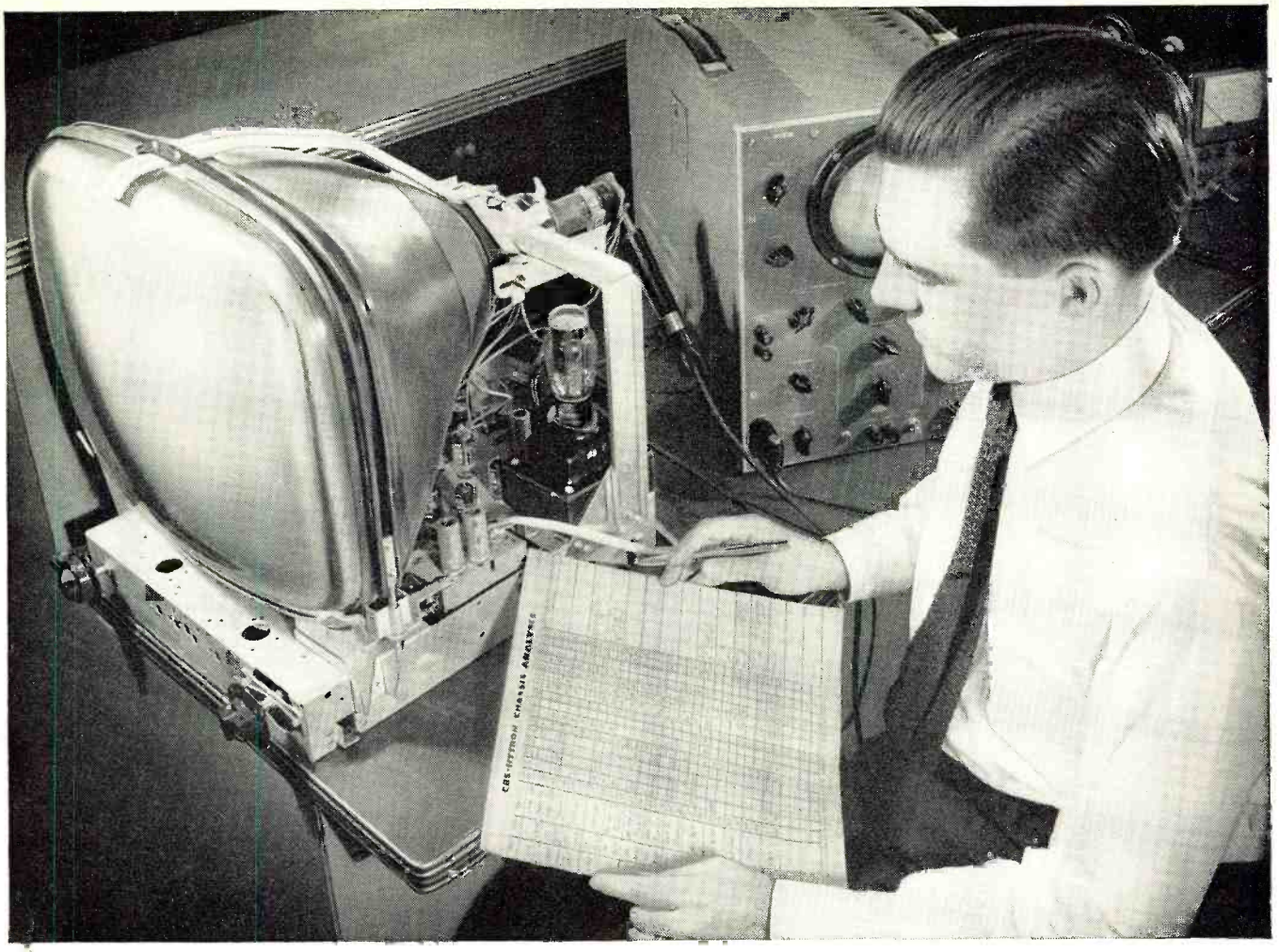
This is the third in the current *Rider* series covering troubleshooting procedures as developed by the set manufacturers themselves.

Service notes for receivers manufactured by *Kaye-Halbert, Kent, Magnavox, Majestic, Meck, Mercury, Midwest, Montgomery Ward, Motorola, Muntz, National, North American Philips, Olympic, Pacific Mercury, Packard-Bell,* and *Philco* have been included in this volume.

The book is completely indexed by model numbers to permit the rapid location of the desired data. Subsequent volumes will cover receivers of other companies.

* * *

"TV SWEEP ALIGNMENT TECHNIQUES" by Art Liebscher. Published by *John F. Rider Publisher, Inc.,* New York. 120 pages. Price $2.10. Paper bound.



Bring back that New-Set Sparkle with Performance-Tested Tubes

Meet John Cunningham, a CBS-Hytron Commercial Engineer. John is beginning at the beginning for you. Socket by socket, he is analyzing the tube requirements of a brand-new TV set design.

John knows the superior performance demanded. He concentrates his know-how on insuring top tube operation within standard specification limits. He tests sample tubes . . . checks analysis data. Working hand-in-glove with the set designer . . . and with CBS-Hytron engineers . . . he assures control of the characteristics of all tubes for this new chassis. Finally he achieves . . . from rectifiers to picture tube . . . the perfect performance all of this engineering team (and you) seek.

Constantly CBS-Hytron carries on teamwork like this. Socket by socket analysis. Day in, day out — with 9 out of 10 leading TV set makers. Both tube and set engineers pool their specialized skills. Scores of the nation's foremost TV set engineers help make endless CBS-Hytron improvements. Help assure you of unsurpassed performance in virtually *all* leading TV sets.

Small wonder that your CBS-Hytron replacement tubes recapture that new-set sparkle. Please *your* customers. Cut *your* call-backs. Profit more. Take advantage of CBS-Hytron engineering. Demand CBS-Hytron . . . your logical replacement tube, because it is performance-tested all the way . . . from original to replacement.

Now CBS-HYTRON MIRROR-BACK

ALUMINIZED PICTURE TUBES 27EP4 and 24TP4 . . . both mirror-backed, spherical, electromagnetic types.

Leading TV set makers demanded maximum brightness from their large-screen sets. Without strain on component parts. For them, CBS-Hytron introduced its *Mirror-Back* picture tubes. Mirror-like effect of their aluminized backing steps up light output. Adds sparkling brilliance to the picture. Gives greater contrast and freedom from screen discoloration. You, too, will want CBS-Hytron *Mirror-Back* tubes for replacement. Because your customers can *see* them recapture that bright, new-set sparkle. Order the performance-tested 27EP4 and 24TP4 from your CBS-Hytron distributor.

CBS HYTRON

Manufacturers of Receiving Tubes Since 1921

CBS-HYTRON Main Office: Danvers, Mass.

A Division of Columbia Broadcasting System, Inc.

RECEIVING . . . TRANSMITTING . . . SPECIAL-PURPOSE AND TV PICTURE TUBES • GERMANIUM DIODES AND TRANSISTORS

This is a practical handbook for the television technician which is characterized by the common-sense approach which marks all of Mr. Liebscher's writings.

The book is divided into eleven main chapters and includes discussions of modern sweep alignment, sweep alignment techniques, markers, "supermark," sweep curves, tuner curve formation, i.f. alignment, i.f. curve adjustment, sound i.f. and sound detector alignment, video amplifier response testing, and u.h.f. sweep alignment.

The text material is lavishly illustrated with oscilloscope patterns showing the various circuit conditions encountered in television service work.

Both the practicing service technician and the student will find this little book a worthwhile adjunct to the servicing library.

* * *

"UHF ANTENNAS, CONVERTERS, AND TUNERS" by Milton S. Kiver, Published by *Howard W. Sams & Co., Inc.,* Indianapolis, Ind. 134 pages. Price $1.50. Paper bound.

As more and more television stations take to the air in the u.h.f. band, more and more service technicians are encountering problems heretofore unheard of in their experience.

To cope with these new and unfamiliar problems, Mr. Kiver has written this down-to-earth book to answer just such questions. The book is divided into five sections and deals in detail with such subjects as u.h.f. antennas, transmission lines and matching networks, u.h.f. installation practices, u.h.f. converters, and u.h.f. tuners.

The material presented is specific and to the point. Similarities and differences between v.h.f. and u.h.f. systems are pointed out where such comparisons serve to advance an understanding of circuit operation. Photographs, drawings, graphs, and sketches have been used lavishly to amplify the text material.

Mr. Kiver's style is familiar to all readers of this magazine so it will come as no surprise to them to hear that this book is in the same concise, clear-cut form as his articles, and should provide the technician with a lot of much-needed and authentic data on u.h.f.

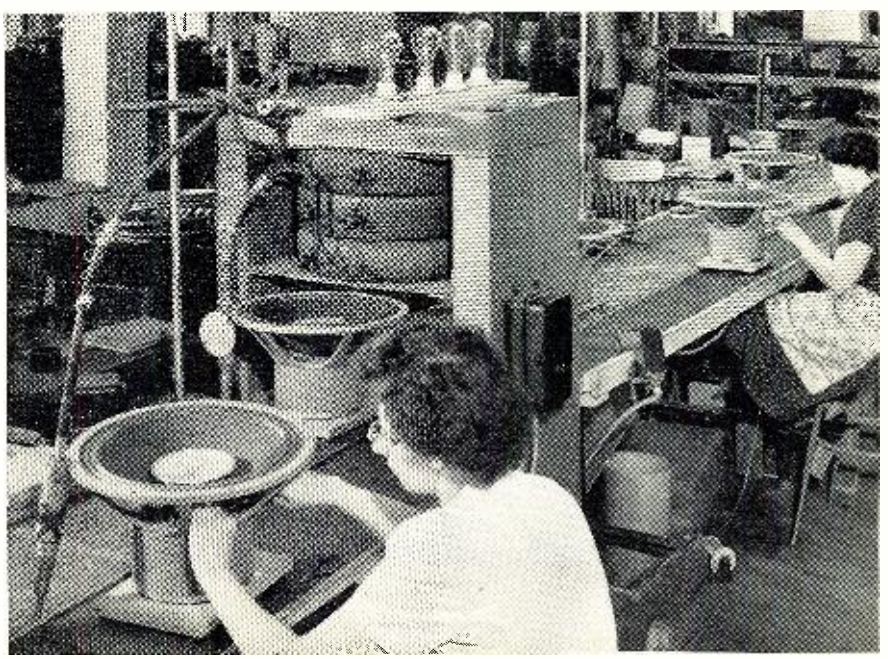
—30—

AMATEUR EXTRA CLASS

FCC has announced that radio "old-timers" applying for the Extra Class amateur radio license may submit, for waiver of some of the requirements, a "Certificate of Skill" issued by the old Department of Commerce and Labor before June 30, 1913. Heretofore it has been necessary for an applicant seeking a waiver to show evidence of possession of an actual amateur license before April, 1917. It is necessary, when submitting a "Certificate of Skill' for this purpose, to supply evidence of either ownership or operation of an actual amateur station before June 30, 1913. Details are in the Commission's Safety and Special Radio Services Bureau Bulletin No. 2, available from FCC, Washington 25, D. C.

—30—

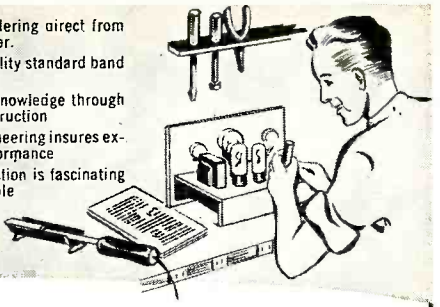
Stromberg-Carlson Company's Sound Division at Rochester, N. Y. has placed in operation a new 2½ ton magnetizing unit on its loudspeaker assembly line. The new electromagnet was designed especially for magnetizing the 10½ pound piece of Alnico V that serves as the permanent magnet in the company's 15 inch high-fidelity speakers. The magnetizing unit consists of a steel yoke, supporting the two pole pieces, each one foot in diameter. Each of the pole pieces is wound with three coils. There are approximately 700 pounds of copper in the coils. The complete assembly weighs slightly over 5000 pounds. The photoelectric cell which controls the magnetizer is activated by the loudspeaker passing through the light beam on the slowly moving belt.



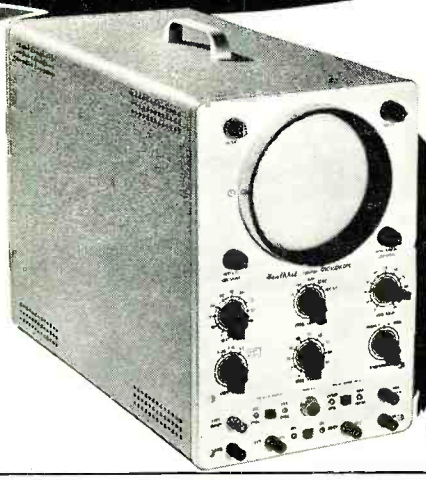
BUILD YOUR OWN Heathkits

- TEST INSTRUMENTS
- AMPLIFIERS
- RECEIVERS, etc.

1. Save by ordering direct from manufacturer.
2. All high quality standard band components
3. Increased knowledge through actual construction
4. Sound engineering insures excellent performance
5. Kit construction is fascinating and enjoyable



Heathkit MODEL O-8 OSCILLOSCOPE KIT



$43.50
Shipping Wt. 26 lbs.

The outstanding new 1953 model O-8 Heathkit Oscilloscope features the finest performance ever offered in this extremely popular kit instrument. Primarily intended as a general purpose oscilloscope for the faithful reproduction of actual wave forms and other electrical phenomena, it's vastly improved band width, good 100 KC square wave reproduction, three step vertical input attentuator, .025 volts per inch vertical sensitivity, etc., admirably qualify this instrument for TV and radio servicing, laboratory use, ham application and all general electronic development work. Improved vertical band width is obtained through the use of shunt peaking chokes with proper cathode compensation in the push-pull output stage. For additional flexibility of operation, provisions have been made for direct connections to the deflection plates, a Z axis input and a spot shape control for really fine focusing.

This beautiful kit is complete with all 10 tubes, including a 5" cathode ray tube, calibrated graph screen and flexible test leads. All necessary construction components, such as hardware, chassis, transformer, etc., and a detailed step by step construction manual, greatly simplify the assembly of this instrument.

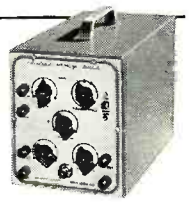
Heathkit VOLTAGE CALIBRATOR KIT

The use of a Voltage Calibrator will greatly increase oscilloscope usefulness. Provides a convenient method of making peak to peak voltage measurements by establishing a relationship between the unknown wave shape and the Voltage Calibrator. Voltage ranges .01–100 volts peak to peak. The Voltage Calibrator features direct reading scales and a regulated power supply system.

MODEL VC-2
$11.50
Shipping Wt. 4 lbs.

Heathkit ELECTRONIC SWITCH KIT

The Heathkit Electronic Switch Kit will further extend scope usefulness by permitting simultaneous observation of two individually controlled traces. Continuously variable switching rates 10 cps to 2,000 cps in three ranges. Will also serve as a square wave generator over the range of switching frequencies.



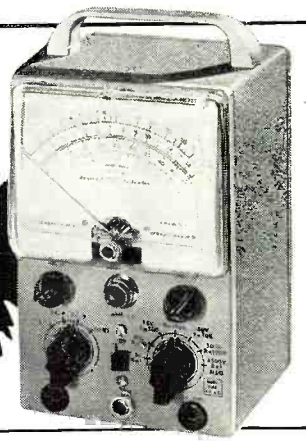
MODEL S-2
$19.50
Shipping Wt. 11 lbs.

Heathkit VACUUM TUBE VOLTMETER KIT

The beautiful new 1953 Heathkit Model V-6 VTVM, the world's most popular kit instrument, now offers many outstanding new features in addition to retaining all of the refinements developed and proven through the production of over 70,000 VTVM kits. The Heathkit VTVM now features extended voltage ranges with 50% greater coverage on the DC range. New 1½ volt low scale provides well over 2⅓ inches of scale length per volt permitting faster measurements with greater accuracy. AC and DC ranges are 0–1.5–5–15–50–150–500–1500 volts (1,000 volts maximum on AC). Ohmmeter ranges are X1, X10, X100, X1,000, X10K, X100K X1 meg. Measures .1 ohm to 1,000 megohms. Other features are db scale, center scale zero adjust and polarity reversal switch. High 11 megohm input resistance virtually eliminates circuit loading.

The low anti-inflation price of this tremendously popular kit includes all tubes, necessary constructional material, test leads and the construction manual.

MODEL V-6
$24.50
Shipping Wt. 6 lbs.



Heathkit AC VACUUM TUBE VOLTMETER KIT

MODEL AV-2
$29.50
Shipping Wt. 5 lbs.

A new amplifier type AC VTVM that makes possible those sentitive measurements so essential in laboratory or audio work. Ten voltage ranges covering from .01 RMS full scale to 300 volts RMS full scale. Input impedance 1 megohm with frequency response 20–50,000 cycles. Ten DB ranges from —52 to +52 DB. Four diodes in meter bridge circuit for maximum linearity.

Heathkit HANDITESTER KIT

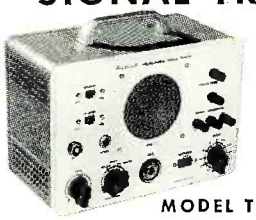
MODEL M-1
$13.50
Shipping Wt. 3 lbs.

The ever popular Handitester is now supplied with a Simpson 400 microampere meter movement. Provides AC and DC voltage ranges 0–10–30–300–1,000–5,000 volts. Ohmmeter ranges 0–3,000 and 0–300,000 ohms. DC current measurements 0–10 and 0–100 milliamperes. A completely self contained portable instrument.

HEATH COMPANY · Benton Harbor 15, Mich.

HEATHKITS for the ENGINEER

Heathkit VISUAL AURAL SIGNAL TRACER KIT



MODEL T-3
$22.50
Shipping Wt. 10 lbs.

Designed especially for service applications in AM-SW-FM-TV repair work. RF and audio two channel input. More than adequate sensitivity—new noise locator circuit—calibrated wattmeter—substitution speaker—visual signal indication. Can be used with scope and VTVM, checks phono cartridges, phono mechanisms, microphones, tuners, etc. Let the Heathkit Visual Aural Signal Tracer help you.

Heathkit RESISTANCE SUBSTITUTION BOX KIT

Choice of 36 switch selected resistance values 15 ohms to 10 megohms. All standard RTMA 1 watt 10% resistors. Buy several for those lab and service applications.

MODEL RS-1
Ship. Wt. 2 lbs.
$5.50

Heathkit CONDENSER CHECKER KIT

An instrument designed solely for its particular job. Not a "sideline" of a multiple function instrument. Measures value and quality of unknown condensers and resistors. Capacity range .00001 mfd to 1,000 mfd. Resistance range 100 ohms to 5 megohms. Sensitive electron beam indicator—five polarizing test voltages—safety spring return leakage test switch. An amazingly accurate instrument at this low price.

MODEL C-3
$19.50
Shipping Wt. 8 lbs.

Heathkit AMATEUR TRANSMITTER KIT

MODEL AT-1
$29.50
Shipping Wt. 15 lbs.

Here is the long awaited Heathkit entry into the amateur radio field. The Heathkit AT-1 Transmitter kit is a well designed basic transmitter incorporating many desirable features and providing maximum overall performance.

Convenient band switching eliminates the bother and annoyance of plug in coils. It is merely necessary to switch to the desired frequency and plug in your favorite crystal or VFO. This transmitter features a self-contained power supply mounted on the same chassis and cabinet enclosed to minimize TVI. AC line by-passed to reduce radiation.

The coils supplied with the Heathkit AT-1 are pre-wound and adjusted for the necessary frequency coverage of 80-40-20-10 meters. The entire kit is supplied complete with all tubes, coils, punched and formed chassis and cabinet, as well as all constructional material required. A detailed assembly and operation manual is also furnished.

Heathkit SIGNAL GENERATOR KIT

MODEL SG-7
$19.50
Ship. Wt. 8 Lbs.

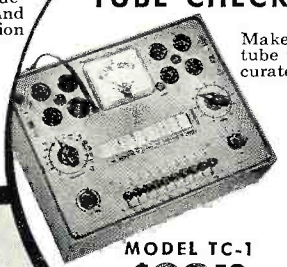
A service "must" is a reliable source of modulated (400 cycles) or unmodulated RF output. Frequency range 150 KC to 150 MC. Step attenuated and variable output—internal or external modulation. High output level and performance with low cost.

Heathkit GRID DIP METER KIT

World's largest selling Grid Dip Meter. Five pre-wound coils—frequency coverage 2–250 mc. Simplified construction and operation

MODEL GD-1A
$19.50
Ship. Wt. 4 Lbs.

Heathkit TUBE CHECKER KIT



Make those all important tube tests quickly and accurately. Checks all tube types encountered in radio and TV work. Simplified setup and switching system provides fast checks for shorts, opens, individual elements and over-all quality. Portable cabinet available at slight additional cost. TV picture tube adapter also available. See order blank.

MODEL TC-1
$29.50
Shipping Wt. 12 lbs.

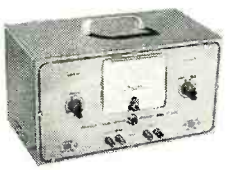
Revised Roll Chart .50

Heathkit SQUARE WAVE GENERATOR KIT

MODEL SQ-1
$29.50 Ship. Wt. 12 lbs.

True square wave output with frequency range 10 cycles to 100 KC. High variable output voltage level 0–20 volts at 600 ohms output impedance. Provisions for external synchronization. The ideal instrument for TV service work and wide band amplifier circuit development.

Heathkit LABORATORY REGULATED POWER SUPPLY KIT



MODEL PS-2
$29.50
Ship. Wt. 17 Lbs.

A regulated variable 160-450 volt DC output power supply for the lab or service shop. Accurate voltage and current measurements with large Simpson meter. AC supply 6.3 volts at 4 amperes—standby switch eliminates warmup time. Low hum content—5 tube circuit. AC and DC output voltages isolated from panel for maximum operational flexibility.

Heathkit VIBRATOR TESTER KIT

Checks for starting and quality of interrupter and self rectifier type vibrators. Five sockets—checks hundreds of types. Operates from continuously variable type battery eliminator.

MODEL VT-1
$14.50
Shipping Wt. 6 lbs.

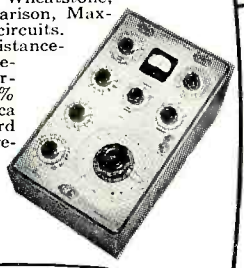
HEATH COMPANY • Benton Harbor 15, Mich.

SERVICEMAN · AMATEUR · STUDENT

Heathkit

IMPEDANCE BRIDGE KIT

Provides choice of Wheatstone, Capacitance Comparison, Maxwell or Hay bridge circuits. Measurement of resistance-capacity-inductance-dissipation factor-storage factor. 1% precision silver mica capacitance standard. ½% precision resistors.



MODEL IB-1B

$69.50

Shipping Wt. 15 lbs.

Heathkit

INTERMODULATION ANALYZER KIT

Intermodulation distortion analysis is one of the most satisfactory methods of checking audio equipment. The IM-1 features two self contained high frequency generators (3,000 and 7,000 cycles) a 60 cycle low frequency source, intermodulation section, AC VTVM, and power supply all in one complete unit. Direct reading IM percentages on 3 calibrated scales 30%—10%—3%.

Shipping Wt. 17 lbs.

MODEL IM-1

$39.50

Heathkit

AUDIO OSCILLATOR KIT

MODEL AO-1

$24.50

Ship. Wt. 11 lbs.

Features sine or square wave coverage from 20–20,000 cycles in 3 ranges. Variable 10 volt output level at 600 ohms impedance. Thermistor controlled linearity—precision multiplier resistors—distortion less than .6%. An outstanding instrument value at this amazing low price.

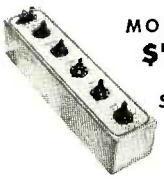
Heathkit

DECADE RESISTANCE KIT

MODEL DR-1

$19.50

Ship. Wt. 4 lbs.



Individual switch selection of twenty 1% precision resistors in 1 ohm steps from 1 to 99,999 ohms. Sturdy ceramic wafer switches featuring silver plated contacts and smooth positive detent action.

Heathkit

Q METER KIT

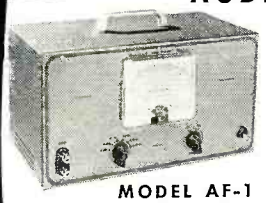
A typical Heathkit invasion of the laboratory instrument field. Here is the first successful low priced Q meter ever offered in kit form. Oscillator supplies RF in the range of 150 KC to 18 mc. Reads Q directly on calibrated meter scales. Measures Q of condensers, RF resistance and distributed capacity of coils. Calibrate capacitor with range of 40 mmf to 450 mmf with vernier ±3 mmf. All measurements made at the operating frequency.

MODEL QM-1

$39.50 *Ship. Wt. 14 lbs.*

Heathkit

AUDIO FREQUENCY METER KIT



Indicates audio frequency on large 4½" Simpson meter. Ranges 10 cycles to 100 kc at input voltage level of 3–300 volts RMS. The input wave shape is not at all critical. Useful in production line testing—indicating square wave frequency—determining generator output. Operation entirely electronic, no vibrating reeds.

MODEL AF-1

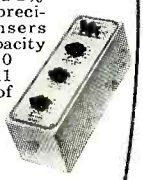
$34.50

Ship. Wt. 12 lbs.

Heathkit

DECADE CONDENSER KIT

Switch selected 1% silver mica precision condensers providing capacity range of 100 mmf. to 0.111 mfd. in steps of 100 mmf.



MODEL DC-1

$16.50

Shipping Wt. 4 lbs.

Heathkit

AUDIO GENERATOR KIT

A new extended range 18 cycles—1 megacycle audio instrument at a remarkably low price. Five continuously variable output ranges—600 ohm output impedance—low distortion figure, less than .4% from 100 cps through audible range.

MODEL AG-8

$29.50

Ship. Wt. 11 lbs.

Heathkit

BAR GENERATOR KIT

MODEL BG-1

$14.50

Ship. Wt. 6 lbs.

The Heathkit BG-1 Bar Generator represents another welcome addition to the fast growing line of popular Heathkits. The station transmitted test pattern is rapidly disappearing and the Bar Generator is the logical answer to the TV serviceman's problem in obtaining quick accurate adjustment information.

The Bar Generator produces a series of horizontal or vertical bars on the TV screen. These bars are equally spaced and will quickly indicate picture linearity of the receiver under test. Since picture linearity is independent of transmitting frequency, it is unnecessary to provide coverage throughout the VHF range, thereby holding down instrument cost.

The Heathkit Bar generator is simple to use and is extremely portable, providing a quick means of checking the television receiver either in your workshop or in the customer's home.

Heathkit

TELEVISION SWEEP GENERATOR KIT

Frequency coverage 10–90 mc and 150–230 mc. Variable sweep width 0–12 mc, built in absorption type marker, step and continuously variable output and blanking circuit.

MODEL TS-2

Ship. Wt. 20 lbs. **$39.50**

Heathkit

BATTERY ELIMINATOR KIT

A variable 0–8 volt DC supply source rated at 10 amperes continuously and up to 15 amperes intermittently. Voltmeter, ammeter, automatic overload relay, fuse protection—heavy duty Mallory 17 disc rectifier.

MODEL BE-3

Ship. Wt. 17 lbs. **$24.50**

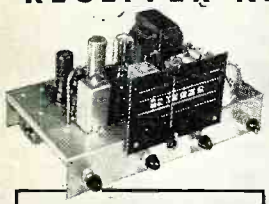
WRITE FOR *Free*

CATALOG

New 32 page 1953 Catalog lists all kits, specifications, schematics and latest price information.

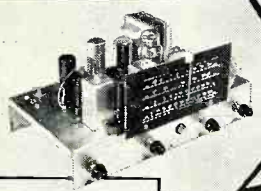
HEATH COMPANY · Benton Harbor 15, Mich.

Heathkit SUPERHETERODYNE RECEIVER KITS



Broadcast Model BR-1 5 Tube-Broadcast Band 550 to 1600 KC coverage. Shipping Weight 11 lbs.

$19.50

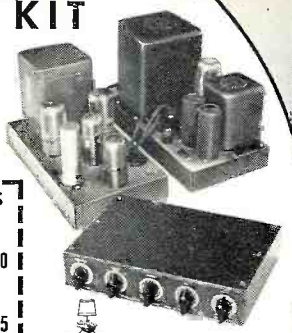


Three Band Model AR-1 6 Tube all wave circuit 3 Ranges, continuous coverage 550 KC to over 20 MC. Shipping Weight 11 lbs.

$23.50

NEW HEATHKIT WILLIAMSON TYPE AMPLIFIER KIT

The ideal amplifier for custom high fidelity audio installations. Tops in performance, value, and flexibility of operation. Either Altec Lansing Peerless or Acrosound output transformers available. First Williamson type amplifier supplied with a matching preamplifier.



PRICES OF VARIOUS COMBINATIONS

W-2 Amplifier Kit (Incl. Main Amplifier with Peerless Output Transformer, Power Supply and WA-P1 Preamplifier Kit) Shipping Weight 37 lbs. Shipped express only	$69.50
W-2M Amplifier Kit (Incl. Main Amplifier with Peerless Output Transformer and Power Supply) Shipping Weight 29 lbs. Shipped express only	$49.75
W-3 Amplifier Kit (Incl. Main Amplifier with Acrosound Output Transformer, Power supply and WA-P1 Preamplifier Kit) Shipping Weight 37 lbs. Shipped express only	$69.50
W-3M Amplifier Kit (Incl. Main Amplifier with Acrosound Output Transformer and Power Supply) Shipping Weight 29 lbs. Shipped express only	$49.75
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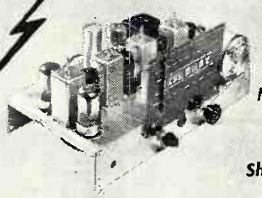

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Six-Meter Transceiver

(*Continued from page 58*)

by 3½" over-all, which contributes much to a neat finished appearance. The transceiver is built as two small subassemblies which are completely wired before mounting within the "Minibox." Aluminum sheet salvaged from old transcriptions was folded to form the two chassis bases. A flat mounting plate with lips serves for the receiver and audio section, with the tubes and audio transformers mounted below the plate. The transmitter r.f. section required a step-shaped chassis to position the tubes and coil forms properly. The layout of components for these two units has to be carefully correlated so that the sections will interlace when fitted into the "Minibox."

The control switches should be mounted on the "Minibox" panel with suitable lengths of wire soldered to them before the two subassemblies are bolted in place in one corner of the box. The interconnecting wiring can then be completed, and the end support plate attached to form the battery compartment. This space measures just under 4" x 6" to provide room for two 90-volt "B" batteries in parallel, together with three 1½-volt flashlight cells which are connected in parallel for the "A" supply.

Operation and Adjustment

The initial tune-up of the transmitter is most easily done with the aid of a grid-dip meter. The oscillator slug should be detuned slightly from resonance so that the circuit will be sure to oscillate whenever power is applied. The multiplier tanks are tuned for peak output. The "Minibox" cover has some detuning effect on the coils, so optimum adjustments are best made with this cover in place. Small ¼" holes drilled in the cover to give access to the slugs from outside can be neatly covered by hole plugs when not in use.

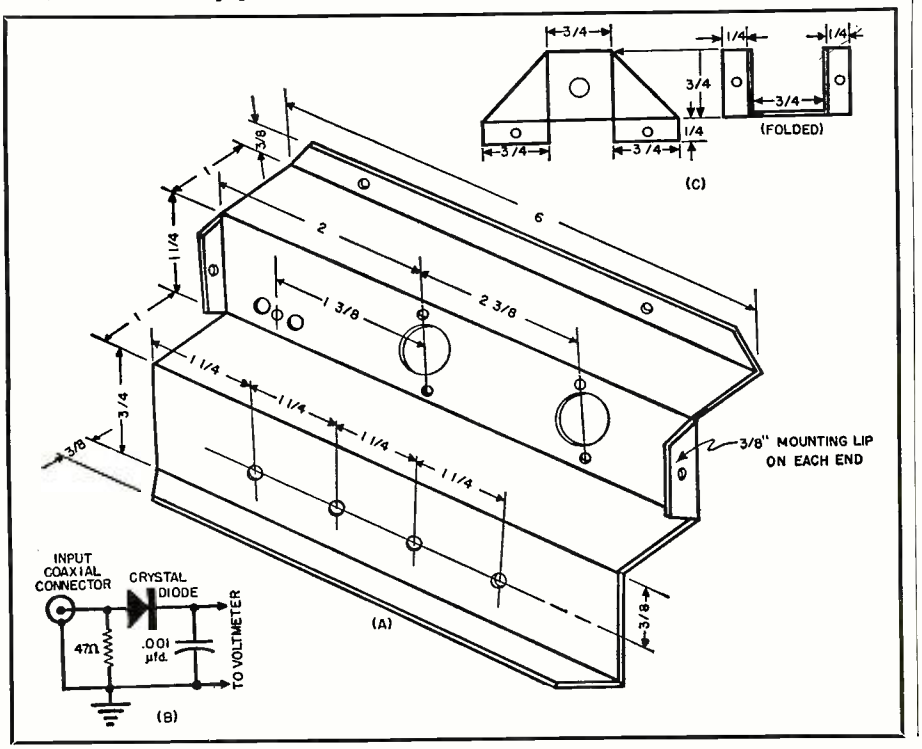
A communications receiver "S" meter, or a voltmeter connected to the suggested dummy load will make a handy output indicator for the tuning adjustments.

The detector slug, accessible through the front panel hole, can be adjusted by listening to a received signal. Since the operation is on a fixed frequency, the tuning adjustment will hold for long periods.

As would be expected, the useful range of the transceiver is limited by the signal-to-noise ratio of the receiver, so antenna efficiency plays a major part in the performance. Center- and top-loaded verticals were found to be less satisfactory than a quarter-wave whip for portable operation. A three-section collapsible auto radio whip fitted to a coax connector has proved to be a very serviceable antenna.

Any simulated ground plane or counterpoise will increase the antenna effectiveness. The range can, therefore, be increased by placing the transceiver on top of a car or other metal surface. In some applications a low-channel TV antenna can be used with excellent results. When used in a car, the regular 55" broad-

(A) Details of the transmitter chassis, bent up from sheet aluminum. (B) A dummy load for tuning the transmitter. (C) Details of the receiver coil mounting bracket. Its position can be seen in receiver bottom-view photograph. Receiver chassis is a flat mounting plate, 3¼" x 6", with ⅜" lips. See photos for parts layout.



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cast receiver antenna gives a fine account of itself.

The range between transceivers is naturally affected by intervening terrain. Transmissions of a mile or so can be expected over good paths when the units are hand-held, with correspondingly greater coverage when better antenna systems are used. —30—

Anti-Flutter Circuit

(*Continued from page 39*)

a diode a.g.c. circuit, direct-coupled video amplifier, and cathode drive to the picture tube. Its modification is more complicated. See Fig. 4. The 470k resistor and parallel condenser are removed and replaced by the anti-flutter network shown in Fig. 4B. The resistance values in the network are modified as one of the steps to restore the picture tube cathode potential to its original value and the condensers are changed to maintain the proper time constants with the new resistance values. A resistance-capacitance low-frequency compensation network is added in the plate circuit as the second step in restoring the picture tube cathode potential and also to boost the transmission of the video signal d.c. component to approximately 100%, assuming a picture tube cathode input resistance of 50,000 ohms.

REFERENCES

1. *Billin, J. J.: "Anti-Flutter Circuit," Journal of the Television Society, October-December 1952.*
2. *British Patent 648,537.*

—30—

INTERNATIONAL CONTACTS

UNITED STATES radio amateurs are reminded that communication between amateur stations licensed by the Federal Communications Commission and foreign amateur stations is permissible subject to the limitations of Section 1 of Article 42 of the Radio Regulations annexed to the International Telecommunications Convention (Atlantic City 1947). Section 1 of this Article provides as follows:

"Radiocommunications between amateur stations of different countries shall be forbidden if the Administration of one of the countries concerned has notified that it objects to such radiocommunications."

Information available through April 16, 1953, indicates that the following countries have forbidden radio communication between their amateur stations and amateur stations of other countries: Austria, Cambodia, Indonesia, Iran (all amateur operation forbidden), Korea, Laos, Thailand, and Viet Nam.

Amateur stations in Australia are authorized to conduct radiocommunication for purely experimental purposes with amateur stations in other countries, the administrations of which permit such radiocommunication.

Amateur service has not yet been organized in Jordan and Rumania.

This information does not modify the handling of third-party communications by amateurs as outlined in the Commission's Public Notice of April 15, 1952. —30—

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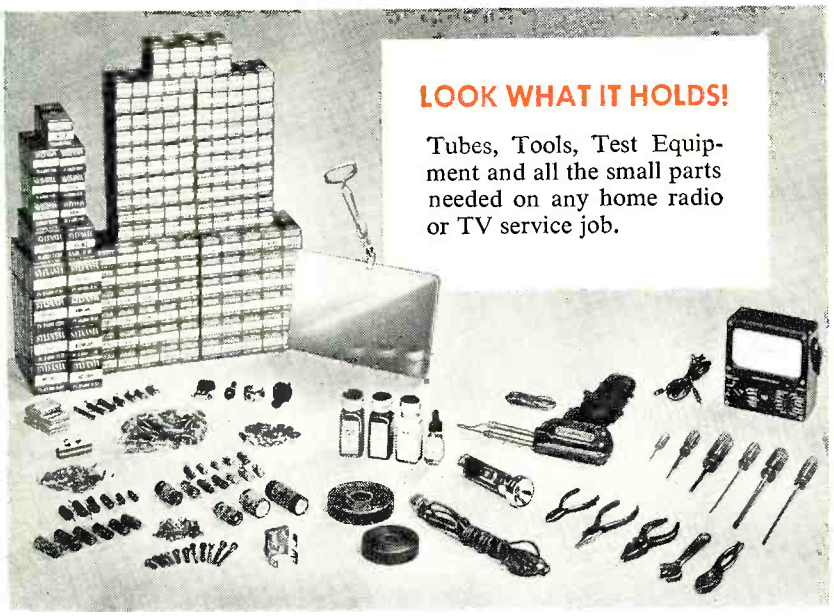

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MODERNIZE YOUR AM-FM TUNER

By **LT. COL. BYRON E. HARGROVE**
Signal Liaison Officer
TRADS, Fort Eustis, Va.

Pep up those older model AM/FM tuners by making a few easy circuit changes and substituting newer and hotter tubes.

MANY FM-AM enthusiasts purchased sets as soon as they were available after World War II. Although many have given excellent service through the years, almost all of them are performing considerably below what could be expected of them.

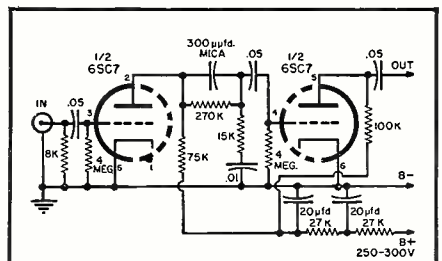
The modernization of a *Meissner* Model 2961 is described. Some, or all, of the changes described can be applied profitably to most FM-AM receivers.

The *Meissner* Model 2961 is a 29 tube FM-AM-phono combination with completely independent FM and AM tuners, but a common power supply and audio system. It was equipped with a phono unit having a crystal pickup and compensating preamplifier.

The audio system uses four 6L6 tubes, triode connected, in push-pull parallel as output tubes. Original specifications called for substantially flat response between 60 and 20,000 cps. Since the speaker with which this unit is equipped is capable of good reproduction of considerably lower frequencies, all audio coupling condensers in the main audio unit were replaced with .1 μfd., 600 volt units. Low frequency response was considerably improved by this change.

To obtain better record reproduction, the crystal pickup was replaced with a *G-E* reluctance unit. This necessitated replacement of the original preamp stage using a 9002 triode, with a 6SC7 preamp stage. The 6SC7 tube was mounted in the same position as the original preamplifier by removing the miniature socket, reaming the hole, and mounting an octal socket. See diagram Fig. 1.

In the FM unit, the 6AG5 r.f. tube and the three 6AG5 i.f. tubes are replaced by 6CB6 tubes, a newer, hotter type. No circuit changes are required except to connect pins 2 and 7 together at each tube socket concerned.

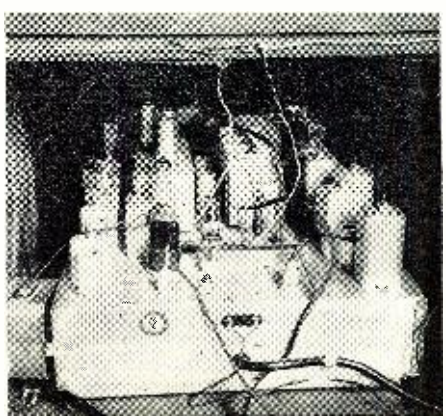


1—8000 ohm, ½ w. res.
2—4 megohm, ½ w. res.
1—270,000 ohm, ½ w. res.
1—75,000 ohm, 1 w. res.
1—15,000 ohm, ½ w. res.
1—100,000 ohm, 1 w. res.
2—27,000 ohm, 1 w. res.
1—.05 μfd., 400 v. cond.
1—300 μμfd., 500 v. mica cond.
2—.05 μfd., 600 v. cond.
1—.01 μfd., 500 v. mica cond.
2—20 μfd., 450 v. elec. cond.

Fig. 1. Preamp circuit added to permit use of the G-E variable reluctance pickup unit.

Re-alignment of the set will be required. While the use of a sweep generator and oscilloscope is preferred, a thoroughly satisfactory job can be done with nothing more than a good FM station within comparatively short range.

Tune the set to the high frequency portion of the FM band to a point where no station is being received. Beginning with the i.f. transformer nearest the discriminator (not the discriminator transformer), and progressing toward the "front end", adjust all i.f. transformers for maximum noise output. (Better relations with the wife and other members of the family will be maintained if this is done when you



Rear view of the author's "modernized" FM tuner. At the extreme left is the Drake 300-ohm hi-pass filter. The glass tube above the "UL" stamp on the chassis is the 6SC7 preamplifier with aluminum foil wrapped around it. This is not necessary if a metal tube is used. To the rear of the 6SC7 and above it is the 6AB4 grounded-grid r.f. stage mounted on aluminum bracket. Behind this is the original FM tuner. To the right of the tuner is the AM r.f. mixer and oscillator tubes. In front of the AM tuning condenser is the new "Ferri-Loop" antenna. The 300-ohm ribbon to this antenna connects one side of the original loop antenna to top of "Ferri-Loop." The two hook-up wires from top of cabinet are built-in antennas, one for push-button tuner and the other for reception on the shortwave bands.

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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.

SPECIFICATIONS:

6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 Volts.
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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 3⅜"x 5⅞"x2¼".

$14.90 NET

The Model 770 comes complete with self-contained batteries, test leads and all operating instructions.

Superior's New Model TV-11

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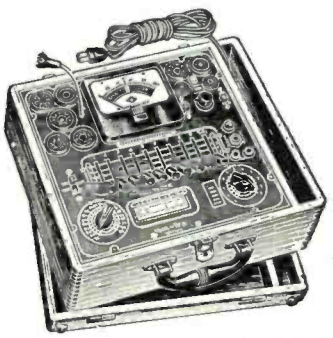

• Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary. • Uses no combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket. • Free-moving built-in roll chart provides complete data for all tubes. • Phono jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose external connections.

Operates on 105-130 Volt 60 Cycles A.C. Hand-rubbed oak cabinet complete with portable cover .....

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Superior's New Model 670-A

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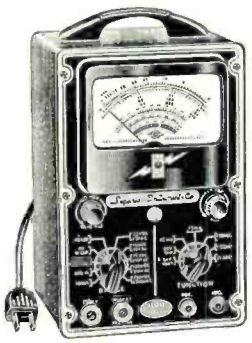

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D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Quality test for electrolytics)
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• Tubes used: 1—6BE6 as R. F. Oscillator, mixer and amplifier. 1—6BE6 as Audio Oscillator. 1—6H6 as Power Rectifier. The Model 660-A comes complete with coaxial cable test lead and instructions .....NET

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are the sole occupant of the house.)

After completing the i.f. alignment, align the 1st detector or converter stage and the r.f. stage in that order, again tuning for maximum noise. The FM antenna to be used should be connected before aligning the r.f. stage.

Now tune in an FM station. Identify it and check the frequency. Adjust the oscillator trimmer, if necessary, to bring it on frequency. If you are lucky, the quality should be OK. However, if distortion is present, adjust the discriminator transformer for best audio quality.

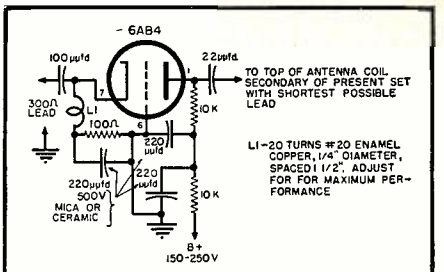
It should be possible now to obtain considerably improved FM reception. Further worthwhile improvement can be obtained by adding a grounded-grid triode r.f. amplifier. This stage is broadly tuned to the FM band and no additional controls are required. The r.f. stage should be mounted on a bracket as close as practicable to the existing r.f. stage. No shielding is necessary and if the set has been free from amateur radio and other interference previously, none should be present after the stage is installed.

"B+" for the 6AB4 grounded-grid r.f. amplifier should be taken from the "B+" lead for the r.f. or i.f. tubes in the original receiver. This will insure a well filtered, correct voltage for this stage. Heater voltage (for pins 3 and 4) may be obtained from any i.f. or r.f. socket.

The output from the r.f. amplifier is fed through a 22 $\mu\mu$fd. condenser directly to the "hot" end of the original antenna coil by means of the shortest lead possible. Use insulated hook-up wire, not shielded wire.

Now turn on the set and re-align the original r.f. amplifier for maximum noise output. The noise output will be increased slightly, since a grounded-grid triode amplifier introduces little noise, but the receiver sensitivity should be up materially.

With the completion of the above changes, the number of usable FM stations should be vastly increased.



1—100 ohm, ½ w. res.
2—10,000 ohm, ½ w. res.
1—100 μμfd., 500 v. mica or ceramic cond.
3—220 μμfd., 500 v. mica or ceramic cond.
1—22 μμfd., 500 v. mica or ceramic cond.
Note: Output from 6AB4 connects to grid of previous r.f. amplifier (if included, if not, to grid of mixer). Use unshielded hook-up wire and keep as short as possible.

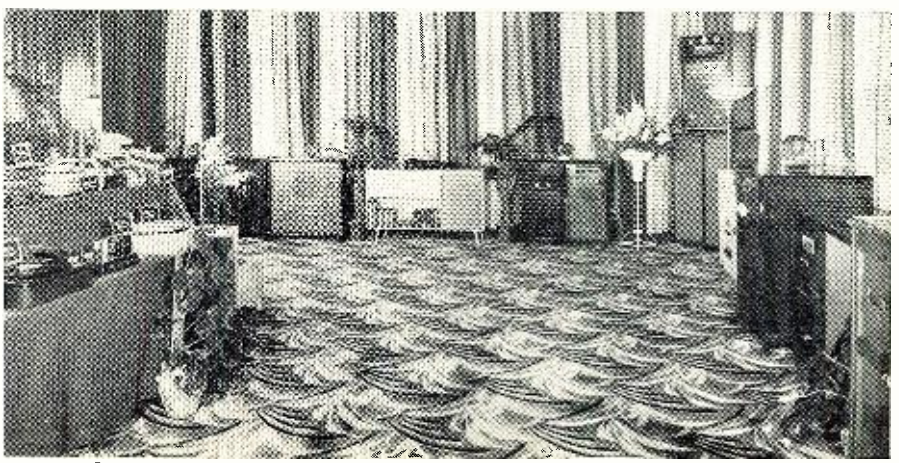
Fig. 2. Adding a grounded-grid triode r.f. amplifier to Meissner Model 2961 radio.

Now to tackle the AM portion of the set. Disconnect the lead from the antenna coil to the tuning condenser. Mount a "Ferri-Loop" (one of the new compact antennas) above the chassis and close to the tuning condenser. Ground one side of the "Ferri-Loop" and connect the other lead to the variable condenser. Remove the small wire attached to the "Ferri-Loop" and connect one side of the original loop antenna to the point where this small wire was attached. Leave the other lead from the loop antenna disconnected.

Now tune the set to about 1000 kc. and adjust the "Ferri-Loop" for maximum signal response. The *Meissner* uses 9003 tubes as the r.f. amplifier and in the two i.f. stages. Replacing these with 6BJ6 tubes will raise the performance considerably. No circuit changes are required other than connecting together pins 2 and 7 on the sockets concerned.

After installing the new tubes, realign the set. Performance on AM, FM, and phono should be much better now than when the set was new. Total cost, if all parts are purchased new, should be approximately $25.00 —30—

Visitors to Electronic Wholesalers, Inc.'s recent "High Fidelity Music Festival" were able to see and compare a wide variety of audio equipment at this Sound Sales Salon set up in the Emerald Room of the Hotel Burlington in downtown Washington. The 45-day event drew thousands of interested spectators, attesting to the ever-increasing popularity of high quality home sound systems. Because of this widespread interest, the company has recently opened a new downtown Sound Sales Salon.



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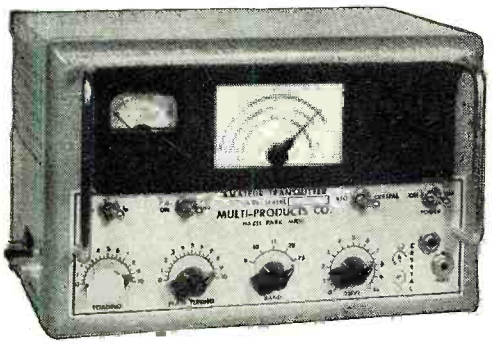

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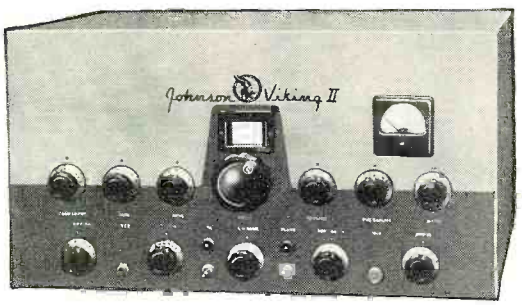

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HINTS and KINKS for MOBILEERS

By **JACK NAJORK, W2HNH**

These simple antenna tricks and a painless addition to the receiver will add greatly to the enjoyment of mobile QSO's.

MANY articles on center- and base-loaded mobile antennas have pointed out that an antenna of this type must be accurately pruned to resonance at the operating frequency if it is to accept power and do a good job of radiating. If the ham is fortunate enough to own a grid-dip meter, finding the resonant frequency of the antenna is a simple matter.

Without such an instrument, determination of antenna frequency can become quite a problem, especially if a loading coil of unknown inductance is used with a whip whose capacity is also a matter of speculation. Starting with such a combination, it is often found that the resonant frequency of the system may be a half megacycle or more removed from the desired frequency.

The approximate resonant frequency of a new or experimental antenna of this type can be found very easily (and inexpensively) by a method filched from the broadcast antenna engineers*, which makes use of an ordinary buzzer and a calibrated receiver. The whip is grounded and the buzzer is loosely coupled to it, as shown in Fig. 1A. The resulting shock excitation of the system radiates a signal which peaks up sharply at the resonant frequency of the antenna. The station receiver is used to find this frequency and the system can then be pruned to the desired channel.

This method really works very well, the buzzer radiation showing a peak about 30 kc. wide which can be detected at a distance of twenty to thirty feet from the antenna with the average communications receiver. The higher the *"Q"* of the antenna being excited, the sharper will be the noise peak.

It is best to make the test at a time when the frequencies involved are relatively quiet, otherwise strong QRM may mask the noise peak. To prevent detuning, short leads should be used at the base of the antenna. An extra two inches in the form of a single-turn loop will provide sufficient coupling.

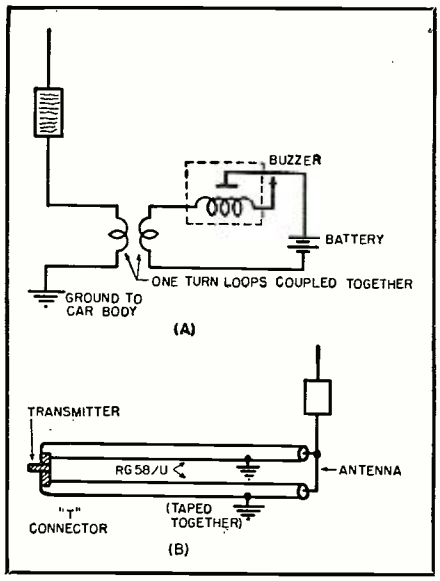


Fig. 1. (A) Method of using a buzzer to determine resonant frequency of a mobile antenna. (B) The use of paralleled 52-ohm coax cables to improve impedance match.

Feeding the Loaded Whip

Antennascope measurements on a number of base- and centerloaded 75 meter whips show that the base impedance of these systems is very close to 25 ohms. Although 52-ohm coax can be used as a feed line, a much better match can be obtained by using two sections of small diameter RG-58/U (53.5 ohms) in parallel.

A neat job can be done by taping the two sections of line together and using a "T" coax fitting at the transmitter end, as shown in Fig. 1B.

* Henney, Keith: "Radio Engineering Handbook" (4th Rev. Ed.), chap. 14, p. 613.

Improving Receiver Selectivity

The usual converter-car receiver combination used for mobile reception leaves much to be desired from the standpoint of selectivity, especially on the lower frequency bands where considerable activity is encountered. Aside from the common deficiency of poor station separation, the poor selectivity causes loss of gain on weaker signals, because a.v.c. action on a strong adjacent carrier decreases the sensitivity of the receiver over a relatively broad spectrum. Since adjacent-channel attenuation is primarily a function of the i.f. bandwidth in the car receiver, considerable improvement can be made by sharpening the skirt selectivity in the i.f. amplifier in "Q-5'er" fashion by the insertion of additional tuned circuits.

Such a modification is not nearly as complicated as it sounds or looks, and it will be found that quite a few of the modern automobile receivers now have ample room for the additional components required.

Fig. 2 shows the circuit added to a 1950 *Philco* receiver in the author's *Studebaker*. Two additional midget i.f. cans (four tuned circuits) were added between the mixer and i.f. amplifier tubes, together with a 6BJ6 amplifier tube. There was sufficient room inside the set to mount these components alongside the i.f. amplifier stage without crowding.

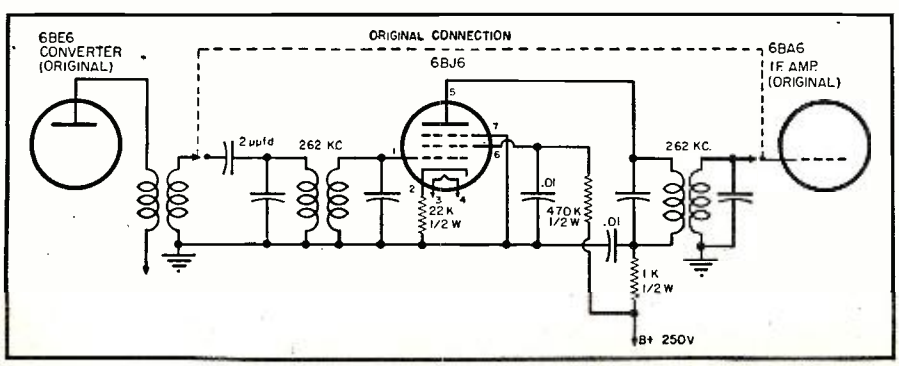
With the circuit values shown (265 kc. i.f.) the gain of the 6BJ6 stage is held down to 1.5 times because all that is desired here is sufficient amplification to make up for the insertion loss of the additional transformers. It is necessary that the suppressor of the 6BJ6 be grounded rather than being connected in usual fashion to the cathode. With the high value of cathode resistance used, the tube cut off completely until this change was made. Total cathode current of the 6BJ6 is less than two milliamperes, and the heater current was gotten "for free" by disconnecting one of the two dial lamps.

You will have to take the usual precautions in installing the extra stage to avoid oscillation in the i.f. system of the set.

After the modification is made, a complete i.f. alignment (preferably visual alignment with a sweep generator and scope) should be carried out. When you put the set back in operation you will find that you can sneak up a lot closer to the strong ones to copy those "S3" signals that were formerly "snowed under." The additional stage gives a healthy improvement with practically no increase in power consumption.

—30—

Fig. 2. Circuit diagram of an additional i.f. stage for the car's broadcast receiver to improve over-all selectivity. Unmarked condensers are in the i.f. cans.



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14-Inch Conversion Kit WITH G.E. TUBE $25.95

14-inch conversion kit: You get a 14-inch black face, 1 year guarantee G.E. 14CP4 picture tube, a 70° deflection yoke with matching 14,000 volt G.E. flyback and a 14" plexiglas gold trim safety mask, plus conversion instructions. Stock No. 14CC-G, Sale price, $25.95.

17-INCH CONVERSION KIT $25.95

17-inch conversion kit with a 17BP4A, 17" rectangular blackface electro-magnetic focus picture tube with 6 months' guarantee, plus a matched 70° cosine yoke, a G.E. built 14,000 volt flyback and a 17" rectangular gold trimmed plexiglas mask and safety shield. Suggested diagram furnished. Shipping weight, 30 lbs. via Express or Truck only. Stock No. 17-4XL, 17" conversion kit. Sale price, **$25.95.** Kit Price with GE or Raytheon 1 year guarantee picture tube, **$5.00** extra.

20-Inch Conversion Kit $29.95

Our 20" conversion kit includes a 6-month guaranteed 20HP4, 20" rectangular blackface picture tube, plus a 14,000 volt G.E. built high voltage flyback transformer, plus a matched 70° cosine yoke, plus a 20" rectangular gold trimmed plexiglas mask and suggested diagram. The picture tube is the latest electro-static focus type that requires no focus coil. Shipped via express or truck only. Ship. weight, 40 lbs. Stock No. 20-TP, net price, **$29.95.** Price with Raytheon or GE 1 year guarantee picture tube, **$10.00** extra.

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8" SPEAKER AND BAFFLE $4.95

Stock No. 818, Tan leatherette covered, plywood slant type wall baffle; plus an 8" Oxford, 2.15 oz. Alnico 5 magnet PM speaker. A red hot McGee special for only **$4.95** each, or **$4.70** each in lots of 3 or more.

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12" SPEAKER AND BAFFLE $7.95

Stock No. CA-12, Tan leatherette covered plywood slant type wall baffle; plus a 12" Quam, 4.64 oz. Alnico V magnet PM speaker. (Popular Adjustacone model.) A terrific McGee value for only **$7.95** each, or **$7.50** each in lots of 3 or more.

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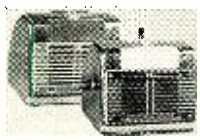
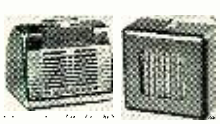


3-station intercom master housed in chrome plated metal cabinet 7½"x6"x5" sloping front. Full 3-tube amplifier for 110 volt AC-DC operation. Press-to-talk switch is on top of the cabinet and volume control with off-on switch and station selector switch are on either side. May be used with from one to 3 sub-stations. (See matching cabinet chrome plated sub-station No. PM-A5.) Master is quiet at all times except when press-to-talk switch is pressed at the master or call-back switch is pressed at the sub. Uses 3-wire intercom cable. 3-station intercom master MPM-A3, shipping weight 10 lbs. Sale price, **$16.95** each, sub-stations extra. 3-wire plastic intercom cable, 100 ft. for **$1.95**, 500 ft. for **$8.95.**

1000 INTERCOM SUB-STATIONS TO SELL AT $3.95 EACH



Chrome plated, with call back switch for a 3-wire intercom master. Size 7½"x6"x5" sloping front. 5" Alnico V PM spkr. Intercom dealers buy at less than present production costs. Limited quantity. Stock No. PI-A3, weight 8 lbs. Sale price, **$3.95** each or 3 for **$10.00.** Special 3-wire plastic intercom cable. 100 ft. **$1.95**, 500 ft. for **$8.95.** Brown leatherette covered intercom sub-station with call back switch for use with 3-wire intercom masters. 5" square and 2½" deep. Has new plastic grill cloth. Alnico V PM speaker. A true McGee value. Stock No. NE-5, ship. weight, 1½ lbs. Sale price **$3.95** each or 3 for **$10.00.** 3-wire plastic intercom cable. 100 ft. for **$1.95**, 500 ft. for **$8.95.**

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Read the article on pages 52 and 53 of the December "Radio & TV News." You will see how a booster like the McMurdo Silver Super Sonic was used for fringe area TV reception. We can't guarantee this unusual reception, but we will guarantee this booster to be a sensational value. Continuously variable inductance type tuner from channel 2 including the FM band through channel 13. Self-powered for 110 volts AC operation. Incorporates a 6J6 tube. Input for 300 ohm TV line and 300 ohm output to TV set. Single knob tuning. Attractive plastic case. McMurdo Silver Super Sonic TV-FM booster, Stock No. GB-6B, shipping weight 5 lbs. Sale price, **$10.95** each or two for **$20.00.**

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This popular Sarkes-Tarzian Type 3 tuner is widely used. 13 channel rotary type switch with individually tuned coils. Price is complete with diagram and three tubes: 6C4 osc., 6BH6 R.F. and 6AG5 mixer. Regular factory cost is twice our price. Each tuner is wired ready to hook up to a video and sound IF strip. May be used with either inter-carrier or separate sound IF circuits. Has built-on contactor coil, built in fine frequency control, Sarkes Tarzian TV tuner, with 3 tubes. Net price, **$9.95** each. Specify shaft length, either 2⅞" or 4⅜".

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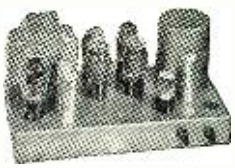

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2-Mike Pre-Amp $12.95 Extra. Not a Kit, but a Manufactured Amp.

50-WATT BOOSTER A sensational value, 50 watt booster amplifier with push-pull parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-2X Pre-amp to add the use of 2 mikes and one low level input. The booster amplifier has one input jack and with 1 volt input gives 50 watts of audio. Booster has a 6 lb. potted case high fidelity output transformer, matches speaker with 4-8-16 ohm voice coil. also 500 ohm and 250 ohm line. Booster has a 225 mill power supply with 5U4 rectifier. Price includes tubes: 4 6L6, 7N7 and 5U4. The two variable controls are for master volume control and bass boost tone control. Size 8 x 6½ x 14½. Stock No. PA-55N. Shipping weight 26 lbs. Sale price **$39.95** ea.

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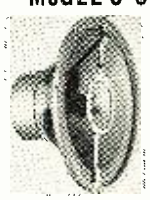
New 1953 Model—21 Oz. Alnico V Magnet—5" Tweeter



This is the finest 15" coaxial PM speaker value that we have ever offered. New 1953 production, of a famous manufacturer of fine speakers. The 15" speaker has a 21½ oz. Alnico V magnet; equal to 68 oz. of the Alnico 3 type magnet. The cone is free floating, of one piece construction. Will reproduce low frequencies down to 20 cps. The 5" tweeter is coaxially suspended and has a ridged cone to reproduce only the high frequencies. It will respond up to 17,500 cps. The high-pass filter is concealed under the pot cover, leaving only two wires to connect both the tweeter and woofer to any 8 ohm output transformer of a radio, or high fidelity music lover's amplifier. Stock No. P-15CS, shipping weight 13 lbs. Net price **$23.95.**

12" COAXIAL SPEAKER, $12.95

McGee offers the new 1953 model 12" coaxial PM speaker. Quality you would put in your finest sets if you were a manufacturer. 12" woofer has 6.8 oz. Alnico V magnet, Tweeter is coaxially suspended and has a metal diffuser. High pass filter is under the pot cover. Only two wires to connect to your radio or audio amplifier. 8 ohm with 18 watt peak and 10 watt average. Shipping weight 8 lbs. Response from 30 to 17,500 cps. Stock No. CU-14Y. Sale price **$12.95** each; 2 for **$25.00.**

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Another McGee Scoop! Jensen Concert 12", 14½ oz. Alnico V magnet PM speaker. 8 ohm voice coil. Will take 25 watt audio. You save dollars on this speaker. Just 100 to sell. Shipping weight 8 lbs. Stock No. P-12P. Sale price **$15.95**; 2 for **$30.00.**

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Another tremendous McGee Scoop! Brand new General Instrument 3-speed automatic record changers. Complete with RPX-050 G.E. variable reluctance cartridge with turn-about stylus. Plays all 3 speeds automatically: 7", 10" or 12" records. Has reject button. Repeats last record. Base size, 12"x12⅞". Shipping weight 14 lbs. Stock No. 700-GE. Scoop price, **$22.95.**

GI 3-speed changer same as above, but with Webster flip-over twin needle cartridge. Stock No. GI-700, Sale price, **$21.95** each.

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3-WAY PORTABLE KIT

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New 1952 Model 3-way personal portable radio kit. Operates on 110 Volts AC-DC or 67½ B plus 1½ volt self-contained batteries. Leatherette covered case size, 5½x5¾x8". Receives broadcast 550 to 1650 KC. A conventional 2-gang superhet circuit with 456 KC iron core IF's. Incorporates the new super gain stick loop antenna. All plated chassis. Lab. approved circuit—matched parts. Price includes all parts, tubes, diagram, Alnico V PM speaker. A factory quality kit. Stock No. PN-4T, shipping weight 7 lbs. The complete kit. Less batteries. **$15.95.** 67½V. B, **$1.59**; 1½V. A, 39c extra.

Build Your Own Phono-Mike Broadcaster $7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio within your home, (about 75 feet) from 1000 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes. Kit Model DE-6R. Net price, **$7.95.** DE-6RWT, wired and tested. Net price, **$9.95.** Crystal mike and desk stand, **$4.95** extra. Concealed microphone unit, only 1" in diameter and ¼" thick. Specify hidden mike when ordering. Stock No. T-001. Net, **$3.95** extra.

8-Tube Hi-Fi Amplifier Kit $29.95

A complete kit, including tubes: 3-7E5, 2-12AX7, 2-triode plus rectifier diagram and photos. Inputs for radio tuner and any kind of phono pickup (crystal or G.E. variable reluctance) and either crystal or dynamic mike. Output matches 8 ohm voice coil. Twin electronic bass and treble tone controls with range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. Response 18 to 20,000 cps. 8 tube all triode amplifier kit, complete with tubes. Shipping weight 25 lbs. Model 7X5. Net **$29.95.**

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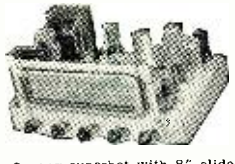
10-TUBE RADIO KIT $29.95



10 tube broadcast radio chassis kit, complete with tubes: 2-6SK7, 6SA7, 3-6SN7, 1-6SL7, 2-6V6 plus 5Y3 rectifier, diagram and instructions. 3 gang superhet with 8" slide rule dial. Chassis size, 12½"x10"x6½" high. Features push-pull 6V6 high fidelity audio. Output matches 3 to 8 ohm voice coil speakers. Inputs for G.E. variable reluctance or crystal phono pickup and crystal mike. Heavy duty power transformer. Model BK-R10 kit less speaker, shipping weight 18 lbs. Net **$29.95.**

17, 20" T.V. Kit $59.95 Less Tubes

A complete kit of parts to build an AC transformer operated television chassis for use with a 16", 17" or 20" rectangular picture tube. The 12 channel Sarkes-Tarzian tuner is ready wired, as is the 4 tube video IF strip. Circuit is of the conventional design. Do not buy this unless you understand Television. It is difficult to wire. We furnish schematic. Kit model WH-20. Ship. wt. 40 lbs. less all tubes. Net **$59.95.** Cascode tuner $10.00 extra! 12" speaker $2.95 extra. Kit of 22 tubes, less picture tube **$16.95.** 17" 17BP4A, **$19.95.** 20HP4. **$25.00.**

6-TUBE 2-BAND KIT $14.95

Popular with schools and colleges for training. 6 tube AC-DC, 2 band radio kit with plastic cabinet. Receives broadcast and 6 to 18 mc shortwave. Full 3 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12SK7, 12K8, 12SK7, 12SQ7, 50L6 and 35Z5, diagram and instructions. Factory quality. Cabinet size 13"x6¾"x6¼". Shipping weight 12 lbs. Model ME6-2. Net **$14.95.**

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Model RS-5. A 5 tube AC-DC straight broadcast kit, housed in the same cabinet as ME6-2 above. Complete with tubes. Shipping weight 10 lbs.. Net **$12.95.**

AC POWERED BROADCAST TUNER KIT $12.95

A self-powered, 3-gang superhet tuner kit with R.F. stage. This complete kit is furnished with a diagram, photos and tubes. 6BA6 R.F., 6BE6 oscillator R.F., 6BA6 I.F. detector, 6AL5 diode, AVC, plus rectifier. Connect to any audio amplifier. Ideal for use with our S-2020 or 7x5 amplifier kits. Chassis size, 9½x4x4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, **$12.95.**

International Short-Wave

(*Continued from page 68*)

1745-1800 closing. (Roberts, Conn., others) Good with news on these channels. (MacIndoe, N. J.)

Germany — Overseas Service from Cologne noted on 11.795 at 1400 to Africa; signed off with German, *English* announcements 1547. (Pearce, England) Heard on 6.270 at 0045 to North Africa. (Sanderson) Surprisingly good signal heard on 7.290 around 2130; news in German 0015-0025. (Lerch, Mass.) Has Mailbag Program Mon. 1400, 1800 on 11.795; 2130 on 6.270, 7.290; Tue. 0630 on 15.275, 1030 on 11.795. Correct reports will be verified by *new* card. The "Staatliches Rundunkomitee" in the Russian Zone operates Berlin I, 6.115, at 2330-1930; Berlin II, 7.150, at 2230-1930, and Berlin III, 9.730, at 2230-1900. (Radio Sweden) AFN, 5.740, Beyreuth, noted in Sweden 1200 with jazz music. (Malmo DX-aren, Sweden)

Gold Coast — ZOY, 4.915, Accra, shortly will increase power to 20 kw. (Fox, N. Z., via Radio Australia)

Greece—Radio Athens, 11.718, noted around 1240 in *English*. (Mast, N. Y., others) *Central Forces Radio Station*, 6.33, Athens, seems *nearer* 6.34 lately, noted 1330 with call in Greek, then Greek music; also heard 0100 with Greek songs. Larissa, 6.745, noted 0115 with popular music. (Pearce, England)

Guadeloupe—FG8HA, 9.430V, Basse-Terre noted 1810 in French; closes 2000 with "La Marseillaise." (Cox, Dela.) Heard also erratically 0600-0630 closedown. (Stark, Texas, others)

Guam—KUJ39, 9.490, noted *testing irregularly* around 0250. (Hooker, Alberta)

Guatemala—TGWA noted opening 0730 on 9.760 (rather than old 15.17 outlet.) (Ferguson, N. C.) If not found on 9.760, try 15.17.

TGCQ, 9.702, noted around 2315 at weak level. (Cox, Dela., Stark, Texas) TGNA lists frequencies of 720 kc., 5.9525, 9.668, 11.850, 15.100 (*inactive*), 17.870 (*inactive*). (Carroll, Me.)

Haiti—4VEH, Cap Haitien, noted 0600-0900 on 9.69A, mostly *English*. (Middleton, Ohio) 4VCP, Cap Haitien, is now back on 6.993, modulation is still poor. (Robbins, Ind.) *Radio Haiti* noted recently parallel on 10.06A, 5.84 with *English* in progress at 2146 tune-in; continued with U. S. popular music until 2221 closedown. (Gay, Calif.)

Holland—Hilversum, 11.730, noted with music 1700-1725, then short newscast prior to 1730 closedown. (Wade, Fla.)

Honduras—HRP1, San Pedro Sula, has moved from 6.351 to 6.360 where it mixes badly with Lisbon around 1800. (Robbins, Ind.)

Hungary—Budapest, 11.910, noted in *English* 1800-1815. (Zerosh, Pa.)

Iceland—TFJ, 12.175, noted Sundays *only* in its 1115-1130 session in Icelandic; CWQRM, QSB. (Cox, Dela.)

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DELCO RADIO

Indo-China (Vietnam) — Radio France-Asie, 6.116A, Saigon, noted 0600 with news in French; on 11.975 with news 2030. Hanoi, 7.405, noted 0630 with French program; is *Radio Hirondelle.* (Sanderson, Australia) Saigon, 9.750A, noted opening 0600 with "La Marseillaise;" heard on 11.935A at 1000-1115 at strong level. (Ishikawa, Japan) *Radio Laos* is heard at fair strength on 7.215 around 0830 to closedown 0923 with "La Marseillaise." "Voice of Vietnam," Saigon, closes down around 0958-1001 and then announces use of 9.620, 7.288, 4.969; however, latter is heard on 4.960A. (Japanese Short-Wave Club)

Iraq—Radio Baghdad, 11.725, noted around 2308 in Arabic. (Bellington, N. Y., others)

Israel—Tel Aviv, 9.010A, noted with "Voice of Zion" relay from Jerusalem 1515-1600 closedown; asks for reports to Box 754, Jerusalem, Israel. (Mast, N. Y.; Bjornert, Sweden, others)

Jamaica—Radio Jamaica verified 3.360 with QSL card in two colors—green and black. (Klein, Va., others)

Japan — The Far East Network (AFRS), Tokyo, is scheduled 1600-0645, JKL2, 9.605, JK16, 11.825; 0500-1000, JKL, 4.860, JK13, 6.080. (Scheiner, N. J.) JOA6, 15.135, JOA4, 11.705, noted opening in *English* to Western North America 0000. (Hooker, Alberta) JOA3, 9.675, heard 0600 with news. (Sanderson, Australia)

Luxembourg — Radio Luxembourg by now should have its *new* 50 kw. transmitter on the air on 6.090 at 0040-0930, 1045-1700 in French. (ISWC, London, others)

Madagascar — Radio Tananarive, 9.515, noted with interval signal 2229; signed on 2231 with "La Marsellaise."

Malaya—Forces Broadcasting Service, 5.010, Singapore, 7.5 kw., is scheduled 0645-0659 with tone; 0700-0730 Swahili, Chinyanja; 0730-0800 Fijian; 0800-0900 Gurka; *English* is to be added shortly. (WRH, others)

Mexico—XEHH, 11.880, very strong 1745 with call in Spanish. (Norman, N. C.)

Monaco — Radio Monte Carlo, 7.349A, noted closing 1800 (some days earlier). (Cox, Dela.)

Mozambique—CR7BJ, 9.768A, Lourenco Marques, still noted with *English* from 2300 opening (from 0000 Sun.). (Littlefield, Mass., others) Heard on 4.920AV at 1750 with popular music and *English* announcements; ended with Ted Lewis' "Goodnight Waltz" at 1800. (Cox, Dela.) Lourenco Marques, 4.872, noted with news in Portuguese 1500, then music, closing announcements after chimes and call, played "A Portuguesa" and signed off 1514. (Pearce, England) Heard signing on in Portuguese on 11.952A at 0000, weak level in Ind. (Niblack)

Nepal—Still uses 7.10 with *English* 0845-0900. (Etersvep, Sweden)

New Zealand—Heard closing 0625 on 9.540. (Middleton, Ohio)

Nigeria—Radio Nigeria is to increase power to 20 kw. shortly. (Fox, N. Z., via Radio Australia)

Norway—LLG, 9.61, Oslo, noted 2300-2400 (Sun. to 0020 Mon. with "Norway This Week" in *English*) to West Coast, excellent level. (Riggs, Balbi, Calif.) Channels that may be used during the year are LLQ, 21.730; LLP, 21.670; LLN, 17.825; LKW, 17.755; LLM, 15.175; LKV, 15.170; LLK, 11.850; LKQ, 11.735; LLH, 9.645; LLG, 9.610; LLD, 9.550; LKJ2, 9.540; LLR, 7.240; LLS, 7.210; LLI, 6.185; LKJ, 6.130; LKF, 1578 kc. (Hornstein, Mich.)

Pakistan—Radio Pakistan noted on 17.770 with news 0200-0210; in *English* 0515-0530 on 17.835. (Fernell, Sweden) Noted with news 0330 and Western music 0400 on 17.710; news 0730 near 17.750 now. (Pearce, England) Heard on 9.645A with *English* for Turkey 1430-1530 and to Britain 1530-1615. (Pearce, England, Bellington, N. Y.) Noted parallel on 11.885, 15.335 at 2035 tune-in with Hindu music for Southeast Asia. (Bellington, N. Y.) Heard opening 0630 on 15.27, 17.770, much native music. (Takemi, Japan)

Panama—HOLA, 9.505, Colon, noted recently 2200-2400 closedown. (Gay, Calif.) Heard in *English* 2130. (Hornstein, Mich.)

Peru—OAX4H, 6.307, *Radio Mundial*, Lima, noted with call in Spanish 2130. (McPhadden, Calif.)

Philippines—DZH3, 9.500, heard around 0700; uses commercials. (Stark, Texas) The Far East Broadcasting Co., Manila, reports that the two *new* 10 kw. transmitters—for use on 9.730, 11.855—are on order; one will be ready by this fall, the other several months later; a *new* transmitter on 21.475 is expected to be in operation within a year; higher power will be given all transmitters gradually. (Scheiner, N. J.) DZH9, 11.855, heard best in Alberta 1100-1200; noted closing 1203. (Hooker) DZ16, 17.804, noted 0130 with religious program in progress. (Sanderson, Australia) DZH2, 9.640, Manila, noted 0600 at good level in Tokyo with news. (Ishikawa, Takemi)

Poland—Radio Warsaw, 9.57, noted in *English* 1715-1800, strong signal. (Wade, Fla.)

Portugal—Emissora Nacional, Lisbon, is reported on three *new* channels in the 25-m. band—11.797, 11.760,

11.835. (WRH) The 11.835 channel noted in Indiana at 1430. (Niblack) Signs on 1230. (Pearce, England)

Reunion—Radio St. Denis is heard in Sweden on 7.170 around 1625. (Radioklubben Universal, Sweden)

Saudi-Arabia—Djeddah now broadcasts on 725 kc., 3.960, 3.980, 5.975, 6.175, 7.245 at 2305-2335, 1045-1135, 1215-1335, and on 725 kc., 3.950, 5.975, 7.245, 11.850, 11.950 at 0605-0635. (WRH) (The 41-m. channel more recently has been heard around 7.300A instead of 7.245.) Noted by Pearce, England, opening with interval signal 1030 on 11.850A.

South Africa—Cape Town, 5.892A, noted 0110-0125 with morning produce market quotations in *English*. (Gay, Calif.)

South Korea—Radio Korea informs Scheiner, N. J., that the *new* 10 kw. short-wave and medium-wave transmitters to operate as *Radio Seoul* are still under construction; the 9.555 outlet in Seoul is still 300 watts, and there is another outlet there—HLKA, 3.8925, 1 kw.

Spain—Madrid, 9.363, noted in *English* for North America 1800-1840. (Middleton, Ohio, others) *Measured* 9.359 recently. (Roberts, Conn.)

Switzerland—HED5, 15.120, Berne, noted 1145 with *English*. (Mast, N. Y.)

Tahiti—In verifying, *Radio Tahiti*, Papeete, listed FO8AA, 6.980, 200 w.; FZP8, 6.135, 1 kw. Both use half-wave antennas. (Kary, Pa.)

Thailand—Bangkok, 6.240, heard with news by man 0515; 7.105 heard 0700 when identified in *English*.

Trinidad—Radio Trinidad, 6.085, noted 0515 when identified. (Stark, Texas) Heard closing 2202 with "God Save the Queen" on 3.275; good level, slight heterodyne. (Cox, Dela.)

RCA'S PRINTED-CIRCUIT COMPONENTS

THE tube department of Radio Corporation of America has announced the development of a series of printed-circuit components which is expected to stimulate the production of more compact and efficient radios, TV sets, and communications gear.

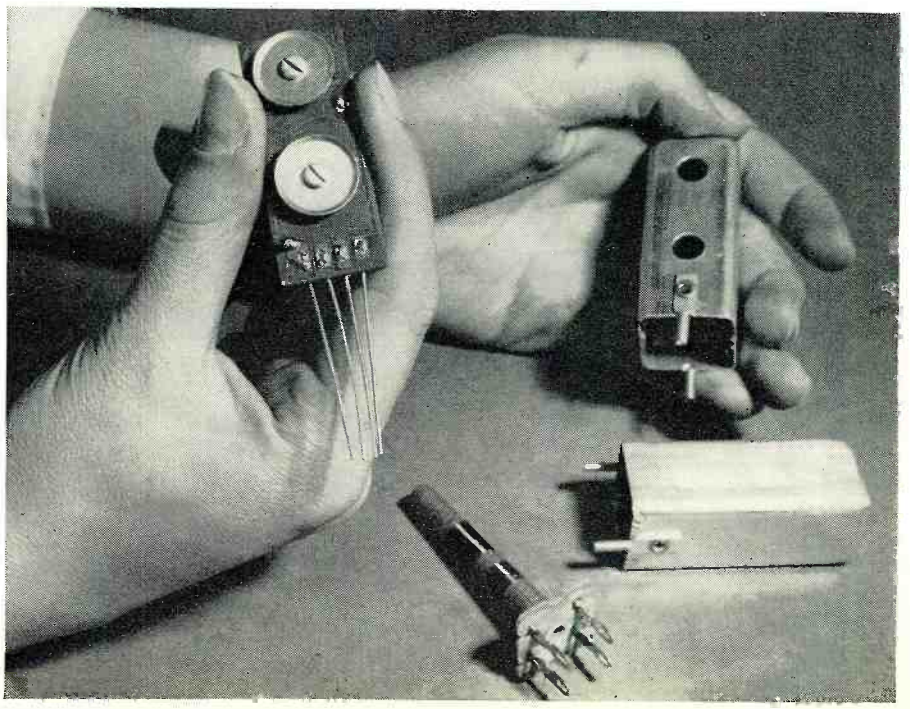
These new components—six 40 mc. i.f. transformers, coils, and traps—are produced by a special photo-etching process which makes possible virtually limitless production of identical electronic circuits from a single photographic negative.

Conventional inductors depend upon coils of handwound or machinewound copper wire to provide the desired inductance values—the exact values are largely determined by the number of turns of wire, its spacing, and the diameter of the coil form. With the printed circuit method, both the copper wire and the wire-winding operations are eliminated. Inductances are provided by flat inductors having rectangular windings which are photographically printed on copper-clad plastic strips.

Although these RCA printed-circuit components are intended for applications in home television receivers, the same photo-etching process can be used to print circuits for components used in a wide range of radio and communications equipment.

The new components are i.f. types designed for television sets utilizing intercarrier sound systems and incorporating picture i.f. and sound i.f. carriers of 45.75 mc. and 41.25 mc., respectively. The presently-available components include a first video i.f. grid-circuit coil and trap; a first video i.f. plate-circuit coil; a second video i.f. grid-circuit coil; first and second video i.f. filter traps; second video i.f. transformer; and third video i.f. transformer. —30—

RCA'S "Tandem" 40 mc. printed-circuit i.f. transformer used in home TV sets. A standard wirewound transformer is shown on table to permit a comparison of size.



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0Z4	59c	2A6	89c	6AH6	1.89	6BH6	69c	6K5GT	.69	6SQ7		7C5	.89	12AU7	.79	12SN7GT	.99	26	59c	57	79c
0Z4G		2A7		6AK5	.89	6BJ6		6K6GT	.59	6SQ7GT	59c	7C6		12AV6	.59	12SQ7		27		58	
1A5GT	.79	2B3	.89	6AK6	1.08	6BK7		6K7GT	.69	6SR7GT		7C7	79c	12AV7	.89	12SQ7GT	69c	35A5	.99	70L7	1.49
1A7	.69	2B7	.89	6AL5	69c	6BL7	.79	6K8GT	1.19	6SS7	.99	7E5		12AW6	1.19	12SR7GT		35B5		70L7GT	
1A7GT	.79	2C34	.60	6AQ5		6BN6	1.19	6L5G	.95	6T7G	1.15	7E6	79c	12AX4	.69	12Z3	.95	35C5	69c	71A	.87
1B3GT	.95	2E5	.89	6AQ6	.81	6BQ6G	1.19	6L6G	95c	6T8	.89	7E7		12AX7	.69	14A7	1.05	35L6		75	.79
1B5	.29	2X2/879	.74	6AQ7	1.19	6BQ6GT	1.19	6L6GA		6U5		7F7	.89	12AY7	1.95	14AF7	.93	35W4	.59	77	.69
1B5GT	.59	3LP4	1.25	6AR5	.79	6BQ7	1.29	6L7	1.19	6U6GT	69c	7F8	1.47	12BA6	.59	14B6	89c	35Y4	99c	78/6D6	1.10
1L6GT		3Q4	.69	6AT6	.59	6BZ7		6N6G	1.40	6U7G		7G7	1.19	12BA7	1.19	14B8		35Z3		80	.69
1L4	69c	3Q5GT	.89	6AS5	.90	6C4	.59	6N7GT	1.19	6U8	.89	7H7	1.05	12BE6	69c	14C5	1.25	35Z4	.75	83	1.45
1L6		3S4	.69	6AU5GT	1.29	6C5GT	69c	6P5GT	.69	6V3	1.29	7H8	1.19	12BF6		14C7	1.12	35Z5	.55	84/6Z4	.72
1LA4	1.19	3V4	.95	6AU6	.59	6C6		6Q7GT	.59	6V6GT	.69	7K7		12BH7	.89	14F7	1.05	35/51	.79	85	.79
1LA6	1.19	5T4	1.40	6AV5GT	.89	6CB6		6R7GT	.69	6W4GT	.59	7L7	1.19	12BY7	.89	14F8	1.45	36	1.06	VR90	$1.19
1LC5	.69	5U4G	.59	6AV6	.59	6C8	1.29	6S4	.59	6W6G	.69	7N7	.69	12BZ7	1.19	14H7	1.12	37	.93	VR105	
1LC6	1.19	5V4G	.87	6AX4	.69	6CD6	2.49	6S7GT	1.15	6X4		7Q7	.79	12F5GT	.65	14Q7	1.05	38	88c	VR150	
1LD5		5W4	59c	6AX5	.79	6CD6G	1.69	6S8GT	1.25	6X5GT	59c	7R7	1.19	12H6	.89	14W7	1.19	39/44		VT51	29c
1LE3	1.19	5W4GT		6AX6	.69	6D6/78	1.10	6SA7GT	69c	6X8	1.29	7S7	1.19	12J5GT	.75	14X7	1.19	41	.72	VT52	
1LH4	1.19	5Y3GT	.45	6AY5GT	.89	6D8G	1.15	6SC7		6Y6G	.69	7V7	.79	12K7GT	.69	19BG6	1.89	42	.69	117L7	1.40
1LN5	1.19	5Y4G	.54	6B4G	1.44	6E5	.69	6SD7GT	.99	6Z4/84	.72	7W7	1.19	12K8	.89	19BG6G		43	72c	117N7	1.95
1N5GT		5X4G	81c	6B8GT	1.15	6F5GT	59c	6SF5	.59	7A4	.95	7X6	1.05	12Q7GT	.89	19T8	.89	45		117P7	1.95
1P5GT	79c	5Z3		6BA6	.59	6F6GT		6SF5GT	.59	7A5	1.19	7X7	79c	12S8	.89	20	1.40	45Z5	.69	117Z3	.59
1Q5GT		6A3	1.68	6BA7	.89	6F7	1.59	6SG7		7A6	.89	7Y4		12SA7GT	.69	24A	.69	46	89c	117Z6	1.19
1R5		6A7	1.21	6BC5	.69	6F8G	1.59	6SH7	69c	7A7	79c	7Z4	.89	12SC7	1.05	25AC5GT	1.04	47		715B	7.75
1S4	.99	6A8GT	69c	6BC7	1.05	6G6G	.95	6SH7GT	.69	7A8		12A7	1.59	12SF5GT	.69	25BQ6	1.19	50A5	1.05	807	1.55
1S5	69c	6AB4		6BD5GT	.89	6H6GT	.89	6SJ7	.79	7B4	.89	12A8	.69	12SF7	.99	25BQ6GT		50B5	69c	866A	1.49
1T4		6AB7	1.15	6BE6	.59	6J5GT	.59	6SJ7GT	59c	7B5	.89	12AH7	1.38	12SG7	.89	25L6GT	.59	50C5		1298	29c
1U4	.59	6AC5GT	.89	6BF5	69c	6J6	.79	6SK7GT		7B6	.89	12AL5	.54	12SH7GT		25W4GT	.69	50C6G	1.39	1619	
1U5		6AC7	1.45	6BF6		6J7G	.69	6SL7GT	.69	7B7	89c	12AT6	.59	12SJ7GT	69	25Z5	.69	50L6	.69	2051	1.15
3V	89c	6AG5	1.05	6BG6	1.89	6J8G	1.15	6SN7GT	.69	7C4	1.30	12AT7	.89	12SK7GT		25Z6GT	.69	50X6	.69		
1X2A		6AG7	1.49	6BG6G								12AU6	.69	12SL7GT		32L7GT	1.15	50Y6	.99		

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				27"	10.00

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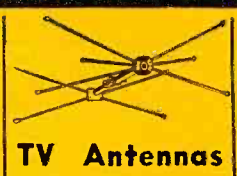

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1,000 ft.	13.95
20 Ga, 80 Mil, 100 ft.	1.89
1,000 ft.	16.95
UNF TUBULAR 300 OHM LINE 1,000 ft.	$34.50
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75 mil	79c
100 mil	89c
150	$1.10
200	$1.48
250	$1.59
300	$1.79
350	$1.98
450	$2.45

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Turkey—*Radio Ankara* noted in *English* 1600-1645 now on 15.160 to Western Europe, Britain. (Golden, Mass., others) Still has powerful signal in *English* to North America daily 1815-1700 over TAT, 9.515. (Wade, Fla.; Oestreich, Wash. State, others)

Uruguay—CXA19, 11.835, Montevideo, noted 1715 at good level with music. (Cox, Dela.) CXA10, 11.909, Montevideo, is good level daily around 2100. (Norman, Ferguson, N. C.)

USI (*Indonesia*)—Djakarta, 9.710, strong with news 0900, 0945. (Hooker, Alberta) Heard opening 1400 after chimes on 11.785 to Europe-New Zealand; announces 9.710 parallel in this beam which closes 1500. (Pearce, England)

Western Samoa—By this time, Apia should have *tested* on 6.040 and (later) 3.241; probably will settle down on one of these channels and may follow the m.w. schedule of 1700-1900 Sun.-Wed.; 2200-2300 Sun.-Wed.; 0230-0600 Mon., Wed., Sat., 0230-0530 Fri.; 0330-0430 Sun. (Scheiner, N. J.)

Zanzibar—The Information Officer, Box 344, Zanzibar, informs Scheiner, N. J., there is one station operating in that country—"Sauti ya Unguja," 4.795, 250 w., 1000-1100 in Swahili *only*.

* * *

Press Time Flashes

Radio Somali, 7.125, Brt. Somaliland, is on the air 0815-0930; all-Somali language; transmitter is *RCA* type ET-4331 with nominal output of 1 kw.; uses half-wave dipole antenna. (Radioklubben Universal, Sweden)

Forces Broadcasting Service, Tripoli, has been noted around 1845 on 4.785; closes 1600A with "God Save the Queen." (Pearce, England)

More recently, *Radio Africa*, Tangier, has been using 7.193 again instead of 7.126; noted 1030 with popular music. (Pearce, England)

Damascus, Syria, has been noted recently on 11.725A around 1900-2100 closedown (parallel 11.913A), evidently to Latin America. (Niblack, Ind., Bellington, N. Y.)

HS8JS, Thai Army Radio, Thailand (Siam) is heard at fair strength 0630-0700 on 4.870; programs in Thai. (Cushen, N. Z.) ALF, 9.915A, Juneau, of the Alaskan Communications System, noted *testing* 2230 at excellent level. (Niblack, Ind.)

Ishikawa and Takemi, Japan, say *Radio Free Japan* is Red-Chinese operated, heard on 11.896 and 10.180 at 0800-0830 in Japanese; location is North Korea; strong level in Tokyo.

Radio Pakistan, 11.884A, lately has had news 2035A. (Ferguson, N. C.)

The *new* s.w. VOA relay station at Salonika, Greece, is scheduled on 6.040 at 1215-1645 to Europe; 7.270 at 0900-1645, 1730-0130 to Europe; 11.735 at 0900-1230 to USSR-Middle East. URDXC says is 35 kw.

Cairo, Egypt, noted on *measured* 11.966 around 1928-2046 closedown; seems parallel 6.085 (Ferguson, N. C.; Niblack, Ind.; Bellington, N. Y.)

At press time, Balbi, Calif., reported Peking, 6.20A, weak 0400 with news; 7.50 fair, 10.26 weak, 11.67A fair; 6.200 good level 0500 with Home Service. USSR heard to China from 0230 on 15.11, 11.72, 11.75, 9.725, 9.66, 9.545, 6.11, 6.055; signing off 0900.

Catch, England, flashed he had noted Lisbon, 9.742, opening to Brazil, Cape Verde Islands, Portuguese Guinea at 1600, excellent level; ZPA5, 11.950, Encarnacion, Paraguay, fair level 1645; ZYP23, 5.045, Petropolis, Brazil, fair 1725; a station, probably the *Yugoslav Emigrant Station*, noted opening with march 1720 on 6.283, and clandestine *Radio Espana de Independiente*, noted on 10.280 around 1730. And Niblack, Ind., noted CE1173, Santiago, Chile, at 1940-2030 on 11.945AV one day, next on 11.965A.

* * *

Acknowledgement

Thanks for FB reports! *ISW DEPARTMENT* monitor's certificates for 1953-54 are now available—*gratis* to all reporters to the Department. Send reports and requests for monitor's certificates to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA.

.....K.R.B.

NEW "PAY-AS-YOU-WATCH" SYSTEM

Boxoffice Television's new closed-circuit transmitter for TV makes possible retransmissions on Channels 2 through 13.

THE ever-mounting cost of television program sponsorship is causing more and more companies to cast a tentative eye at the various "TV-for-pay" systems which have been developed in the past few years.

Although not as yet sanctioned by the FCC, several companies are proceeding with the development of equipment to handle this type of transmission.

Among the new items on the market is *Boxoffice Television's* "Picturecaster", a unique closed-circuit transmitter for television pictures and sound.

The unit accepts video and audio from any source—a receiver, camera chain, coaxial line, generator, etc. and transmits them into any type of transmission line on any v.h.f. channel, 2 through 13. The transmitter frequency is crystal-controlled, with the sound and video carriers automatically maintained 4.5 mc. apart for best results with intercarrier receivers. AM pictures and FM sound are receivable on all standard TV sets.

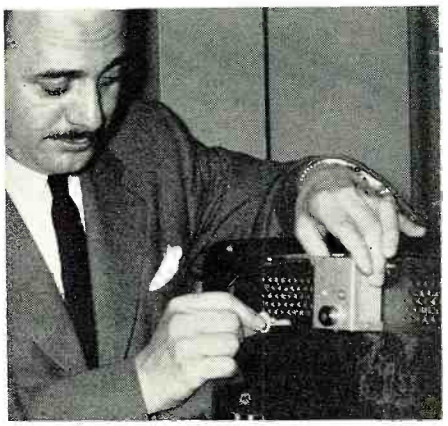
The system as it operates now, in conjunction with master antenna systems, is inexpensive and easily installed and operated.

The audio and video are piped by a common carrier (such as telephone company lines) to each master antenna system which is part of the network. These normal signals are then fed into the "Picturecaster" which scrambles the picture so that while it can be tuned in in the normal way it cannot be viewed.

The special decoder with which the receiving set is equipped consists of an inexpensive tube circuit, which is installed in one of the receiver's existing tube sockets, and a box with a keyhole.

To view an unscrambled picture, the user inserts the key in the keyhole and the picture comes in clear. Keys can be rented for various periods of time, the rental depending on the program material to be received. The key rental is the fee for watching the program. Removing the key scrambles the picture again so that a single key cannot be used to operate several receivers.

The equipment is undergoing extensive testing at the present time in anticipation of an FCC OK on "Pay-As-You-Watch" programming. —30—



Max Genodman, president of United Elco (a contracting firm specializing in hotel master antenna system installation), inserts the decoding key in the rear of a television set equipped to receive Boxoffice Television's closed-circuit TV.

Lee Bunting, treasurer of Bell Television, Inc. (a master antenna TV system operating firm), is shown with a demonstration set-up incorporating the new "Picturecaster" and the TV set with which it is employed.

MANUFACTURERS' LITERATURE

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

INDICATOR LIGHTS

Dialight Corporation, 58 Stewart Ave., Brooklyn 37, N. Y. is currently offering a copy of its new brochure, L-153.

This four-page publication describes and illustrates the company's line of subminiature indicator lights for various applications. Units described fall into five general categories: for plastic plate edge lighting, indicator lights, dimmer types, light shield, and indicator lights with "press-to-test" feature.

When writing for a copy of this brochure, address your requests to Mr. E. Greene of the company.

REPLACEMENT GUIDE

Standard Transformer Corporation of Chicago has prepared a "Tape-Wire Recorder Replacement Guide" which lists sixty-three models by twenty-two companies manufacturing tape and wire recorders.

The Guide has been published to meet the need for authoritative information on power transformer, filter choke, and audio output transformer replacements, according to the company.

Manufacturer and model number, manufacturer's part number and *Stancor* part numbers are listed for all models included in the Guide.

Distributors and service technicians may secure a copy of this guide by writing the company at 3580 Elston Avenue, Chicago 18, Ill.

CONVERTER AND BOOSTERS

Electro-Voice, Inc. of Buchanan, Michigan has issued a new bulletin covering its u.h.f. converter and v.h.f. booster line.

Features, specifications, and other details on these products are covered in Bulletin No. 182. Information on the company's 3300 u.h.f. converter, "Tune-O-Matic" and "Tenna-Top" boosters is given in detail.

U.H.F. BOOKLET

How its signal generators can be adapted for u.h.f. applications is the subject of a new booklet, "How to Use the *Simpson* 478-480 for U.H.F. Alignment", currently available from *Simpson Electric Company,* 5200 W. Kinzie Street, Chicago 44, Ill.

The booklet describes how the company's v.h.f. test equipment can be adapted for use in u.h.f. service work. By following the instructions given in the publication the technician can obtain signals of the type, accuracy, and strength necessary to identify the nature of troubles in u.h.f. circuits.

Copies of this booklet are available without charge from the company.

TRIAD TRANSFORMERS

The new catalogue just released by *Triad Transformer Corporation* of 4055 Redwood Avenue, Venice, California lists more than 500 items of interest to technicians.

The publication features an expanded line of TV components and industrial transformers including toroids, pulse transformers, transistor transformers, and additional miniatures. The catalogue also contains a geophysical section.

Copies of Catalogue TR-53 may be obtained by writing the company direct.

DISTRIBUTOR CATALOGUE

Dealers and technicians, in addition to the company's distributors, are currently receiving copies of the new 1953 *Mallory* distributor Catalogue No. 553, according to the company.

The new publication lists and describes more than 2200 items, mostly replacement components which are handled through the company's distributor system. For the first time the catalogue also includes list prices for the items covered.

A copy of this new catalogue may be obtained by writing to *P. R. Mallory & Co. Inc.,* 3029 E. Washington St., Indianapolis 6, Ind.

ANTENNAS AND ACCESSORIES

A 36-page catalogue of television antennas and accessories has been issued by *Radio Merchandise Sales, Inc.* of 2016 Bronxdale Ave., New York 60, N. Y.

The new publication covers all items necessary for receiver installation from the rooftop to the set itself. The catalogue contains a general alphabetical index which provides a logical breakdown of accessory categories which helps speed the location of the desired parts.

As a further aid to the technician for whom the catalogue is intended, *RMS* has included a technical data section. Copies of this publication are available from the company's distributors or from the company itself.

"GLASSEAL" CATALOGUE

A new 20-page catalogue covering its line of "Glasseal" condensers has been issued by *Pyramid Electric Company,* 1445 Hudson Boulevard, North Bergen, N. J.

Designated as Catalogue PG-3, the new publication contains complete en-

gineering data, performance curves, construction styles, sizes, capacitance, and voltage listings for the subminiature units.

Copies of this two-color catalogue are available without charge upon letterhead request direct to the manufacturer.

TUBE CHARACTERISTICS

The Receiving Tube and TV Picture Tube Divisions of *Sylvania Electric Products Inc.,* 1100 Main Street, Buffalo, N. Y. has released new versions of its characteristic booklets. The two booklets, revised and brought up-to-date, are available without charge and can be obtained through the company's distributors or the company's Advertising Distribution Department at the above address.

The "Television Picture Tube and General Purpose Cathode Ray Tube" characteristic chart has been revised to include the latest modifications, type changes, etc. Over 30 tube types have been added, which brings the total types listed in the booklet to over 250. There are 56 different basing diagrams accompanying these tube types.

The revised "Radio and Television Receiving Tubes" booklet includes, in addition to previously listed types, the latest television receiver and subminiature tubes. Over 750 different receiving tube types are listed in the chart along with their basing diagrams.

NEEDLE REPLACEMENTS

The Recoton Corporation, 147 West 22nd Street, New York, N. Y. has issued a 1953-54 edition of its "Simplified Reference Guide to Replacement Needles."

Designed to assist dealers in selecting the correct replacement part, the guide is thoroughly cross-indexed for fast reference.

Copies are available without charge from the company on request.

DEALER AID

A new thermometer designed to attract the attention of customers of radio and television dealers is now available from parts distributors of *Sprague Products Co.,* 51 Marshall Street, North Adams, Mass.

Twelve inches in diameter, the easily-visible face is finished in characteristic *Sprague* orange and blue. Weather-sealed in an aluminum case for outdoor as well as indoor use, this thermometer is available to radio and television service technicians through all *Sprague* jobbers or may be obtained postpaid by sending a $4.00 check or money order to the company. Ask for Thermometer D-114.

U.H.F. ACCESSORIES

Mosley Electronics, Inc. of 8622 St. Charles Rock Road, St. Louis 14, Missouri is currently offering a copy of its new catalogue which lists and describes the company's line of television installation accessories.

Catalogue 53-54 offers several of

the company's new products which have been designed for the particular requirements of u.h.f. as well as v.h.f. television installations.

Copies of this publication are currently available from radio and television parts jobbers or from the company direct.

VIBRATOR GUIDE

A completely revised "1953 Vibrator Guide" is now available from *P. R. Mallory & Co. Inc.* of Indianapolis 6, Ind.

The new guide is a complete vibrator handbook for the auto radio technician. Containing nine sections of valuable information, it includes reference sections prepared according to the *Mallory* replacement number, original equipment number, vibrator type and application, and manufacturer's replacement number.

Sections are included which show the company's vibrator specifications and base diagrams, installation notes and circuit diagrams, buffer condenser reference circuits, auto battery ground chart, and auto radio service notes.

The "Vibrator Guide" contains 50 pages and sells for 15 cents.

STANDBY POWER

D. W. Onan & Sons Inc., Minneapolis, Minnesota has issued a two-color folder which describes and illustrates its line of standby power units for communications systems.

The folder shows examples of portable and mobile electric plants on the job providing primary electric power for mobile TV studios, radio remote broadcasting units, television maintenance trucks, and mobile CD centers.

A copy of Communications Folder, Form A-307, is available on request.

PRE-RECORDED TAPE

The *A-V Tape Libraries, Inc.* of 730 Fifth Avenue, New York, N. Y. has published a new catalogue of pre-recorded tapes for home, office, and classroom use.

The handy, pocket-size publication lists many new semiclassical compositions, "pops", vocal varieties, as well as a lecture series on English literature and Bible readings.

A copy of this new catalogue is available on request from the company.

COMPONENT PARTS

A new two-color catalogue covering TV and radio components is now available from *Heppner Manufacturing Company,* Round Lake, Illinois.

Illustrations and detailed descriptions are given on slip-on ion traps, snap-on ion traps, centering devices, correcting magnets, PM speakers, ED speakers, ferrite rod antennas, flyback transformers, and PM "Focomags".

RCA TRANSISTORS

The Commercial Engineering Department of the *RCA Tube Department,* Harrison, N. J. has issued an 8-page booklet describing its new transistors.

Included in the booklet is information on the company's Type 2N32 point-contact transistor for use in pulse or switching applications where an operating frequency for voltage-gain cut-off of .9 mc., an operating frequency for current-gain cut-off of 2.7 mc., and a high current amplification factor are important design considerations.

The Type 2N33 point-contact unit for use in oscillator service at frequencies up to 50 mc. is also described.

The types 2N34 and 2N35 junction transistors of the *p-n-p* and *n-p-n* type respectively are covered in some detail.

Each of the four types has a base with three small pins in line and spaced to provide mechanical indexing for socket insertion. —30—

HOW MUCH IS YOUR LABOR WORTH?

AN INFORMATIVE little booklet is now available to all radio and television service technicians from the Howard W. Sams Co., 2201 E. 46th St., Indianapolis, Ind. The publication offers an intelligent approach to the setting up of labor costs for service establishments of varied requirements.

Written by Donald B. Shaw, vice-president and treasurer of the company, the booklet is a "must" for all service shop operators. It contains information on the simplest possible ways of estimating labor and assuring compensation for time and business expenses in the operation of a one-man shop. It also explains "productive labor" (the labor performed on a repair job for which you can charge a customer at a given rate). These examples are also based on a one-man shop.

Mr. Shaw demonstrates how these same general principles may be applied when an owner adds personnel. The booklet concludes with a discussion of the allocation of overhead expenses to all profitable departments of the business. —30—

The meteoric rise of the Heath Company of Benton Harbor, Michigan continues unabated as the firm announces the opening of a new addition which more than doubles its facilities for the design and production of all types of test equipment in kit form. The new building houses enlarged laboratory facilities, assembly lines, and office space for the expanded staff of clerical workers necessitated by increased business.

RECTIFIERS AGAIN

By THOMAS R. HUGHES

THIS is a further commentary on my article, "Unrecognized Hazards in Electronics," which was published in the April issue of this magazine. Since this article appeared, I have received some objections from the manufacturers of rectifiers who feel that it may have placed the use of selenium rectifiers in a bad light.

I want to assure you that I had no such intention, in fact—if anything—I meant to accomplish the opposite. Being a safety engineer and, at the same time, an experimenter in sound equipment and electronics, I was somewhat concerned over a previous article on the subject, in another publication, that included misinformation and exaggerations.

My article was aimed at electronics designers, maintenance men in factories and plants, and radio or television technicians in repair and service shops. It was not expected to apply to users of electronic equipment in the office or home, nor to workers in selenium rectifier manufacturing plants (where suitable precautions are observed).

Selenium rectifiers have provided the means for valuable progress in many fields where direct current is required. Though they are used extensively in the electronics and aircraft industries in California, we apparently have no record of serious injury as a result.

My article was not intended to cause alarm in the mind of any reader but it was my wish to call to the attention of those who deal with large rectifiers that the existence of toxic fumes is possible.

While there is little in past experience to base opinions on, I left the implication that one could dismiss the normal use of small rectifiers (in radios, television, etc.) as a source of serious hazard. However, since the uses of electronic circuits and their supply from rectifiers are invading more fields every day and we have no means of anticipating their applications or misuse, we cannot let possible hazards go unrecognized.

Thus, I went to some pains to outline the precautions that one could observe if he felt any concern over his application of a rectifier. I used the word "should" in some places and was careful not to imply that any of the precautions recommended were absolutely required.

One more point that I feel should be cleared up is what I meant by a "burn-out." I used the word "arc-over" as electricians use it—to indicate that damage was caused by electricity passing over the surface of a dielectric or insulator rather than through an internal short circuit. I find that my use of the term was misinterpreted as referring to the momentary flashes frequently occurring during the first energizing of the cells in manufacture.

By a "burn-out," I was referring to the breakdown of a group of cells and the burning, by prolonged arcing or conduction of current, to chemical compounds differing from those required for normal operation. In other words, its destruction as a rectifier.

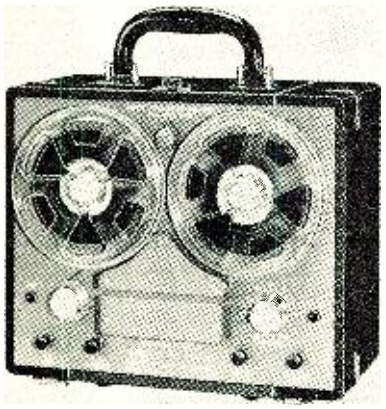
I hope this will be of value in removing any discredit my article may have brought to selenium rectifiers. In their present state of perfection they merit our high regard as simple, foolproof servants. —30—

WHAT'S NEW

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page and the issue number, delay will be avoided.

PORTABLE RECORDER

The Magnematic Division of *Amplifier Corp. of America,* 398 Broadway, New York 13, N. Y. is now offering a



new 117 volt, a.c. portable tape recorder which weighs 19 pounds and attains a frequency response of 50 to 15,000 cps at 7½ inches-per-second.

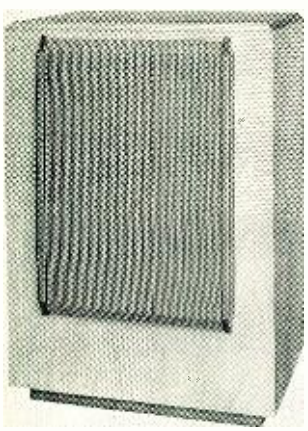
Completely operated by push-button control, the new unit features a solenoid-operated, clutch-controlled capstan drive to start and stop tape travel within 1/20th of a second.

The "Magnematic" is designed for extreme simplicity of operation; it is ruggedly constructed to withstand the rigors of portability, and provide maximum stability and dependability of performance.

For complete technical specifications and prices write the company direct.

BASS REFLEX ENCLOSURE

Beam Instruments Corporation, 350 Fifth Avenue, New York 1, New York has added two new wall and corner type bass reflex loudspeaker enclosures to its line of "Tannoy" housings.



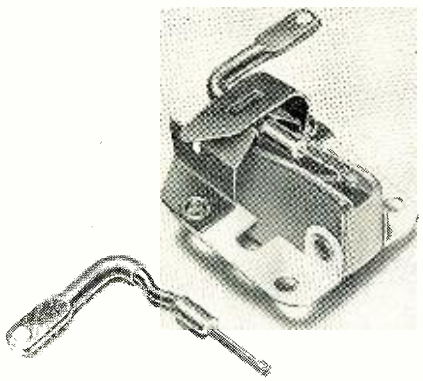
While designed to be used with the company's dual-concentric speakers, the new enclosures can be used with other makes of 12- and 15-inch loudspeakers. They are constructed of ¾" lumber with all joints close battened, screwed and glued. Interiors are completely insulated to absorb internal standing waves and sound reflections.

The wall-type enclosure is designated as the "Westminster," the corner-type has been named the "Parliament." The "Westminster" is 39½" high, 28" wide, and 19¾" deep. The "Parliament" is 42¾" high, 30" wide, and 20½" deep. Both styles are available on a custom basis.

TURNOVER CARTRIDGE

Sonotone Corporation of Elmsford, New York is now offering a new phonograph pickup design, the "Titone Turnover."

Using a high-compliance, high-sensitivity ceramic element and a unique turnover method, the new cartridge provides some interesting characteristics. Requiring no equalizers or preamplifiers, the cartridge has an out-



put of one volt and is unaffected by moisture or temperature.

The jewel needle tips (either diamonds or sapphires) are mounted back-to-back on a single shank, the entire assembly rotating for needle change. When replacement is required, the complete needle assembly, including the lever handle, is removable as a unit.

NEW UTAH BAFFLES

Utah Radio Products Co., Inc. of Huntington, Indiana has added a series of wall baffles to its line of products.

The new baffles have been tradenamed "Utone" and are designed and engineered to give a maximum of clean, life-like tone. The baffles are built without a single nail, all joints being mortised and secured with waterproof glue. They are self-mounting, needing no metal brackets for installation.

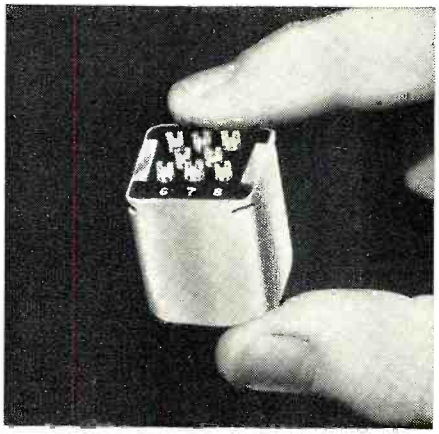
They are available in four sizes for 6, 8, 10, and 12 inch speakers and

come in three finishes—red or brown mahogany finish and futuristic blonde finish. All sizes are also available in natural, unfinished wood.

STANCOR "TINYTRANS"

Standard Transformer Corporation, 3580 Elston Ave., Chicago 18, Ill. is now marketing a new line of miniature high-fidelity audio transformers, known as *"Stancor* Tinytrans."

The miniature units are made with nickel steel laminations, with a frequency response of ± 1 db, 30-15,000 cps, maximum level 0 db. They are sealed and potted in ⅞" square, anodized aluminum cases with phenolic terminal boards. Total height, including terminals, is only 1¼". The case has two 2-56 threaded inserts, 1 1/16" centers, for easy chassis mounting. It weighs only 1.3 ounces.



A bulletin on these units is available on request.

REGULATED SUPPLY

Kepco Laboratories, 131-38 Sanford Ave., Flushing 55, N. Y. has introduced the Model #400 voltage regulated power supply which features one regulated "B" supply, one regulated "C" supply, and one unregulated filament supply.

The "B" supply is continuously variable from 0-400 volts and delivers from 0-150 ma. Ripple voltage is less than 5 millivolts. The "C" supply is continuously variable from 0-150 volts and delivers from 0-5 ma. The filament supply delivers 6.3 volts at 10 amperes and is unregulated, center-tapped, and ungrounded.

The power supply is designed for relay rack mounting or bench use. The cabinet is 7" high, 19" wide, and 11" deep. The weight is 40 pounds.

SUPPORT CHANNELS

The Lowell Manufacturing Company of 3030 Laclede Station Road, St. Louis, Mo. has announced the availability of a line of steel support channels which simplify the installation of sound system speakers in suspended ceilings.

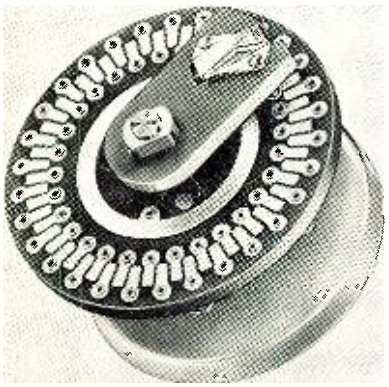
These channels are available for 24" and 48" spans and are easily installed in any standard type of suspended ceiling construction. They can be used in either new or existing ceilings.

Specifications and information on these steel support channels are available from the company on request.

PRINTED-CIRCUIT SWITCH

The Daven Company, 191 Central Avenue, Newark, N. J. now has available a new printed circuit rotary switch Type PCF-1 with 60 position, shorting-type action.

Eyelets are provided for solder connections at every position. The Type



PCF-2, having non-shorting positions, is also available. The switch segments are silver-alloy bonded to the phenolic contact panel. The rotor arm is the company's "knee-action" type rotor which provides uniform contact pressure and very low contact resistance throughout switch life.

Contact resistance is approximately .003 to .004 ohm and does not vary more than .0003 ohm over the life of the unit. The diameter is 3" and the depth is 2 1/16".

Additional information is available from Dept. PCS of the company.

GERMANIUM DIODES

A line of nineteen point-contact germanium diodes has been announced by the transistor division of *National Union Radio Corp.* of Hatboro, Pa.

The encasing cartridge is composed of a plastic material impervious to moisture and having good electrical characteristics and mechanical stability at high temperatures. The stiff terminal pins permit clipping of the unit into spring terminals either for test or circuit application and the flexible leads permit soldering or other suitable connection means.

An engineering bulletin, No. 1001, gives electrical specifications on the nineteen new units. It is available on request.

GENERATOR ADAPTER

The Accessory Division of *Philco Corporation,* Allegheny & "A" St., Philadelphia, Pa. is in production on its Model G8000 v.h.f.-to-u.h.f. signal generator adapter.

The company's u.h.f. tuner is the heart of the new adapter. It permits measurements to be made at u.h.f. while controls, markers, and attenuators are operated with the usual convenience at the common v.h.f. frequencies.

As the output from any v.h.f. signal generator at 60 mc. is fed into the

adapter, the v.h.f. sweep or marker signal beats against the u.h.f. oscillator of the unit, producing u.h.f. signals having the same characteristics as the v.h.f. input signal.

The company will supply full details on this and other units in its test equipment line on request.

TV BOOSTER

Electro-Voice, Inc. of Buchanan, Michigan is now offering a new, improved Model 3012-A, 3-tube automatic, all-channel television booster, for v.h.f. applications.

A new low-noise, broadband circuit

multiplies the signal at the antenna. Three tubes in balanced stages, including a power multiplier stage, are used to provide adequate gain for producing clear, sharp signals.

The booster unit is housed in a weather-resistant case which mounts on the antenna mast. The junction box plugs in between the receiver and an a.c. outlet. Input and output are to 300-ohm balanced line.

Bulletin No. 182, available from the company, describes the Model 3012-A in detail.

LEAD-IN WALL PLATE

A new television lead-in wall plate socket that requires no wall opening or outlet box has been announced by *Mosley Electronics, Inc.* of 8622 St. Charles Rock Road, St. Louis 14, Mo.

The new socket mounts flush on the wall or baseboard and may be installed in seconds with a screwdriver. Designated as the F-2, the new unit was designed to meet the need for plug-in convenience. The socket is available in brown or ivory molded polystyrene and is supplied with mounting wood screws. It is also available packaged with one mating constant-impedance solderless plug.

Write the company direct for additional information.

TUBE SALVAGE

Kahle Engineering Co. of 1307 Seventh Ave., North Bergen, N. J. has developed and is manufacturing a combination neck cutting and neck splicing machine that will salvage larger size cathode-ray picture tubes.

Rejected tubes in 24", 27", 30", 33", and larger sizes can be easily and rapidly returned to the assembly line as all operations are performed with one handling of the bulb.

The Model 2185 is a single head machine that takes all standard sizes and shapes of tubes. The neck cutting operation is performed by the hot-chill method, producing a clean, square cut. The cut-off mechanism is adjustable up and down. Neck tubing can also be cut.

The company will supply complete specifications and performance data on this unit to manufacturers writing the firm direct.

TUBULAR TWIN-LEAD

A new tubular twin-lead for u.h.f., designed so that attenuation is negligible under all weather conditions, has been announced by *Plastoid Corporation* of 42-61 24th St., Long Island City 1, New York.

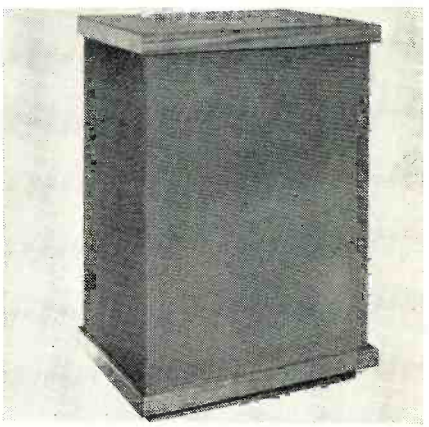
Known as "Synkote Ultratube", the new transmission line has the leads spaced several millimeters within the tube, equidistant from the outer insulation. Thus the magnetic field between them is unaffected by any moisture or salt which may condense on the outer covering and the signal strength is maintained at a maximum all the way down to the receiver.

The new twin-lead can be used not only for u.h.f. but for peak transmission of v.h.f. signals in stormy weather, in fringe areas, and in seacoast areas where moisture and salt spray are factors.

NON-CORNER HORN

A non-corner horn, tradenamed "The Purest", has been recently introduced by *Gately Development Laboratory,* Barrington, N. J.

The unit is a new type baffle employing a horn load on the back side of the speaker it encloses for improved low-frequency response, at the same time permitting direct radiation of high frequencies. The enclosure is designed for use along any wall and does not rely on the walls of the room to act as an extension of the horn. The unit gains adequate horn mouth



area by exhausting on three sides of the enclosure. Total fold of the horn is 180 degrees.

"The Purest" is available for 12 or

15 inch speaker systems. Standard finishes are dark mahogany, blonde, and natural mahogany. It is also available unfinished for those who desire to do their own finishing. Over-all dimensions are 38″ high, 28″ wide, and 18″ deep. Technical literature is available on request.

"CUSTOM SOUND ENSEMBLE"

The *General Electric Company* has announced additions to its line of audio products which will be marketed under the name "Custom Sound Ensemble".

The ensemble consists of a preamplifier control unit, a 10-watt amplifier, and a dual coaxial speaker. A three-speed record changer equipped with the company's variable reluctance cartridge is used with the system for demonstration purposes.

All units are so designed as to make them adaptable to either custom installation or as separate furniture pieces.

Full details on all of the units comprising the new line are available from *G-E* dealers and distributors.

24-INCH TUBE

CBS-Hytron of Salem, Massachusetts has recently added the Type 24TP4 to its line of television picture tubes.

This 24-inch rectangular, 90 degree, all-glass, magnetically-focused picture tube provides an effective screen area of over 370 square inches. It features an aluminized screen for increased brightness, spherical filter-glass face plate, single ion-trap gun design, and an external conductive coating which serves as a filter condenser.

Performance and engineering data on the Type 24TP4 are available on request.

HI-FI COMPONENT LINE

The Engineering Products Department of *Radio Corporation of America* recently introduced its initial line of matched high-fidelity sound reproduction system components.

Although the new components will be marketed individually to preserve the flexibility and freedom of choice demanded by most hi-fi enthusiasts, characteristics are carefully matched to insure maximum performance in any system.

Built around the *"Olson* speaker", the line will include a deluxe three-speed automatic record changer, two AM-FM tuners (one a deluxe instru-

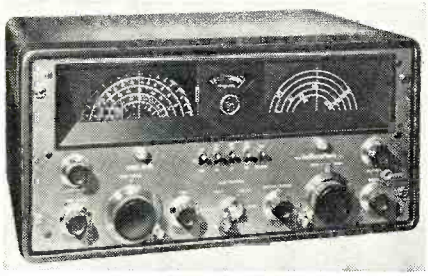
ment with built-in preamp), four different high-fidelity amplifiers, three hi-fi speakers (8", 12", and 15") and separate speaker and equipment enclosures.

The line will be marketed through *RCA* electronic parts distributors and is expected to be available in September.

SX-88 RECEIVER

The Hallicrafters Company of Chicago has recently introduced its SX-88 communications receiver which has been designed to replace the company's SX-28.

The new receiver is said to offer an exceptionally high degree of usable



selectivity, incorporate a new audio system which provides for standard broadcast reception with near high-fidelity quality, and features a reduction of selective fading in short-wave reception.

The unit uses 17 tubes, plus voltage and current regulator and a rectifier. Six tuning bands cover a range from 535 kc. to 33 mc. Over-all dimensions are 20" long, 10⅜" high, and 18¼" deep. It weighs 65 pounds.

The SX-88 is currently available at dealers.

TRANSMISSION LINES

Fenton Company, 15 Moore St., New York 4, New York is featuring two new products, "Fentube-Airspaced" and "Twistube" which are designed to give better reception on u.h.f. and v.h.f. by reducing interference pickup.

The "Fentube-Airspaced" uses one common covering tube which surrounds and is fused to the spiral cords to the extent of from about 180 to 270 degrees of a circuit. There is practically no dielectric between the conductors.

"Twistube," besides being air-spaced, incorporates the added feature of being transposed to equalize the average proximity, and thus the capacity, of both conductors in relation to the mast and other grounded objects. The twin conductors are uniformly transposed which drastically reduces interference pickup. —30—

TRANSISTOR PRICE CUT

Raytheon Mfg. Co. of Newton, Mass., has announced a new low user price of $4.50 for its CK722 junction-type transistors.

The price reduction, according to a company spokesman, was made possible by the greatly increased production of these units.

Within the Industry
(*Continued from page 26*)

until its net worth in 1953 was $41,750,000 and its original six employees had increased to 10,000. Sales increased from $63,000 in 1928 to $168,730,000 in 1952. The company operates plants in Chicago, Quincy, Phoenix, New York, Philadelphia, Detroit, and Toronto for an aggregate of 1,500,000 square feet of space.

* * *

RALPH R. SHIELDS has been named to the newly-created post of product sales manager of television picture tubes for *Sylvania Electric Products Inc.*

He joined the commercial engineering department of the company's radio tube division at Emporium in 1948 as a senior engineer. He joined the merchandising department in 1950, assuming supervision of test equipment products. In the following year he was given an additional responsibility as supervisor of distributor sales engineering, which included a nationwide program of special projects and meetings. In October 1951, he was appointed merchandising supervisor, television picture tubes, with headquarters at Seneca Falls, N. Y.

* * *

CBS-HYTRON has purchased a 42,000 square foot plant in Lowell, Mass. which will be used to manufacture transistors and germanium diodes. Present plans call for the employment of up to 1000 people, but the company has taken an option on adjoining property for future expansion . . . **SPIRLING PRODUCTS CO., INC.** has built a new plant at Hicksville, Long Island which will enable the firm to increase production of its line of indoor and outdoor TV antennas. The new address is P. O. Box 411, Hicksville . . . **TRIPOINT MANUFACTURING AND DEVELOPING CO.** has moved into a new and modern plant at 401 Grand St. in Brooklyn, N. Y. The company specializes in the machining of plastics for the electronic, electrical, aircraft, etc. industries . . . The Statistical Department of **RADIO-TELEVISION MANUFACTURERS ASSOCIATION** has moved to new and enlarged quarters in Room 201, Bond Building, 1404 New York Avenue, N. W., Washington 5, D. C. . . . **ERIE RESISTOR CORPORATION** of Erie, Pa. is building a new plant for the manufacture of electronic and plastic products at Holly Springs, Mississippi, 40 miles south of Memphis, Tenn. . . . **HARRISON RADIO CORPORATION** has removed its Jamaica Branch from 172-31 to 144-24 Hillside Avenue in Jamaica to provide larger warehouse and sales facilities for its Queens and Long Island customers. The new location features convenient drive-in shipping

and receiving platforms and 5000 square feet of service area on a single floor . . . **GATES RADIO COMPANY** of Quincy, Illinois has opened a new and larger office in New York City at 51 E. 42nd Street, across the street from the Airlines Terminal Building . . . **CBS-COLUMBIA INC.** has moved its administrative offices from its Brooklyn plant to its new Long Island City plant at 3400 47th Avenue . . . A second plant has been opened by **HEPPNER MANUFACTURING CO.,** Round Lake, Ill. manufacturer of television components. The new plant at Mendota, Ill. will be devoted exclusively to the manufacture of ferrite rod antennas and flyback transformers . . . **GENERAL ELECTRIC COMPANY** has opened a new tube warehouse at 3800 N. Milwaukee Ave. in Chicago. The structure provides almost 100,000 square feet of floor space and will serve as headquarters for the company's central regional sales organization for electronic tubes . . . **PHILCO CORPORATION OF CANADA** is erecting a modern, 80,000 square foot plant at Don's Mills, a Toronto suburb, which will be devoted to the manufacture of television receivers, radios, and other electronic equipment. The plant is expected to be ready for occupancy early in 1954. The company is currently operating in rented quarters in Toronto . . . **RAYTHEON MANUFACTURING COMPANY** has started a $1,750,000 modernization program at the former Lowell (Mass.) Ordnance plant. The plant was occupied last November by the company and the modernization program is being carried out while the plant is in production . . . **SYLVANIA ELECTRIC PRODUCTS INC.** has announced plans for a new 416,000 square foot television set manufacturing plant to be built in Batavia, N. Y. The plant is expected to be completed by Feb. 1, 1954.

* * *

RAYMOND C. COSGROVE has been elected to the post of chairman of the board of the *National Company,* succeeding William A. Ready who retired recently.

Mr. Cosgrove was formerly executive vice - president of *Avco Manufacturing Corp.* and president of Radio Television Manufacturers Association.

Mr. Ready is the oldest official of an electronic manufacturing firm still active in the ARRL. He has been an official of the company for 38 years and until March of this year served as president and chairman of the board.

* * *

E. F. JOHNSON COMPANY of Waseca, Minn. has purchased the inventory, tools, dies, and rights to manufacture the *Signal* line of telegraph instruments and keys. The line was formerly manufactured by **SIGNAL ELECTRIC MANUFACTURING COMPANY** of Menominee, Mich. . . . A new organization for the development and manufacture of electronic equipment has been formed under the name of **AMPLITRONIX INC.** at 280 Ninth Ave., New York 1, N. Y. Products include multiwaveform generators, projection scopes, electronic timers, and oscilloscope calibrators.

* * *

THE WESTERN ELECTRONIC SHOW'S ninth annual meet will open August 19th at the Civic Auditorium in San Francisco for a three-day run.

Almost 80 per-cent of the electronic manufacturers of this country will occupy 327 booths to display products used in broadcasting, communications, telemetry, servicing and installation accessories, etc.

The trade show is closed to the general public and no home receivers or other strictly consumer items will be displayed.

Four technical sessions daily will be sponsored by the (7th Region) Institute of Radio Engineers. —30—

ATLANTA HAMFEST

THE Atlanta Radio Club, Inc., will hold its annual Hamfest on August 30th at Robinson's Tropical Gardens near Atlanta, Georgia. The menu will include fried chicken and free drinks, and the program features games and activities for YL's and XYL's as well as contests and a transmitter hunt for the men.

Admission will be $3.00 for adults, $1.75 for children. Reservations and further information can be had from R. R. Warren, W4RVH, 490 Angier Ave., N.E. (Apt. #3), Atlanta, Georgia. —30—

MARS CD PLANS

BY JOINT agreement the Department of Army and the Department of Air Force have issued the policy indicated below to military commanders in the interest of providing guidance relative to civil defense planning.

"Within the scope and mission of the MARS program as approved and published, the use of MARS facilities as a military communications asset in support of Civil Defense will be governed by these policies. Within the current availability of personnel and equipment MARS may:

a. Make available communications services between the military forces in support of civil defense and the civil defense agencies.

b. Make available communications services for civil defense forces on a temporary or emergency basis when such services are not otherwise available.

c. Make available radio terminal facilities at designated military installations for civil defense tie-in as required.

d. Make these services available on military frequencies assigned to established MARS networks."

The military requirement for MARS and the availability of personnel, equipment, and frequencies during periods of national emergency will govern the extent to which MARS services can be made available to Civil Defense agencies.

A survey will be conducted by MARS in order to determine those civilian members who will be qualified and willing to participate in this communications support mission. —30—

Home Security Radio

(*Continued from page 62*)

proximately 10 microvolts-per-meter.

A second series of trials was next made to compare the sensitivity of the receivers when situated in unfavorable reception locations. In this test all 1000 watt and less stations in a 100 mile radius were recorded without grouping according to power. The number of these stations which could be logged by each of the three sets was determined and the per-cent received was calculated. This pattern was followed for three locations: an above the ground site, a householder's cellar, and a "bomb shelter."

The A-2 receiver, when set up in the cellar, was provided with 20 feet of horizontal antenna one and one-half feet below grade. The "bomb shelter" was a culvert 33 feet long, 18 feet wide, and 7½ feet high, open at each end and overlaid by reinforced concrete and a secondary roadbed. The 17-foot horizontal antenna of the emergency receiver was positioned in the center of the culvert and perpendicular to its long axis. The three sites were geographically less than one-half mile apart.

The comparative sensitivity of two of the receivers in the three locations is shown in Fig. 4B. The security receiver is superior to the commercial four-tube portable at two sites but at the third, the "bomb shelter," they appear as equal. Lack of apparent superiority of the A-2 receiver in the shelter site may be explained by the fact that there was no signal of intermediate strength. The culvert attenuated weak surface signals to a nondetectable level while strong original signals penetrated the culvert sufficiently to be heard by both receivers.

Immediately following an enemy attack on a large metropolitan area, each surviving household would require vital information and instruction to forestall panic. Instruction could be broadcast, lacking telephone and metropolitan broadcast service, by utilizing a sensitive battery-operated receiver tuned to a transmitter located in a neighboring community. A home security receiver designed for this purpose and operating from a single No. 6 dry cell is described. The sensitivity of this receiver assayed at ground level, in a cellar, and in a simulated bomb shelter was superior to a commercial four-tube portable vacation radio but less than that of a commercial communications receiver.

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Electronics for Yachtsmen

(*Continued from page 67*)

The radio direction finder has begun to find acceptance among small boat owners in recent years. Basically, it is a sensitive radio receiver with a very directional loop antenna which can be rotated on a compass-calibrated base. When beamed on known signal sources, generally RDF (radio direction finder) stations or charted broadcast stations, the boat's position can be established. Once this point is known, it is plotted on the chart and the new compass bearing determined. From there on it is a simple matter to hit the destination "on the nose."

While these are the only really important items needed aboard small craft, there are other pieces of electronic gear that contribute to the safety of the boat and the peace of mind of the captain. Moderate cost radio depth finders (fathometers) are now available and are being enthusiastically accepted by yachtsmen who cruise outside of charted areas. The instrument gives an indication of the depth of the water based on half the time it takes the signal to be transmitted from the boat to the bottom and return, with some allowance being made for mud penetration. In addition to preventing accidental grounding of the boat on hidden reefs, the fathometer is being used extensively to locate schools of fish whose massed bodies reflect the sound waves in the same way that the sea bottom does. Like the direction finder, the depth finder can be used to advantage in fogs and other closed-down conditions. By comparing depth readings from the graph with depth readings on the navigation charts, a fairly educated "guess" as to location can be made.

Since many small boats do not have the battery capacity to operate all this equipment for any extended period of time, extra generators (run from the motors), extra batteries (if possible), and shoreline battery chargers and eliminators are essential. Batteries can be recharged either at the boat's destination or in its home port. Power lines are run to the boat when in port and the charging handled there.

In addition to the safety radio equipment aboard a boat, many owners are adding such purely pleasure gear as television receivers and small portable radios. Television lends itself particularly well to use in close quarters and provides ready-made entertainment when in strange ports. Because of the load, it isn't practical to run the television receiver from the boat's battery supply but in port where it can be operated from power lines it is a real addition to the basic equipment. The requisite a.c. is available at most commercial and yacht club piers.

The boat, "Miss Eico", shown on

this month's cover is a 31-foot cabin cruiser which carries a full complement of electronic devices including a *Jefferson Travis (Emerson)* 35-watt radiotelephone. The unit covers four bands and a spare (two ship-to-ship; one Coast Guard emergency; one marine—*Bell System*—telephone channel; and the spare). Calls may be made to any telephone by contacting the nearest marine telephone operator. The cost of the call is the regular toll charge plus an additional fee of $1.00. There is no monthly carrying or minimum charge.

The boat also carries a *Bludworth Marine* radio direction finder, the Model DF1029A. This unit covers three bands (one of which is the broadcast band) and has a range of 125 miles. It will operate on 6, 12, or 32 volts d.c.

The depth finder aboard the craft is a *Bendix* recording model which is capable of measuring depths from 0 to 100 fathoms (0 to 600 feet). It has a single range and may be operated from either 12 or 32 volt power sources.

Other units include a *Surrette* battery charger (12 volts) and an *Eico* Model 1040 battery charger for 6 and 12 volts. This latter unit can be used to provide the requisite 6 volts needed to operate small appliances aboard the boat, the major pieces of electronic gear being operated by either 12 volts d.c. or 117 volts a.c. The a.c. is available in ports and is fed into the boat by means of an outlet in the rear cockpit. The boat carries dual wiring which permits the lights, battery charger, small appliances, the television set, etc., to be run from the a.c. power lines when the boat is docked. The Model 1040 battery charger also provides power for the regular 6 volt gear when in port.

A meter to measure transmitter output is an extremely useful item as it tells at a glance whether or not your signal is getting out. A "Chargicator" which indicates the charge on any of the boat's four batteries by a flip of the switch completes the operating gear aboard. In addition, a television receiver and a radio receiver are provided for the entertainment of guests.

While all of the equipment aboard is standard, it may be a little more elaborate than that desired by the average boat owner. Radiotelephone units (*RCA, Pearce-Simpson, Hudson-American, Fisher,* etc.) range in price from around $230 to $760. They may be obtained with as few as two channels or as many as six and provide coverage from a minimum of 20 to 200 miles. Installation charges are extra. Crystals for the various bands run about $15.00 a pair. Antennas for use with such equipment range in price from a modest $25.00 for a home-built unit comprising a bamboo pole, some wire, and a swivel socket to a commercial unit in the $80 price class. Incidentally, the swivel socket is a "must" for sailing under stationary bridges or up tree-lined inlets, etc.

Direction finders fall in the $200 to $400 price class and range from units which operate from four self-contained batteries and cover 100 miles to units which operate from the boat's 6, 12, or 32 volt power supply, cover three bands, and are effective for distances up to 125-200 miles. One recently announced unit which has been especially designed for small boats and lean pocketbooks is being offered at a price in the neighborhood of $85.00. This simple device consists of a receiver capable of tuning the marine, aircraft, and local broadcast bands, an earphone, and an antenna.

Depth finders, as produced by *Bendix* and *Raytheon,* are priced from $350 to around $1000 depending on the features incorporated. One modestly priced unit features a rotating disc and indicator light. It reads from 1 foot to 160 feet. Another model has two ranges, one for 1-100 fathoms and the other for 1-200 fathoms, while a still more elaborate version keeps a permanent record of the bottom over which the boat is traveling.

Needless to say, there are any number of other devices which can be included should the size of the boat and the wishes of the owner so dictate. *Radiomarine Corp.* is now offering a compact 3.2 cm radar unit which has been designed for small craft while a photoelectric-type automatic pilot which operates on the gyro principle is being made available to yachtsmen who do a lot of open-water cruising over long distances.

While many of the items described herein may appear to be unduly elaborate for a small craft, in reality none of the items could be considered "luxuries" since, in conditions of fog or bad weather, every single piece of electronic gear becomes a "life-line" which may be responsible for saving the crew and/or the boat itself—a point well worth considering.

No matter how few or how many pieces of electronic equipment you have aboard, take the word of an experienced "skipper" when he advises that the more protective devices available the more comfortable and trouble-free the cruise. Being ready for any emergency is one of the marks of an "old hand". Electronic gear helps you to anticipate such emergencies and handle them smoothly should they be unavoidable. —30—

DELTA CONVENTION

AMATEURS of the Delta District will hold a convention in New Orleans on September 5-6 at the Jung Hotel on Canal Street.

Sponsored by the Greater New Orleans Amateur Radio Club and by the Westside Radio Club of New Orleans, a full program of sightseeing, convention sessions, and displays has been planned for amateurs and their wives.

Contact A. L. Powell, W5MXQ, at 224 Hollywood, New Orleans 20, La., for further information. —30—

HAM CLUB ACTIVITIES

THE Baltimore Amateur Radio Club, Inc. has scheduled its Sixth Annual Hamfest-Picnic for Sunday, August 9th at Triton Beach, Mayo, Maryland. Tickets are $1.00 per person (children half price) and include the use of the bathing facilities, bath-house, locker, use of picnic tables, and pavilion.

An interesting program has been planned and there will be awards for the best mobile installations. The festivities are scheduled to start at 10 a.m. W3PSG will be on hand to guide visiting mobiles.

For further information write Chairman Ernie Dobos, W3JCL, 2208 North Fulton Avenue, Baltimore 17, Maryland.

* * *

THE Seventh Annual Ham Outing of the Buckeye Shortwave Radio Association will be held August 30th at Happy Days Camp, Virginia Kendall Park, located just north of Akron, Ohio on Route 303, .8 mile west of Route 8.

Registration is set for 2 p.m. with a fee of $2.00 per family. Prizes for young and old have been provided. For further details contact R. J. Nuss, W8KDW.—30—

Spot Radio News

(*Continued from page* 18)

install . . . new communication techniques and facilities . . ." is back in officialdom once again with another transoceanic telecasting proposal. Under consideration now is a "Narcom" or North Atlantic Relay Communications, system, which calls for relays from this country to London, by way of Canada, Greenland, Iceland, and so on.

In the earlier plan which revolved about Near East operations about twenty relay stations were envisioned. It was estimated that the network equipment alone would cost up to $15 million, while annual network operation would involve a budget well over a quarter of a million dollars. Cost of operating each of the relay stations would be about $25,000, and programming could run up a figure of $10 million. Then there would be the technical problem and cost of servicing and maintenance not only the transmitters and associated gear, but projection receivers, also included in the project. According to Senator Mundt who sponsored the measure, only $3 to $4 million would be required at the beginning and only about 5000 receivers would suffice.

In its present form, the global plan would be included within a "Voice of America" program and probably supplement or supplant audio transmissions to certain countries.

EDUCATIONAL TV, which reached a climactic stage a short time ago, as the deadline for reserved channels passed, with little reaction from commercial interests, recently received strong support from the headman of the Senate Interstate and Foreign Commerce Committee, Senator Charles W. Tobey.

Reviewing FCC's position on school television, the Senator said: "I shall keep a watchful eye on each and every one of these 242 channels for education, and upon the slightest evidence that the FCC is about to weaken and to delete one of them or substitute a substantially less valuable channel for one of them, I shall call for a full-scale investigation."

Others supported the Senator. Congressman Heller pointed out that few are aware of the . . . "importance of the action taken by the FCC or of the great significance of the gift it has presented to the American people." He felt that reservations of the educational channels should continue indefinitely, regardless of pressure from the commercial world, or the statement included within the freeze-lift order.

Approval of a move to delay cancelling of the special channels, was also voiced during the nomination hearings of Commissioner John C. Doerfer. Senator John Bricker noted that educational television offers great

possibilities and educators should be given every chance to put up their own stations. He declared that while it would not be wise to have educational institutions take over TV, we would be . . . "passing up one of the great opportunities in the educational field, if we don't reserve channels for them."

When the reservation deadline passed, technically the Commission was in a position to change a channel from reserve for education to commercial, or even the reverse; change commercial to a reserved state. In addition, the government could add a new channel to any city, whether it presently has channels allocated to it or not, and could also remove a channel from any city and assign it to another. It also became possible to substitute or exchange channels among cities, whether they were on the very-high or ultra-high bands. A change in the minimum mileage separation required between a channel in one city and a co-channel or adjacent channel in another city now also can be entertained.

In some quarters, educational interests have been very active. In New Jersey, for instance, a commission report to the governor proposed the erection of a six-station network and allotment of $190,000 to continue research in programming, already under way at New Brunswick, and $425,350 for construction of station and allied facilities.

Suggested was the building of a station with a studio on the campus of Rutgers University, using a 5-kilowatt transmitter and antenna at Washington Rock State Park, Watchung. Other stations, it was reported, would be built in the vicinity of Montclair, and another with a studio in the Camden area with the transmitter and antenna in the Mount Holly vicinity. Still others would be erected in the vicinities of Freehold, Hammonton, and Andover. Local boards of education would be responsible for providing receiving facilities, the report continued.

Among those who served on the report commission were Drs. Elmer W. Engstrom of *RCA* and Allen B. DuMont. Engstrom served as chairman.

MICROWAVES, often described as the eventual home of many, many services, was recently the subject of one of the most searching analyses ever offered by a spokesman of the Commission; Edwin L. White, chief of the Safety and Special Radio Services Bureau.

Speaking before the Petroleum Industry Electrical Association in Houston, Texas, he said that the one outstanding characteristic of microwave systems is the ease with which the radiations of the transmitters and angle of acceptance of receivers can be restricted. In view of this feature, the same frequency can be and is being used in the same geographical area by two independent point-to-point systems, without noticeable interference, it was pointed out. If this engineering can be carried to the ultimate, White said it might well be that, as a matter of policy, the Commission could assign identical frequencies to a number of systems in the same area without harmful mutual interference resulting.

Exploring some of the benefits and some of the possible drawbacks of such a procedure, the Commission's expert said that if such a procedure is practicable, the number of potential channels in any one area could become so large that some of the means of frequency economy applied to individual systems might become unnecessary. For example, he pointed out, it may not make too great a difference if passive reflectors are used, and frequency requirements for any point-to-point system doubled thereby. The bandwidth required for multiplexing might not be of great importance, it was revealed. Under such an ideal

NEW TV STATIONS ON THE AIR

(As of July 25, 1953)

The following new stations brings the lists published in previous issues up to date.

STATE, CITY	STATION	CHANNEL	FREQUENCY RANGE (IN MC.)	VIDEO WAVELENGTH (IN FT.)	VIDEO POWER* (IN KW.)
Kansas					
Hutchinson	KTVH	12	204-210	4.79	115
Minnesota					
Rochester	KROC-TV	10	192-198	5.08	105
Missouri					
Kansas City	KCTY	25	536-542	1.83	93
Nebraska					
Lincoln	KFOR-TV	10	192-198	5.08	59
Ohio					
Akron	WAKR-TV	49	680-686	1.44	145
Ashtabula	WICA-TV	15	476-482	2.06	20
Texas					
San Angelo	KTXL-TV	8	180-186	5.43	11
Texarkana	KCMC-TV	6	82-88	11.8	18.5
Wisconsin					
Madison	WMTV	33	584-590	1.68	16.5
Milwaukee	WCAN-TV	25	536-542	1.83	105

*From Station CP application.

The frequency of the video carrier = 1.25 + channel lower freq. limit.

Total number of television stations now on the air: 207 (49 of which are u.h.f.)

plan, the report added, the Commission could allow each system to be as the applicant might desire, both as to choice of equipment and as to ultimate capacity, and there would be no need to inquire into the plans of the applicants for future growth. Thus, the Commission might assign a channel of from 8 to 10-mc. width to each microwave system, leaving it to the licensee to make his choice of modulation system, and use as much of the channel as his needs dictate, provided, of course, that the techniques used did not result in occupancy of frequencies outside the channel or produce radiation outside of the geographic area provided for the system.

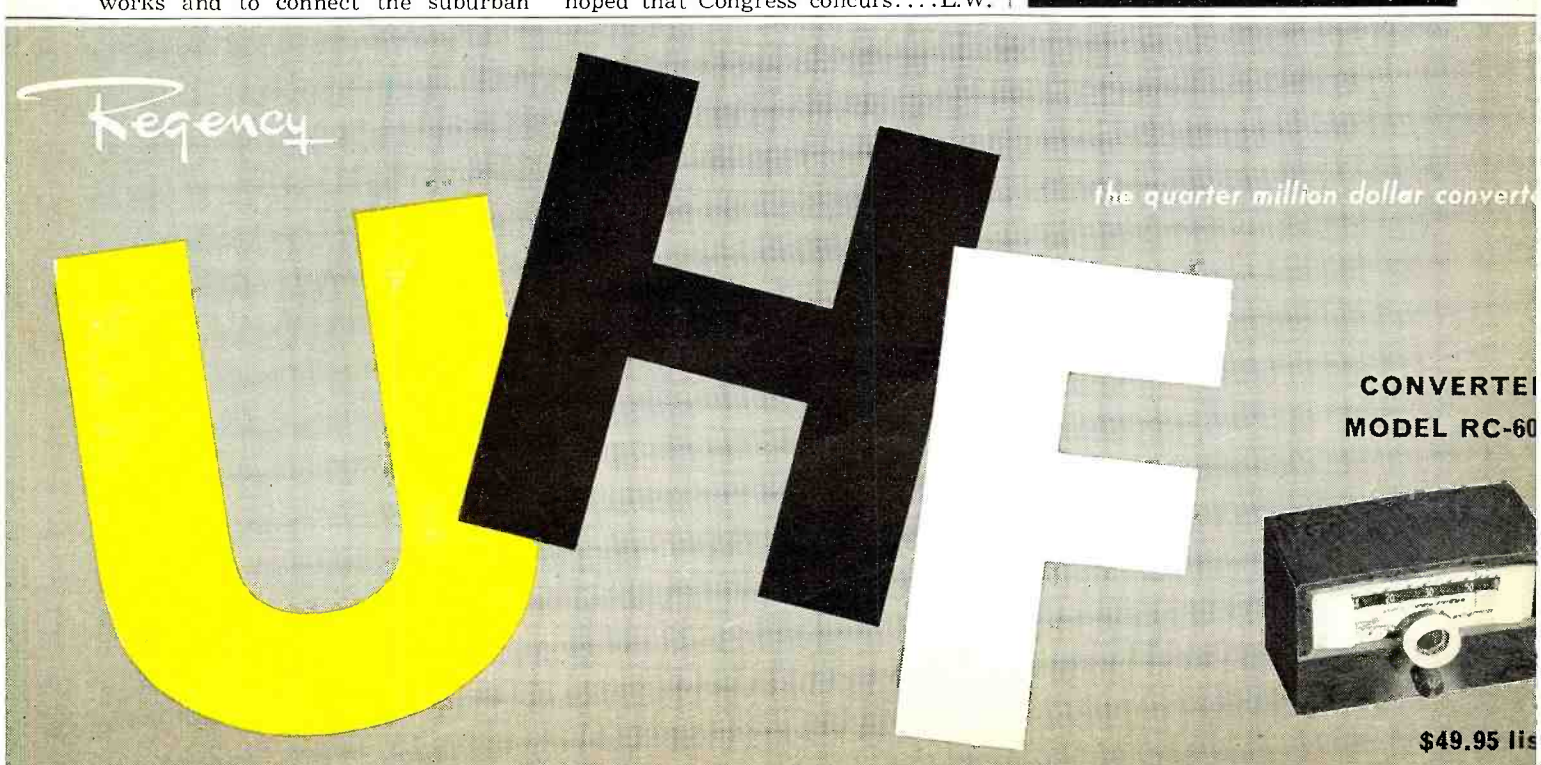
Unfortunately, White said, for some there were a few problems that could disturb the bright prospects. For the mobile and broadcast systems, the frequencies above 800 or 900 mc. are not too attractive. And, information also indicates that above approximately 8000 or 10,000 mc., atmospheric absorption is also serious. Because of these conditions, the report noted, it may well be that at some future time we may find that because of requirements for mobile uses we cannot afford to use the frequencies below 800 mc. for point-to-point communications. If this should happen, White declared, point-to-point systems designed to operate in the lower portion of the spectrum would be forced to vacate and move up to those frequencies suitable for point-to-point, but unsuitable for mobile work. Notwithstanding the interference situation above 10,000 mc., extremely high powers can be used to overcome this atmospheric problem, as radar operation has proved. Under these circumstances, the petroleum specialists were told, the fixed frequencies between 800 and 10,000 mc. might be reserved for intercity point-to-point systems and the fixed frequencies above 10,000 mc. could be reserved for intracity networks and to connect the suburban terminals of intercity networks with central urban terminals.

Noting that the number of microwave systems is growing, White disclosed that there are approximately 60 fixed microwave communication systems which are over 50 miles in length, in addition to possibly 75 to 80 other systems which consist of one or two hops only.

FACED WITH mounting hearing problems, examiners have found it impossible to maintain the early post-freeze pace and grants have begun to trickle instead of pour as they did in the first few months.

As the table on page 16 reveals, the number of approvals for station construction has dropped substantially; over 50 per-cent in this instance as can be readily seen.

It is believed that this situation will be alleviated soon by Congress by means of an appropriation to permit the hiring of more examiner teams. It is expected that about $300,000 will be appropriated for the cause, and at least seven more teams of examiners will be retained. Since one team can handle about 15 applications yearly, the present ten and additional seven would be able to process 255 applications a year. Senator Ed Johnson has been arguing for even more money so that more lawyers and assistants can be hired to expedite further the processing of applications. He warned his colleagues that actually Congress would be continuing the freeze if they did not approve funds for more examiner teams. He would like to see a total of 40 teams in action at the Commission's offices. Such a force, he felt, would enable more stations to begin telecasting and set in motion a chain reaction which very quickly would create billions of dollars in business. Everyone is grateful to the driving Senator for his earthy plea for these urgently needed dollars. It is to be hoped that Congress concurs....L.W.



1953 Emerson TV Sets

(*Continued from page 55*)

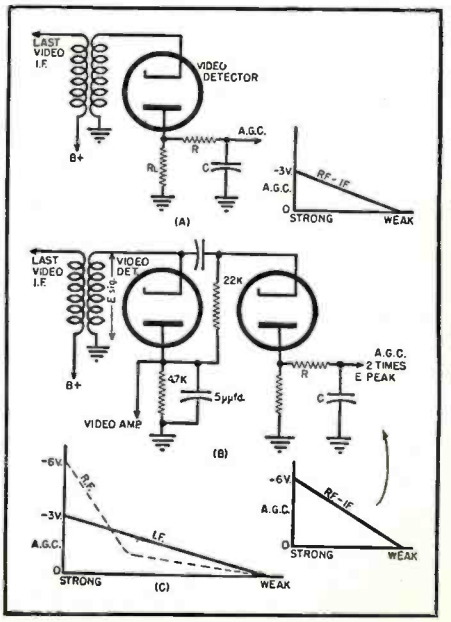
of horizontal and vertical sync. This was remedied by attenuating the signal, or by simply removing the first r.f. amplifier, usually a 6J6 or a 6CB6 tube. On the other hand, when a set was installed in a fringe or weak-signal area, the contrast, or signal strength, could be improved by shorting out the a.g.c. line completely, permitting the receiver to run "wide open," always in the maximum gain condition.

Upon close examination, it will be noticed that the "trick" of obtaining good reception in all signal areas depends upon the amount of amplification the receiver obtains from the r.f. amplifier. In strong-signal areas the r.f. amplifier is not really necessary and, if its amplification were eliminated, there would be enough signal leaking through the tube and wiring capacities to give a very satisfactory picture. This can be done by increasing the bias on the control grid to the point where the tube amplifies very slightly, if at all; likewise, in the weak areas, the tube will have maximum gain if the a.g.c. is shorted out.

Another important consideration is the signal-to-noise ratio of the receiver. This, too, is determined by the r.f. amplifier since, in weak-signal areas, the r.f. amplifier must amplify the signal above the noise level of the receiver in order to have a snow-free picture. To accomplish all this, the r.f. amplifier must have an a.g.c. curve like that shown in Fig. 5C. The a.g.c. for the i.f. stages must also vary with the signal strength, but not as severely as the r.f. a.g.c.

All this is accomplished by utilizing a two-part a.g.c. system. The negative

Fig. 5. (A) Simple a.g.c. circuit with its operating curve. (B) Voltage doubler type a.g.c. and curve. (C) Curve showing ideal a.g.c. for r.f. and i.f. stages.



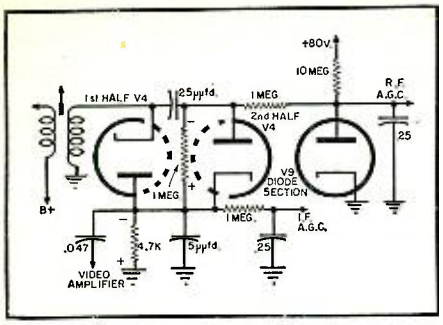


Fig. 6. Simplified schematic diagram of delay type a.g.c. circuit used by Emerson.

d.c. voltage developed across the video detector load resistor serves as the a.g.c. source for the i.f. stages only. (See Fig. 6.) Since in the strong signal areas the r.f. amplifier must effectively be cut off, or close to it, the higher a.g.c. potential is developed by the modified voltage-doubling action of the second-section diode of V_4. This peak d.c. voltage will then add to the average voltage across the 4.7K resistor, giving the total voltage for the r.f. a.g.c., reducing the r.f. gain in the high-signal area. For weak signals, the action of the modified voltage doubler is reduced by applying a positive voltage through the 10-megohm resistor from a positive 80-volt source, reducing the r.f. a.g.c. to some value close to zero. If the diode section of V_9 were removed from the circuit while receiving a weak signal, the r.f. a.g.c. line would go positive. The a.g.c. clamper diode prevents this from occurring by conducting whenever there is a tendency for a positive voltage to exist on the r.f. a.g.c. line. Actually, this a.g.c. line will never become positive, due to the contact potentials of the diodes, and will always be approximately —.5 volt with no signal received.

A low value of negative voltage will be present on the r.f. a.g.c. line until the signal is strong enough to develop a large enough bias in the a.g.c. diode circuit to overcome the positive delay voltage from the 80-volt source. From that point on, the a.g.c. voltage will rise very rapidly as the signal increases, crossing over the i.f. a.g.c. bias point (see Fig. 5C) and, for very strong signals, cutting off the r.f. amplifier.

The vertical oscillator frequency is controlled directly by the vertical sync pulse after it is integrated by an improved integrator network. This improved integrator is made up of two sections of a low-pass network, R_{64}, R_{65}, R_{66}, C_{71}, and C_{72}, rather than the customary three sections. Also, the input impedance is lower which makes its operation more successful, since any noise or horizontal pulses that may induce currents into the vertical circuit will develop a negligible voltage across the low resistance of the integrator. Another important factor is that, with the two-section integrator, the time constant is shorter, therefore permitting the vertical sync pulse to discharge fully after the ver-

tical pulses are removed, within the time interval of the equalizing pulses. This arrangement permits improved interlace, allowing the receiver to have its maximum resolution and resulting in better picture quality.

The horizontal sync circuit uses the latest type of horizontal phase-detector circuit as an automatic frequency control. As seen from the schematic diagram in Fig. 4, the horizontal multivibrator (V_{13}) frequency is not controlled by pulses, as is the vertical circuit; instead, a d.c. control voltage is applied to its grid from the output of the phase detector. This voltage is negative or positive, depending upon the relation of the multivibrator frequency to the horizontal sync pulse. Increasing the horizontal frequency, or to be more correct, its phase, is accomplished by making the grid of the first half of V_{13} more negative, decreasing its gain, but resulting in an increase in horizontal phase. To decrease the horizontal phase, a positive voltage is applied to the grid.

Noise Inverter Circuit

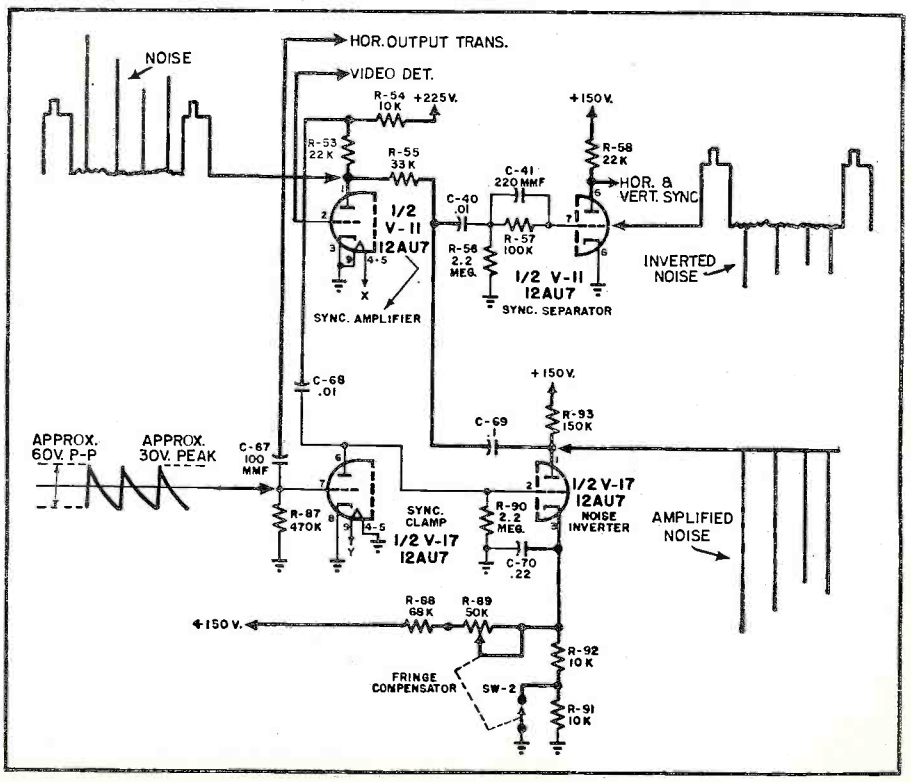
To improve the noise immunity of the circuits, early receivers used a noise clipper diode. The noise was clipped by the diode action down to the level of the sync peaks, at best, if the circuit was adjusted properly. The remaining noise pulse below the sync level, however, could still cause unstable sync. Also, under continuously heavy noise bursts, the noise clipper tended to build up a bias across it equal to the noise peaks and, therefore, was not effective for the elimination of such noise.

The *Emerson* noise inverter circuit, Fig. 7, not only prevents the noise from exceeding the sync peaks, but also reverses the polarity of the noise pulses into the negative region, where they have absolutely no detrimental effects on the sync circuits. It should be noted that the noise inverter circuit will function on noise in the sync circuit only, and not in the video circuit. Noise appearing at the output of the video detector will appear on the picture tube.

The normal path of the sync pulses, with the noise inverter inoperative, would be from the video detector through the sync amplifier, through an *RC* noise-immunity circuit to the sync separator and, finally, to the horizontal or vertical sync circuits. In operation, one-third of the output voltage of the sync amplifier is taken off from the junction of resistors R_{53} and R_{54}, and is applied to the grid of the noise inverter. The variable resistance, R_{59}, which is part of a voltage divider in the cathode of the noise inverter, is adjusted so that the bias of the tube is just at cut-off when no signal is received. The total bias on the grid of the noise inverter must always be equal to the cut-off bias of the tube, plus the peak voltage of the sync pulses. The latter varies from scene to scene, and is coupled to the noise inverter grid. A varying bias voltage that will follow the sync amplitude variations is developed on the grid, due to the action of the sync clamper in the following manner.

Pulse voltages, which are a function of the horizontal frequency, are obtained from the horizontal output transformer and are applied to the grid of the sync clamper at the same instant that a horizontal sync pulse is applied to the plate of the clamper.

Fig. 7. Noise inverter circuit showing the waveforms at essential points.



A grid-leak bias will develop on the sync clamper from the grid pulses which will keep it cut off between horizontal pulses. When the clamper tube does conduct, it charges C_{68} up to the peak voltage of the sync pulses applied, and its discharge through R_{90} develops a bias voltage equal to the peak of the sync pulse. Adding the voltage developed across R_{90}, and the voltage in the cathode circuit of the noise inverter, results in the total bias on the tube, maintaining it at the proper cut-off potential.

When the clamper does not conduct, it appears as a high impedance permitting the noise pulses to overcome the bias on the noise inverter, driving it into conduction. These noise pulses are amplified and appear across the 33,000-ohm resistor, R_{55}, with an opposite polarity and greater amplitude than the same noise coming from the plate of the sync amplifier. The latter noise pulse is therefore cancelled completely, and appears as a negative-going noise pulse having no harmful effects anywhere in the sync.

Although the setting of R_{89} is not too critical, care must be taken so as not to develop excessive or insufficient bias. With excessive bias, not all of the noise will cause the tube to conduct and this will result in inadequate cancellation. With insufficient bias, there is the possibility that the sync pulse will be cancelled, adding to sync instability. This variable resistor is called the "fringe compensator control," and its adjustment is simple since it is rotated until noise does not cause any sync instability of the picture on the screen. If the fringe compensator operation is not desired, the control is rotated fully counterclockwise until SW_2 is opened, removing the short across R_{91}. The increased voltage drop across the additional 10,000-ohm resistor biases the tube well beyond cut-off.

Alignment Data

To aid the service technician in aligning the horizontal oscillator, leads from the multivibrator phase coil (L_{13}), and from the grid of the horizontal oscillator are brought up to a dummy lug on the top rear of the chassis. Since the multivibrator control grid must be at zero voltage for operation at 15,750 cycles, the lug connected to the grid is simply shorted by a jumper to the chassis of the receiver. Another jumper is used to short out the other two closely-wired lugs from the phase coil to each other. Now all controlling elements of the oscillator are removed, leaving the normal RC time constant. The horizontal hold control, R_{73}, located on the front of the chassis behind the hinged *Emerson* name plate, is adjusted so that it is in the center of its mechanical range. With the set tuned to a signal, the horizontal balance control, R_{71}, located on the rear of the chassis, is adjusted so that the picture does not tear. Next, the jumper shorting the lugs connected to the phase coil is

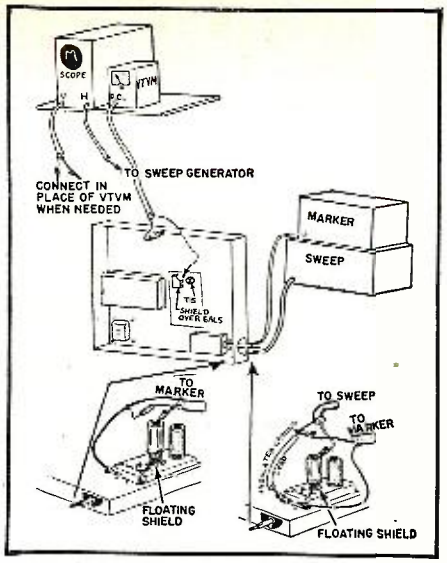


Fig. 8. Test equipment setup for video i.f. alignment outlined in Table 2.

removed, and the phase coil is adjusted so that the picture does not tear.

Note: Since no a.f.c. voltage is being applied to the multivibrator during the above adjustments, the horizontal blanking bar may move back and forth across the face of the picture tube.

To complete the adjustment, the jumper shorting the grid of the multivibrator is removed. The horizontal hold control should hold over the entire range if it is rotated slowly. If the horizontal should tear at only one end of the control, it is still within engineering specifications.

Before aligning the video i.f. stages of the receiver, do the following:

a. Tune the receiver to unused Channels 10 or 12.

b. Connect the negative terminal of a 3-volt bias battery to the i.f. a.g.c. This connection should be made at the junction of R_{10}, C_8, and R_{16} (see Fig. 4). Connect the positive terminal of the bias battery to the chassis.

c. Raise the shield of the 6J6 converter tube, V_{23}, slightly so that it does not make contact with the chassis. (See Fig. 8).

d. The output cable of the sweep and marker generators should be properly terminated in their characteristic impedance (usually 50 to 75 ohms). If this termination has not been built into the end of the cable, connect a resistor of the same value as this characteristic impedance across the output of each generator cable, as shown in Fig. 8.

e. Proceed to step 1 on Table 2. -30-

HAM CLUB ELECTS

MILWAUKEE Radio Amateurs' Club has named K. W. Eggert, W9MOT, president; Dr. G. P. Lawrence, W9RZJ, first vice-president; C. W. Thomas, W9WK, second vice-president; W. E. Herzog, W9LSK, secretary; and E. J. Belanger, W9MDG, treasurer for the year 1953-1954. Four directors were also elected. -30-

TV High-Voltage Supplies

(*Continued from page 49*)

The resistance from the plate cap of the output tube to the low end of the flyback transformer will probably range from 15 to 60 ohms.

If the click and spark are not obtained, the output stage is either defective, the boost voltage is absent, or the output stage is not being driven by the horizontal oscillator circuits. This now requires the use of test equipment to locate the trouble.

Use a vacuum-tube voltmeter to measure the bias between grid and cathode pins on the output tube. Anything less than 20 volts is indicative of insufficient drive. If approximately 30 or more volts is obtained, check the damper by measuring the boost voltage at its cathode. If the boost voltage, which is usually a little less than twice the "B+" voltage, is not obtained, the damper stage or the flyback transformer may be defective. Make sure, of course, that the high voltage fuse (if there is one) is not blown. If the aforementioned tests fail to locate the defective part, use a scope to check the waveshape at the grid of the output tube. Since this is a qualitative analysis and the waveshapes differ from receiver to receiver, it is difficult to give a hard and fast rule as to what to look for. However, Table 1 contains the grid waveshapes and potentials obtained for a number of representative receivers. Failure to obtain these waveshapes and/or potentials indicates that the trouble lies between the grid circuit of the output stage and the horizontal oscillator circuits.

There are many troubles that do not cause the complete loss of high voltage, or which affect the width, linearity, etc. Among the most common troubles of this type are the following.

Picture Blooming: Due to a gassy high-voltage rectifier tube. Replace the tube, and if a doubler circuit is used, replace both rectifier tubes.

Insufficient Width: Caused by weak low-voltage rectifiers, or a weak output tube. Check the output tube cathode bypass if one is used. Also, check the screen grid components. If the linearity on the left side of the screen is affected more than on the right, check the damper tube and associated components. Check the boost voltage and the boost filter, such as the .22 μfd. condenser connected to the damper cathode (see Fig. 3).

Output Tube Requires Frequent Replacement (more than once a year): Check the grid coupling condenser. It may be leaky, causing excessive grid current to be drawn. Also, check the grid waveform to make sure that the tube is not being overdriven. In either case, a check of the bias will reveal if the tube is drawing excessive grid current.

In cases where the trouble has been traced to a defective flyback trans-

former it is very important that an exact replacement be made if additional troubles are to be avoided. Even a direct replacement sometimes may not work properly due to the fact that aging of components, or a previous incorrect substitution of parts may have produced operating conditions which are so far off tolerance that the rear apron controls can no longer reset the circuit for the desired results. Some of the more common troubles resulting from such mismatches, and the cures for them, are described below.

If, after replacing a flyback, insufficient width results, try shunting the width coil with a condenser whose value is between .025 to .05 μfd. Another method is to increase the output tube coupling condenser in increments no higher than 10%, or to decrease the value of the screen dropping resistor in steps no higher than 10%, or combinations of both. If the high voltage is too low, reduce the capacitance across the width coil in decrements of 20%, or increase the drive and/or screen voltage as described for insufficient width. If excessive high voltage is obtained, reduce the drive to the output-tube grid by decreasing the size of the coupling condenser, or increasing the size of the screen-dropping resistor. If this fails, insert a 1000 ohm, 10 watt potentiometer in series with the low side of the flyback and the "B+" supply. Adjust the pot until the high voltage is reduced a sufficient amount. Remove the pot and substitute a 10-watt fixed resistor of a value determined experimentally.

If alternate light and dark vertical bars modulate the raster, check the damper stage and the drive to the grid of the output tube. If parasitic oscillations develop, insert a 47- to 68-ohm loading resistor in the grid circuit of the output tube, and a 68- to 82-ohm resistor in the screen circuit. Parasitics can also be suppressed by means of a magnet clamped to the output tube, or by redressing the leads connected to the flyback transformer. If a horizontal foldover develops, first check the horizontal a.f.c. circuits for correct adjustment, and then check the width and linearity components. Also, try substituting a number of different output tubes to obtain the one that matches best. —30—

HAMFESTERS' PICNIC

THE Hamfesters Radio Club of Chicago will hold its annual picnic and air-mobile meet on August 9th at Mance Park, ¼ mile east of Route 45 and ¼ mile south of Route 66 (Stinson Airport). Free parking of planes at Stinson airport will be available but pilots must bring their own tie-downs.

Food, ice cream, and beverages will be available at the picnic grounds. A full program has been planned for the whole family.

Tickets are available from John J. Ruth, W9GVO, 4460 Oakenwald Ave., Chicago 15, Ill. A donation of $1.50 is requested from those planning to attend the affair. —30—

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

TO MANY of those who attended the annual electronic parts and equipment trade show in Chicago last May, the most significant development in new products introduced was the *RCA* "TV-Eye" and the *Radio Corporation's* new plan for distributing it.

The "TV-Eye" is a new camera for closed-circuit applications. Its significance as a new product stems from its price of less than one thousand dollars. The special importance of *RCA's* plan of distributing is that the "TV-Eye" will be sold through regular parts distributing channels. Installation, maintenance, and service will be handled by the selling organizations or independent service companies.

"You may logically ask—"Why is this development especially significant?"

To answer that question for you we would like to first review what David Sarnoff, chairman of the board of the *Radio Corporation of America*, said about industrial television in his speech before the IRE convention in New York City last March:

Industrial Television

"In a few short years we have seen television develop into a major factor in American life. Its extraordinary potentialities for political education, cultural instruction, and entertainment have been amply demonstrated. However, many other applications of television's basic function—extension of human sight—are ready for practical use.

"Thus far, the phenomenal growth of broadcast television has overshadowed these other applications which operate over closed-circuit systems and constitute the growing field of industrial television. The opportunities for expansion of television in this field are wide.

"Wherever danger, remoteness, or discomfort preclude the presence of a human observer, the industrial television camera can take his place. Handling of explosives, pouring of castings, watching the operations of furnaces, and remote power sub-stations are examples of television's usefulness to industry.

"As yet only a negligible fraction of the potential of industrial television has been tapped. The major obstacle has been cost. That obstacle is being overcome by lightweight equipment. *The dimensions of industrial television may surpass the growth in broadcast television we are now witnessing.*" (Editor's note: italics ours.)

"Tomorrow we will demonstrate a much simplified closed-circuit television system, which provides a Vidicon camera attachment for a standard home television receiver. The simple attachment is connected as easily to a television receiver as a record-player and does not affect the normal use of the receiver in any way. With the addition of this camera unit every-one of the 23,000,000 television receivers now in use becomes potentially a closed-circuit system for schools, the home, and other places.

TV in Schools

"Schools, in which television sets are becoming more and more a standard classroom fixture, may employ their TV sets to bring talks and demonstrations to the entire school or to selected classes, without the loss of time or the confusion attendant upon a call to assembly. On college campuses the linking of the lecture halls by television will permit exchange of instruction between departments, adding to the variety and interest of the courses. In biological research and technical education, this form of television has proved a valuable tool.

"The availability of a simple closed circuit system will put the television microscope as a new instrument for instruction within reach of every high school and college in the country.

"Until now industrial television has been utilized mainly by larger business and industrial organizations, but the reduction in cost brings it within reach of thousands of small businesses.

"Many uses are also foreseen for closed-circuit TV in hotels, department stores, and other business establishments.

Closed-Circuit TV in Homes

"One of the largest fields ahead for the use of closed-circuit television is the home itself. Closed-circuit sound

systems are familiar to Americans. We think nothing of voice communication between rooms in the same house, between offices in the same building, between upstairs and downstairs. We are destined, I believe, to become equally familiar with closed-circuit systems of sight transmission.

"When the cost of the camera attachments is sufficiently low to permit their use in the average home they may make the television receiver truly the control center of the home. The snap of a switch will turn the receiver from the broadcast program to view the children asleep in the nursery or at play in the yard, or the cooking on the kitchen range. The housewife will not only hear but see the caller at the door before she opens it."

Up until last Fall the cheapest "camera chain" available for closed circuit TV sold for more than four-thousand dollars. These units were sold directly by their manufacturers and were installed and maintained by factory service people.

Last Fall the *Dage Electronic Corporation* introduced a TV camera that carries a list price of $2850.00. When this camera was announced the *Dage Company* was literally swamped with inquiries about it, clearly demonstrating the tremendous interest already existing in the field of closed-circuit television.

In the span of less than a year's time closed-circuit TV camera systems have dropped in price from more than five-thousand dollars to less than one-thousand dollars. The most important factor in the cost of a TV camera is the price of the camera tube. The present list price of the Vidicon tube is around $400. *RCA* is said to be stepping up production of this tube and it is possible that production efficiencies and economies will result in a steady lowering of the price of this popular tube.

It is obvious that *Radio Corporation of America* visualizes closed-circuit television as a potentially immense business in its own right perhaps, as Mr. Sarnoff said, "even surpassing the growth in broadcast television we are now witnessing."

Last Fall, speaking before the NEDA convention in Atlantic City, Hal Bershe, renewal sales manager for the *RCA* tube department, told parts distributors assembled there, "Today, now, ITV is practical for millions of applications. Do you realize that in this statement we are suggesting that millions of television cameras may someday be placed in service? Have you considered the possibility of stocking Vidicon camera tubes, as you now do with 6L6's?"

Importance to Service Industry

Many men operating TV service businesses have weathered the vicissitudes of the early "boom and bust" and subsequent periods of thoughtless service price cutting and user indolence to build stable business operations. Many of these men have ex-

panded the scope of their activities to handle other facets of service in the electronics field like AM-FM radios, auto radios, and mobile 2-way communications systems. In some cases, to level off seasonal fluctuations, these service executives have gone into home air conditioning, low voltage house wiring, and major appliance installation and maintenance.

It is for these businesses that closed-circuit television holds the greatest immediate opportunities. In most of our discussions of ITV we have dealt with monochrome systems. Substantial progress has been made in perfecting color TV equipment for closed-circuit work. Color TV has an especial appeal in medical applications and it is reported that one company is now in production on color TV cameras and monitors with the idea of aggressively exploiting the ready markets for this type of equipment. It is the plan of this organization to arrange for the installation, maintenance, and service of its systems by competent, independent TV service companies.

However, it is imperative that any TV service organization that wants to share substantially in the growth of closed circuit television must start now to prepare its personnel in both camera circuitry and application idiosyncrasies of this type of electronic equipment. Where it was possible to learn a lot about TV service and installation through 'cut and try' in the early days, closed circuit installation and maintenance will require expert technical 'know-how' right from the start.

Hi-Fi Future

One of the most interesting developments in recent months is the announcement by such primarily radio and television firms as *RCA, General Electric, Admiral, Philco,* and *I.D.E.A.* ("Regency") that they are entering the high-fidelity audio equipment field. These and other companies are finding out, just as *Stromberg-Carlson* did almost a year ago, that there is a strong and ever-growing market for "packaged" high-fidelity systems or individual units which have been engineered to work together to produce the best results. These "matched" sets, which can be purchased at one time or added as the customer wishes, are gaining an enthusiastic acceptance among audiophiles.

The tremendous interest in high-fidelity reproduction that music lovers have shown during the past two years through their attendance at audio equipment shows in various parts of the country, indicates an ever-widening interest in custom-installed sound equipment in the home.

The bottleneck in the exploitation of the high-fidelity market has been brought about by the wide variety of methods employed in distributing the equipment which is of interest to the mass market of home owners. Service businessmen have not been interested in promoting custom-installed sound equipment because after they have spent the money and time getting a customer interested in high fidelity equipment the customer will discover where he can buy the units at dealer prices and either buy them himself or drop the idea with the feeling that the service dealer is profiteering at his expense.

In numerous instances service operators have shown your editors where, after they had spent considerable time in detailing an installation of sound equipment for a church or a commercial organization, the principals involved bypassed them and bought the necessary units from a local parts distributor. In selling custom-installed sound equipment it is necessary to give the customer a layout of where the units will be placed, how the wiring will be accomplished, and details of the units that will be used in the installation.

A novice to the hi-fi field, figuring on an investment in custom-installed equipment, quickly finds other hi-fi enthusiasts who know all the answers—particularly about where you can buy the elements for a high-fidelity system at the lowest cost. When that happens the retail dealer who developed the interest is out of luck. He doesn't have a chance to close the sale or to get any return on the time and knowledge he has given in developing the consumer's interest.

This situation has brought aggressive selling of high fidelity equipment to a standstill at the consumer level.

The unfortunate part of this situation is that the tremendous mass market for custom-installed hi-fi equipment will remain unexploited because of the lack of aggressive promotional activity at local levels. The present hi-fi market is largely comprised of the audio enthusiasts in the half million segment of our population who are familiar with the elements of electronic circuitry.

This impasse may be broken some day by some manufacturer or combination of manufacturers who set up sales programs for package sound that will be available only through authorized dealers capable of installing and maintaining it. A "package" of quality equipment aggressively merchandised to home owners would find a receptive market among the many thousands who would appreciate the pleasures of high fidelity sound without the bother of trying to understand how it is accomplished.

Service Business Categories

When you speak of an electronic service business, the average man will visualize a one-man shop with the owner busy plying a soldering iron to the innards of an up-turned radio or television receiver. But while industry attention has been directed largely to the expanding base provided by new products and the extension of manufacturing and distributing facilities, a great many changes have been taking place in

the businesses devoted to the servicing of electronics products. We felt it would be of interest to our readers in the service business to know the many categories into which the activity has expanded:

1. Television (installation and service)
   (a) TV Service—dealer operated
   (b) TV Service—wholesale — for non-servicing dealers
   (c) TV Service—consumer only —complete service home and shop
   (d) TV Service—installations only—for dealers
   (e) TV Service—drive-in — customer brings set in —picks it up after service is completed.
2. AM-FM radio service
3. Phono service—automatic changer specialists
4. Auto radio specialists
5. Wire and tape recorders
6. Audio equipment — (industrial and commercial) — sales and service
7. Mobile 2-way communciations equipment
8. Industrial electronics maintenance
9. Community and apartment house TV systems.

In their travels about the country your editors have found several thriving businesses that specialize in the servicing of wire and tape recorders. This type of equipment, now widely used in businesses and by professional people, has been passed up by most service operators. On the other hand, one typewriter sales store that went into selling wire and tape dictating machines soon found the adjustment and servicing of recorders to be a profitable avenue that supplies a consistent volume of business.

TTLB Bulletins Available

From time to time we have offered bulletins to our readers which cover various subjects of interest to people engaged in the service business. From time to time we get letters from readers asking for bulletins that were offered several years ago. Unfortunately, most of these bulletins are out of print.

At the present time we have the following bulletins available to those who would like to have them:

1. Financing a TV Service Business
2. Standard TV Labor Pricing Schedule
3. Your Market — Replacement phono needles, cartridges and changers
4. Closed Circuit TV—Opportunities for Independent Service Businesses.

In requesting bulletins address your letter to: TTLB Information Service, P. O. Box 1321, Indianapolis 6, Ind., and include an addressed, stamped envelope. Twelve cents in postage is required for all four bulletins listed above. —30—

AMATEUR TELETYPE

THE Southern California Radio Teletype Society, an amateur group, has been publishing a highly informative and professionally laid out bulletin called "RTTY" since January of this year. "RTTY" carries articles on amateur teletype equipment and techniques, reports on station and network activities, and supplies information on the availability of equipment, etc.

A page called "Tape off the Floor" gives interesting gleanings from conversations between amateur teletype stations all over this country and Canada. The SCRTS and "RTTY" plan to make an "Amateur Radio Teletype Handbook" available late in September.

Subscription to "RTTY," which is non-commercial and non-profit, is not restricted to SCRTS members and may be had by anyone for $1.80 a year, which covers the cost of printing and mailing. Further information may be obtained from Merrill Swann, W6AEE, at 3769 East Green Street, Pasadena 10, California, the address of the Society. —30—

Over-all view of the manufacturing area of Allen B. Du Mont Laboratories' new Instrument Division plant in Clifton, N. J. The new facility contains 118,000 square feet of space for the development and manufacture of cathode-ray instruments.

Mac's Service Shop

(*Continued from page 66*)

"It's not so strange. People are pretty meter-minded. The gas man measures the pressure delivered to the house with a meter. The electrician uses a similar gadget on the mains. The garageman checks their car battery with a meter, and the local police may even, on occasion, use a meter to tell how many beers they have had. It only seems natural and businesslike to them that the TV service technician should have a device to measure the amount of signal delivered to the set."

"That meter does a fine job of checking set accessories, too," Barney remarked. "With it I can tell in a matter of seconds if a booster is boosting or not and how much. In the same way I can put it across the output of a u.h.f. converter and tell in a minute if the cause of poor u.h.f. reception lies in the converter or in the set. Along with this, of course, I employ the meter to measure the u.h.f. antenna voltage. Since we installed those u.h.f. strips in the meter's turret tuner, the gadget is just as useful on u.h.f. signals as it is on v.h.f. measurements. Some of those u.h.f. antennas have mighty sharp lobes, and you need the meter to line them up exactly."

"I was just thinking," Mac mused, "that we use the field strength meter around the shop for a lot of things besides the ones we've mentioned. For instance, I ran the signal generator into that two-set coupler we bought and then measured the output across the two receiver connections and found that one leg had twice as much output as the other. I used the meter again when I was building up that ladder-type attenuator so we might have as weak a u.h.f. signal as we want for checking fringe-area sets. The field strength meter tells me exactly how many sections to cut in or out to get just the signal strength required.

"It is also just what the doctor ordered for checking the output and attenuators of our sweep and marker generators. You will recall that we found our sweep generator could not be reduced to a very low level of output until probing around with a piece of twin-lead connected to the field strength meter showed that the r.f. was coming out on the line cord. After we put a line filter inside the case, that put an end to the leakage, and the attenuator worked as it should."

"Yeah, and that gave me an idea," Barney exclaimed. "I put a highpass filter on the input terminals of the meter and took it home with me to help track down some harmonic leakage in my ham rig that was causing TVI. With a short length of twin-lead terminating in a two- or three-turn coil for a probe, that field strength meter makes the most sensi-

tive harmonic indicator you could hope for. Later I learned that Phil Rand in the June, 1952 issue of *"QST"* tells how this very meter can be modified especially for running down TVI by installing a coax connector and a couple of filters and by drilling a hole in the panel so the oscillator coils may be adjusted to cover an extended range either side of the video carriers. I was able to track down my trouble, though, without doing this."

"I am glad," Mac remarked dryly as he turned the channel selector knob to make sure no holes *had* been drilled in the panel.

"Don't forget the tests we made on u.h.f. antennas and lead-ins," Barney said, "You had me up on the cold, cold roof connecting identical lengths of various kinds of lead line to the antenna and pouring water down along them while you sat here in the nice warm shop tabulating relative field strength readings."

"Well, you were the one who wouldn't trust the attenuation figures given in the books." Mac retorted; "and then our findings were almost identical with the published ones. One thing worthwhile we did find out, though, was which of the various brands of matching transformers used for connecting a v.h.f. and a u.h.f. antenna to a single lead-in were the best. By connecting the lead first to the u.h.f. antenna and then to the v.h.f. antenna and noting the relative signal strength received, and then by using the various types of matching transformers one at a time and taking new u.h.f. and v.h.f. readings, we got a clear picture of the effect each transformer had on the two signals."

"The thing I like about using a field strength meter is that it teaches you what kind of performance to expect out of each brand of receiver," Barney said. "That is important in this area that is ultra-fringe v.h.f. but primary u.h.f. since we got our new station. While I realize this meter is not intended to measure received signal strength in absolute microvolts—such a job would cost several thousands of dollars—it is a very dependable indicator of relative signal strength. Using it, we have learned that we must have a reading of ten to fifteen microvolts to make some sets hold sync, while others will hang right in there down to two or three indicated microvolts. Certain models will be snow-free when our meter shows 100 microvolts; others take two or three times this amount. Knowing what to expect out of a set is dog-gone important, but first you have to know what goes into it."

"That's right," Mac agreed. "The signal is what the technician has to work with, and with a good field strength meter he can trace it beyond the antenna terminals right up to the antenna itself. Considering the important part that the antenna plays in TV reception, I should say that was essential."

—30—

SERVICE HINTS ON EMERSON TV SETS

CHASSIS 120094A

60-cycle buzz.

To eliminate such buzz from the audio when it is present even at low settings of the volume control, do the following:

1. Dress all leads to the picture-tube socket as far from the 6T8 tube as possible. This can be done by securing the green grid lead wire to the side of the cabinet.
2. If the buzz persists, realign the sound circuits and sound traps.

CHASSIS 120095

Bright noise streaks.

To eliminate such disturbances from the picture, remove the 22-ohm resistor connected between the tuner frame and "B—", and replace with a jumper wire.

CHASSIS 120095B

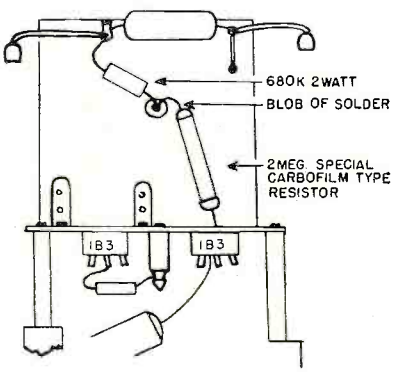
Audio buzz.

Change condenser C_{15} (1500 $\mu\mu$fd.) to a 220-$\mu\mu$fd. unit. This is the cathode bypass condenser of the sound mixer tube (V_4, 12AT7).

CHASSIS 120109 & 120120

Replacement of the 2-megohm high-voltage resistor.

This resistor is R_{30} in the 120109 chassis, and R_{46} in the 120120 chassis. When replacement of these resistors becomes necessary, a 680,000-ohm, 2-watt *Allen Bradley* resistor should be placed in series with the new 2-megohm unit. No substitutes should be used for either one of these resistors. The



method of mounting is shown in the accompanying diagram.

The junction of the two resistors should be looped, and a large blob of solder should cover any points or sharp ends. This prevents ionization of the air, or arcing.

CHASSIS 120118B

Loss of horizontal sync.

1. Replace the horizontal oscillator and control tube (V_{13}, 12SN7GT).
2. Replace C_{47} (.002 μfd., 400 volt) condenser with a 600-volt unit of the same value.

Bad arcing in raster, small irregular raster.

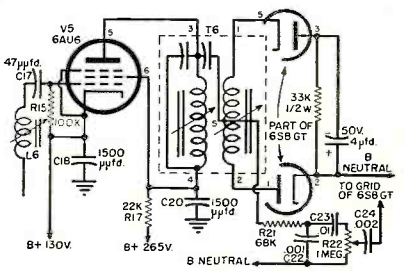
Replace T_7 horizontal oscillator and phasing coils.

CHASSIS 120123B

Intercarrier buzz.

To eliminate this condition, do the following:

1. Remove the following components from the circuit:
   a. C_{21} (110 $\mu\mu$fd.) connected



   between pin 5 and pin 2 of V_6 (6S8).
   b. Resistors R_{19} and R_{20} (100,000 ohms) from lug 5 of T_6, the discriminator transformer. (Lug 1 has a green dot, lug 3 has a blue dot. Numbers run counterclockwise.)
   c. R_{16} (8200 ohms) and C_{19} (1500 $\mu\mu$fd.) from pin 6 of V_5 (6AU6).
   d. R_{18} (2200 ohms) from the "B+" point on the terminal strip to lug 4 of T_6.
2. Reconnect the following components:
   a. Remove pigtail of R_{21} (68,000 ohms) going to pin 5 of 6S8, and connect to lug 5 of T_6.
   b. Remove lead from pin 3 of 6S8, and connect to pin 5.
   c. Add a jumper wire from lug 4 of T_6 to pin 6 of the 6AU6.
3. Add the following components:
   a. A 33,000-ohm, ½-watt resistor in parallel with a 4-μfd., 50-volt electrolytic condenser, from pin 3 of the 6S8 to "B neutral" on the nearby terminal board (second lug from tuner), with the negative side of electrolytic to pin 3 of 6S8.
   b. Add a .001-μfd., 400-volt condenser from pin 6 of the 6S8 to "B neutral."

The accompanying diagram above shows the new circuit.

4. Align the sound circuits as follows:

a. Place a d.c. v.t.v.m. (negative scale) across the 4-μfd. electrolytic, ground terminal to "B neutral" (plus side of electrolytic).

b. Tune in a good television station.

c. Adjust L_6 and primary of T_6 for maximum meter deflection.

d. Remove meter and adjust secondary of T_6 for maximum sound with minimum buzz. (The secondary of T_6 is on top for Part No. 708018; on bottom for Part No. 708017.)

CHASSIS 120124

Interference on AM radio sets in vicinity.

Construct a filter as follows:

Connect a .05-μfd., 400-volt condenser in parallel with a 100,000-ohm, 1-watt resistor from the line switch side of the a.c. input plug to ground.

Unstable sync due to internal radiation.

To eliminate the effect of internal radiation on synchronization circuits of the receiver, do the following:

1. Add a 1500-$\mu\mu$fd. condenser from the "B+" side of fuse, F_1, to chassis. (Keep the leads about ¼" long.)
2. Add a metal shield 4" long, 2" wide, along the side of the i.f. dummy lug strip.
3. Change condenser, C_{73}, from 50 $\mu\mu$fd. (mica) to 42 $\mu\mu$fd. (ceramic, 2000 volts).
4. Change condenser C_{91} (18-$\mu\mu$fd., 6000-volt mica) between the plate of the 6BG6 tube and chassis, to an 18-$\mu\mu$fd., 6000-volt *ceramic* unit.

CHASSIS 120127B & 120128B

Neck shadows.

If a shadow on the right-hand side of the picture tube persists after the beam bender focus coil and the deflection yoke have been properly adjusted, do the following:

1. Reverse the electrical connections to the focus coil.
2. Magnetize the molded iron core in the deflection yoke as follows:

a. Remove V_{15} (6BG6), V_{17} (1B3), and V_{16} (6W4) from their sockets.

b. Remove the white lead from the horizontal deflection yoke at the width coil (junction of L_{11} and R_{91}, 750-ohm resistor), and connect to a "B+" 230-volt point (red lead on electrolytic condenser).

c. Connect the negative terminal of a spare 40-μfd., 450-volt electrolytic condenser to the chassis.

d. With the set operating momentarily, touch the posi-

tive side of this electrolytic to pin 3 of the V_{16} (6W4, damper tube) socket.

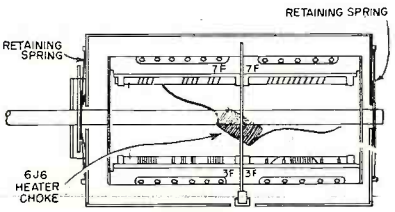
e. Remove the 40-μfd. electrolytic making sure to first discharge the positive terminal to the chassis to avoid a shock.

f. Replace tubes and reconnect yoke.

Black vertical line at left of picture.

This is generally caused by Barkhausen oscillations. After normal means (adjusting the horizontal drive condenser or changing the 6BG6) to eliminate this interference have been tried, and if the oscillation persists, do the following:

Break the cement which glues the 6J6 heater choke to the underside of the tuner chassis, and press this choke away from the chassis (toward turret). See the



accompanying diagram. This can be accomplished by removing both sets of coils for Channels 4, 5, 6, 11, 12, and 13, and then gently prying the choke loose with a screwdriver. Be careful not to damage or change the shape of the coil.

CHASSIS 120142B, 120143B

Horizontal foldover.

This condition is characterized by white hash within the left quarter of the picture which varies with the setting of the horizontal hold control.

To cure this, do the following:

1. Replace resistor R_{75} (220,000 ohms) connected through condenser C_{52} (82 μμfd.) to pin 1 of V_{15} (6SN7 horizontal control tube) with two 100,000-ohm, ½-watt resistors in series.
2. Connect a 25 μμfd. ceramic condenser from the junction of the two 100,000-ohm resistors to chassis ground.

Raster comes on after sound (more than one minute later).

This usually is the result of a slow-starting horizontal oscillator, and may be cured by the following:

1. Check the 6AX5 low-voltage rectifier tubes (V_{19} and V_{20}). These may have low emission causing a low "B+" voltage.
2. Change the 6BQ6 horizontal output tube (V_{16}). It may be necessary to try a few tubes since some of these may have slow heaters.
3. Check C_{60}, the 10 μfd. "B+" boost filter condenser, and replace if leaky.
4. Check all solder connections in the 6SN7 horizontal oscillator and control circuits (V_{15} and V_{16}).
5. In low line voltage areas, change the value of R_{86} (at pin 10 of the CRT) from 22,000 ohms to 15,000 ohms.
6. Try a new horizontal phase coil L_7 and oscillator transformer T_{10}. These may have shorted turns or may be opening intermittently.

CHASSIS 120166D

Vertical roll.

When this occurs with the reception of noise interference, it may be corrected by replacing the 150-ohm resistor, R_{86} (grid resistor from pin 4 of 6SN7 vertical oscillator, V_{18}, to ground) with a 100-ohm unit.

Hiss in fringe areas

To increase the signal-to-noise ratio and reduce hiss in fringe areas, change the value of C_{93} (from volume control to ground) from .001 μfd. to .002 μfd.

CHASSIS 120166D, 120168D, and 120169B, F, & D

Picture wiggle.

This may be caused by incorrect lead dress of the picture tube leads.

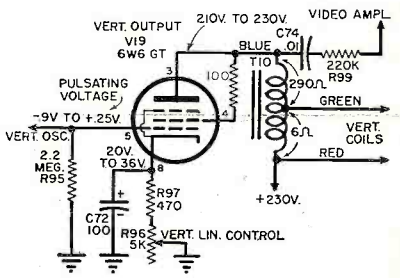
To correct this, do the following:

1. Dress the yellow lead to the cathode of the picture tube (pin 11) away from the horizontal oscillator tube (V_{13}, 6SN7) to prevent stray pickup of video information by the oscillator tube. The yellow picture tube lead can be secured to the deflection yoke support bracket.
2. Dress the white lead to the fringe compensator "on-off" switch away from the horizontal phase coil (L_{11}) and the grid of the 6SN7 horizontal oscillator tube (pin 4 of V_{13}).

CHASSIS 120168D

Popping sound in audio.

When this condition occurs at the same time that the picture starts to roll vertically or when the vertical hold control is adjusted, it may be cured by installing a 100-ohm, ½-watt resistor between the



screen and plate of the vertical output tube (V_{19}, 6W6), as shown in the diagram.

Hiss noise in fringe areas.

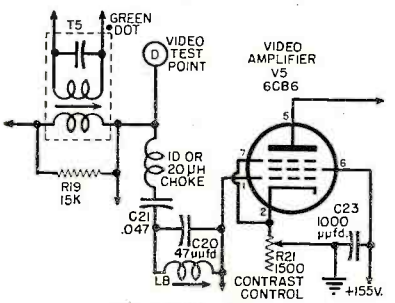
To reduce the amount of hiss, add a decoupling condenser to the

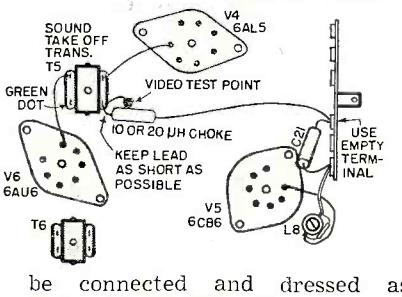
plate circuit of the 1st audio amplifier. This condenser should be .001 μfd., and should be connected from pin 7 of V_9 (6AV6) to chassis.

Black horizontal streaks when tuned to Channel 6.

This condition is usually only apparent in fringe areas, and is caused by harmonics of the picture i.f. generated in the video detector coupling to the front end, causing regeneration of certain frequencies. In many cases it may be tuned out with fine tuning, and can sometimes affect Channels 5 or 7.

These streaks may be eliminated by connecting a 10- or 20-μhy. r.f. choke in series with the .047 μfd. condenser (C_{21}) connected to the grid of the 6CB6 video amplifier tube (V_5). This choke should





be connected and dressed as shown in the diagram.

In some chassis, the 4.5-mc. trap (C_{20}-L_8) has been eliminated. This serves to improve the sound in fringe areas.

CHASSIS 120168D, AND CHASSIS 120169B, F, & D

Repeated fuse failure.

This can be caused by momentary arcs in tubes or components which occur intermittently and soon heal themselves.

To cure such fuse failure, replace the burnt-out fuse with a 6-amp. slow-blowing type.

CHASSIS 120169B & F

Yoke ringing.

This condition is characterized by a rippling of the horizontal raster lines at the left third of the picture.

To cure this effect, check condenser C_{62} which is across part of the horizontal deflection yoke coil. If this condenser is bad, it should be replaced with a new 2000-volt unit between 38 μμfd. and 62 μμfd. (Try values between these limits for the best ringing elimination.)

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Film for TV

(*Continued from page 37*)

with a white light of equal intensity, the latter gives off a highly actinic blue radiation. Photographically speaking, this fits the bill since it cuts down on the all important film exposure time.

Early TV film recording utilized a shutter that opened 170°, resulting in an exposure time of about 1/30th second. By accurately synchronizing the camera motor it was then possible to make the shutter open and close during vertical blanking. With this experimental device, kinescopes were recorded at a 15 frame-per-second rate.

Currently in use, a 16 mm TV recording camera is phased to the system's synchronizing generator. Its shutter, driven by a 60-cycle synchronous motor through a set of precision gears, has a closing angle of 72°. At a 24 cps rate this is equal to a single TV frame. Thus, two and one-half fields occupy one-twenty-fourth of a second which is the equivalent of one frame of 16 mm film.

Since the top portion of field 3 is unexposed during the film pulldown period, it is made up later by exposing the upper portion of field 5, before the shutter again commences its action. Two fields are therefore fully exposed since the continuity of action is at such a rapid rate.

Accurate synchronization must exist at all times. Any change, however slight, in the speed of the shutter inevitably results in banding. TV recording engineers call this "shutter bar." This may sometimes occupy a space of some ten or twelve horizontal lines running through the center portion of the picture. They may be overexposed or underexposed and exist as an unpleasant pulsating optical phenomenon.

In order to insure an extremely high degree of shutter accuracy, today's drives are designed with the care and precision of a Swiss watch. The all-electronic shutter is, however, slowly gaining prominence in certain installations. The adjustments required with mechanical shutters present no problem in this system since no shutter is used.

Due primarily to economic considerations, the great majority of kinescope recordings will undoubtedly continue to be made on 16 mm film. Furthermore, fire regulations covering the use of 35 mm film are most rigorous. Consequently 16 mm technique in both kinescoping and film projection is undergoing vast improvement.

As to the future development of films and television, several noteworthy investigations are taking place simultaneously in Hollywood and Great Britain. Technically very little is known at this time regarding the video tape recording process of the Hollywood *Crosby* laboratories. Presumably pictures have already been produced from a rapidly moving spool of special tape!

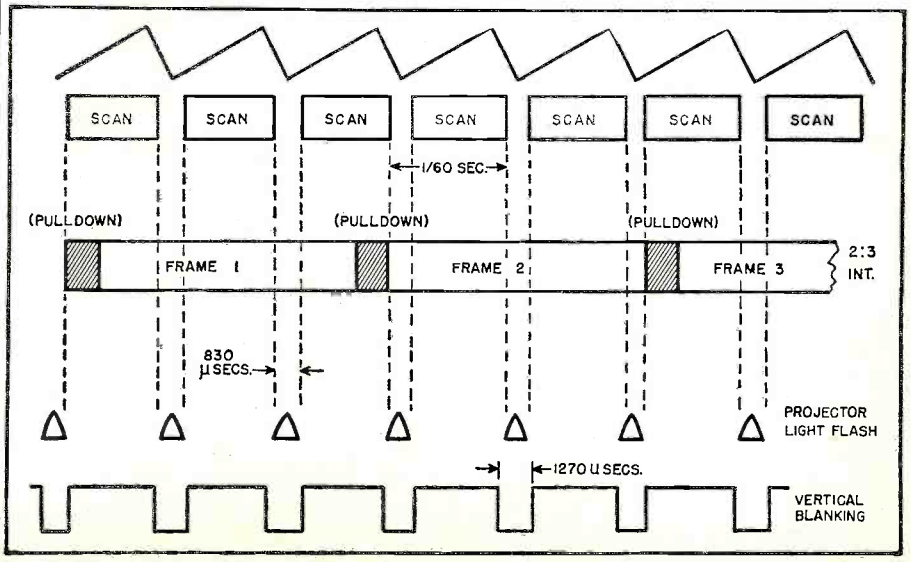
Engineers in England are well on the way towards perfecting a method that eventually will replace existing movie making techniques. In the filming of a movie, no one but the camera operator can have a true picture of what is actually taking place on the stage. His eyes see what the film sees. Consequently two, three, or even four different shots may be taken of the same scene. It remains for the director to integrate these.

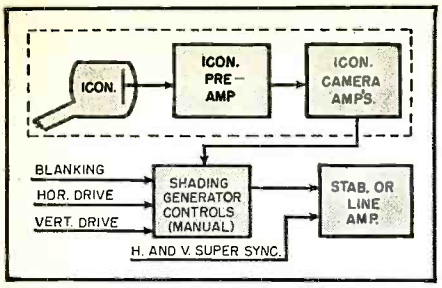
After processing hundreds of these, assembled clips are projected on a screen in the screening room. Within these confines the director selects, chooses, and rejects. This rather crude, though accurate, presentation is rather costly. Now if the director had an instantaneous prevue of several camera shots on location, similar to those on TV broadcast monitors, his problems would be simplified.

Let us have a "preview" of what might occur.

Once a director's decision is made

Fig. 12. 16 mm film conversion using 2 to 3 intermittent. See text for explanation.





A television film camera control chain.

as to a particular shot it is communicated verbally to the technical supervisor, "Take Four." Camera #4 is punched up on the intricate dissolve-switching console and its picture travels over a closed circuit to the recording (kinescope) studio. Here it is recorded on fine grain high quality 35 mm stock.

Special effects such as "wipes," "dissolves" and superimpositions present no problem. Modern TV techniques make use of the latter two, hundreds of times throughout a single evening of transmission. As a matter of fact, London bridge was once "moved" into a rather small TV studio *via* the method of rear screen projection!

Probably the last technical hurdle lies in overcoming the limiting resolution of present-day camera tubes and recording kinescopes. In the writer's opinion an idealized experimental approach would be a closed circuit system capable of passing an over-all bandwidth of some 960 lines (12 mc.). Intermediate video amplifiers are today commercially available with up to ten, twelve, and even fifteen megacycle response.

In view of the fact that most of the film transmission problems have been solved with ingenuity, it is only a matter of time until all the "bugs" have been eliminated.

It seems hardly fair to the already staggering movie industry that television has been elected to deal the final death blow. The film capital's latest comeback is the three dimensional (3D) medium. TV's answer may well be as follows: "Not only are we today experimenting with three dimensional color television, but we propose to have our pictures broadcast on an international scale." Truly it has been said, "In anticipation of tomorrow's miracles lies the inspiration of today's engineer!"

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Choosing a Probe

(*Continued from page 42*)

that the time constant of its output is short enough to pass audio frequencies.

The demodulator probe is primarily intended for observation of sweep curves and audio waveforms. In responding to the modulation envelope of an r.f. carrier, this probe is capable of accurately following the complex waveforms conveyed by modulation. The demodulated output of the probe can be measured as an a.c. voltage on a "VoltOhmyst" or it can be observed as an audio waveform on an oscilloscope. The output range of the WG-291 is flat from d.c. to 5000 cycles and, therefore, includes both the high-frequency and low-frequency components of a 60-cycle square wave, making this particular probe especially good for the observation of sweep curve response.

The input frequency response of this probe is flat from 500 kc. to 250 mc., enabling it to demodulate any video, i.f., and TV channel sweep frequencies or audio amplitude-modulated carriers within that range.

Because of its low input capacitance of 2.25 $\mu\mu$fd., the WG-291 demodulator probe can be used to observe video sweep curves or to observe i.f. amplifier curves at any stage. It is very handy for signal tracing and trouble-shooting whenever modulated carriers are present, and it is particularly helpful in locating causes of hum modulation.

When the demodulator probe is used with an oscilloscope equipped with a d.c. blocking condenser, a demodulated waveform will appear at the normal vertical centering location. When used with an oscilloscope having a direct-coupled amplifier and direct-coupled input, the demodulated waveform is displaced in a positive direction by an amount proportional to the r.f. carrier level. When an unmodulated carrier is applied to the probe and its rectified output is applied to a d.c. scope, the trace is displaced in the positive direction by an amount equivalent to the peak value of the carrier.

The WG-291 demodulator probe is a peak-rectifying type which produces right-side-up video curves on any oscilloscope which is correctly polarized for upward deflection from a positive voltage.

Multiplying Probes

Safety is the prime consideration in the design of the *RCA* WG-289 high-voltage probe. The probe itself is a housing for a high-resistance multiplier and is shaped to minimize leakage and corona.

A 1090-megohm multiplier in a WG-289 high-voltage probe used in conjunction with a "VoltOhmyst" having 10 megohms internal resistance provides a convenient 100-to-1 voltage reduction for all d.c. ranges. The extremely high resistance causes negligible loading on TV high-voltage supplies.

If it is desired to measure 19 kilovolts with a high-voltage probe, the "VoltOhmyst" should be set on the 500-volt range to read 1.9 on the 5 scale. The meter reading is then 1.9 times 100 or 190 volts. This, in turn, is multiplied by the probe factor of 100 to indicate a total of 19,000 volts.

In a unique application of the high-voltage probe, the waveforms of 15.75 kc. television horizontal-output and high-voltage circuits can be viewed on an oscilloscope provided that the scope has a d.c. path to ground of approximately one megohm in series with the probe resistance. Signal tracing and waveform analysis in high-voltage circuits are thereby made practical. This type of probe is not recommended for exact a.c. measurement because of stray capacitance pickup. It is not advisable to shield the multiplier resistor because shielding would reduce the safety factor.

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NEW DIODE FOR U.H.F. TELEVISION

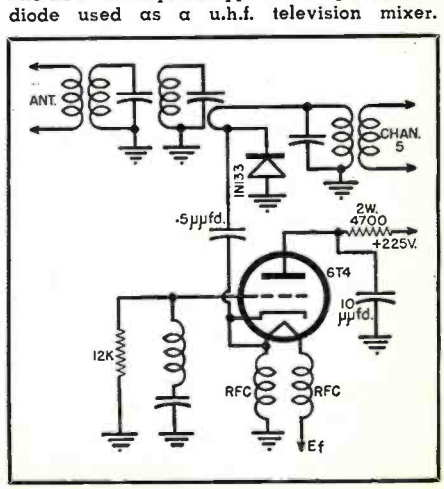
CBS-Hytron has introduced a new germanium diode which has been especially designed and tested for mixer applications in the u.h.f. television spectrum from 470 to 890 megacycles.

The new Type 1N133 is housed in a glass-filled phenolic case and is especially impregnated to insure optimum performance under adverse humidity conditions.

Maximum ratings at 25° C. include a d.c. inverse voltage of 5 volts, a maximum (average) d.c. current of 50 ma.; a maximum d.c. peak current of 150 ma.; surge current (1 sec. duration) of 500 ma. Typical characteristics at 25° C. include: maximum reverse current (at —.6 volt) of .3 ma.; minimum forward current (at +.5 volt) of 3 ma.; average shunt capacitance of .8 $\mu\mu$fd.; and peak inverse voltage of 6 volts.

The germanium diode's mixer characteristics in the u.h.f. television circuit shown include oscillator injection of 1 ma., frequency of 850 mc., average conversion gain of .5, and an average noise figure of 16 db. —30—

The new CBS-Hytron Type 1N133 germanium diode used as a u.h.f. television mixer.



Crystal Calibrator

(Continued from page 63)

band the better, as the beat note in the receiver is S-9 on the fundamental. An 80-meter crystal gives strong beats from 160 to 10 meters and is also usable on the higher bands. Decide how many crystals you want to use in this application, and with an appropriate switch, if more than one crystal is used, wire up the unit in 30 minutes. Note that the tube terminals shown in the schematic are for a 6V6.

A crystal with its fundamental frequency in any amateur band can be used for checking purposes on all of the ham bands since the circuit is rich in harmonics and subharmonics.

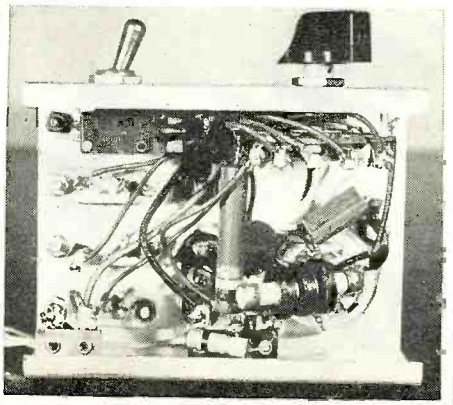
No r.f. connection to the receiver is necessary. Merely place the unit in a convenient location anywhere in the shack, or inside your receiver, if desired, and when you snap the switch "on," there is your checking signal.

The author usually operates near 7100 kc., and the crystal generally used is 3560 kc., giving a fine marker at 7120 kc.

Most modern crystals are accurately calibrated and reasonably drift-free in this application. Some of the surplus crystals available at bargain prices may be of a slightly different frequency from that stamped on the holder. It would be wise to check their frequencies before depending on their accuracy. If your receiver is equipped with a vernier on the h.f. oscillator (like the modern *HRO* series) or an adjustable dial (like the *Collins*), setting it on frequency is easy and accurate. With other receivers, it is easy to interpolate mentally. If the calibrator gives a 7150 kc. signal, and zero beat on the crystal shows 7145 kc. on the receiver dial, it is obvious that within the range of 100 kc. or so, your receiver calibration is 5 kc. low.

Be sure and check the calibration every 10 or 15 minutes for the first half hour warm-up, as most receivers drift and they all vary somewhat from day to day due to differences of temperature and humidity in the shack and due to "aging" of components, as previously mentioned.

Underchassis view of the junk-box calibrator shows easy wiring of the few parts.



FCC rules provide that some method external to the transmitter be provided to insure that operation is within the assigned bands. This unit is a "natural" for this job. Establishing your receiver frequency and then zero-beating the transmitter with the receiver insures operation within the law.

The unit will be found valuable for other purposes around the shack. Adding a .0001 μfd. condenser as shown in dotted lines on the circuit diagram gives you an exciter and keeps you on the air while you rebuild your v.f.o. and you have a choice of six frequencies at the turn of a switch, if your unit is constructed similar to the author's. If you have a crystal of the proper frequency the 455 or 453 kc. subharmonic or any other desired subharmonic can be used for alignment of the receiver i.f. By itself, the unit is a fine low-powered transmitter for emergency use, with a key in the negative high-voltage lead. Power can be supplied by batteries if necessary and the antenna may be connected at the dotted line point in the diagram. Dozens of other uses will come to mind. All in all, it will turn out to be a handy gadget around the shack. It will be well worth the time and money involved in its construction. —30—

COMPACT FILAMENT AND SHORT CHECKER

By ROBERT BAXTER

THIS checker can be built with a minimum of time and expense and will test filament continuity on all types of 7-pin miniature, 9-pin miniature, octal, and loctal tubes.

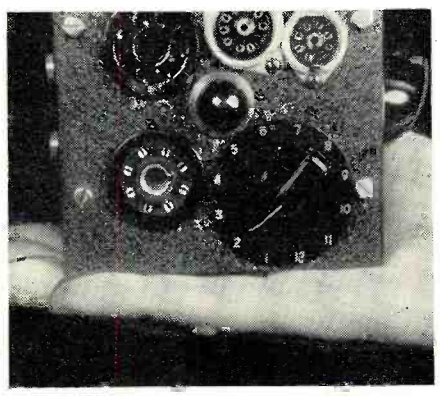
Shorts may be checked between any two elements of any of the above-mentioned tube types.

Two pin jacks have been provided for test leads which may be used to check continuity externally. When using test leads, a condenser, C_1, is used to prevent direct contact between the a.c. line and the user's body.

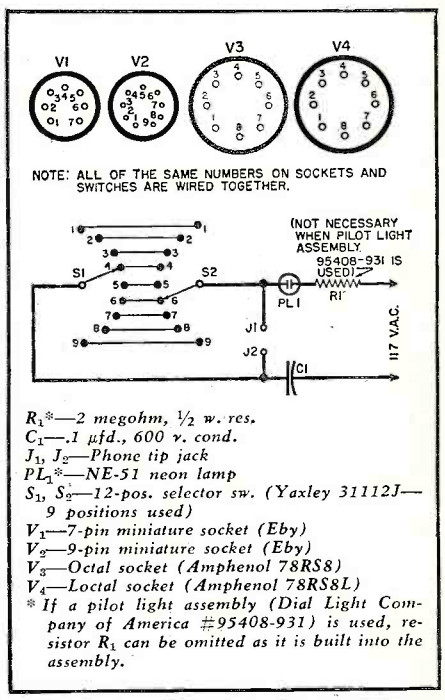
All socket pins of the same number are wired together. These pins are then wired to the corresponding number on both selector switches. This combination makes it possible to select any two elements for checking.

Modifications may be made which will effect some economy including the use of wafer-type tube sockets, a less expensive pilot light socket, etc. A small wood cabinet could be used in lieu of the metal unit.

The selector switches have twelve positions, of which only nine are used. It is necessary to remember that when testing for continuity externally, the selector switches must be switched to different numbers. —30—



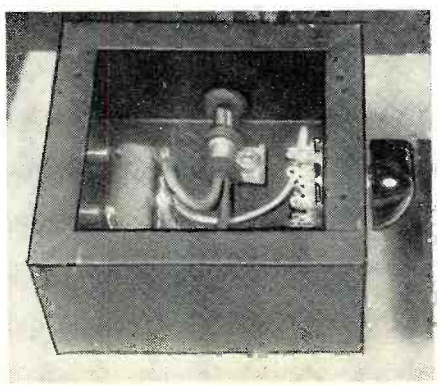
Over-all view of filament and short checker.



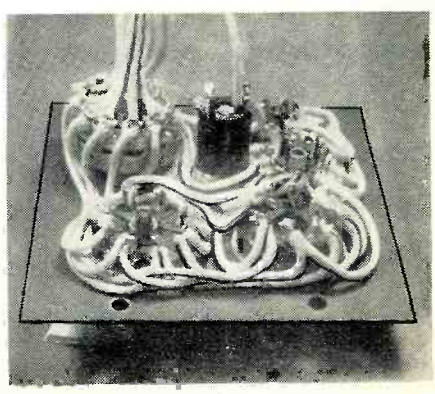
R_1—2 megohm, ½ w. res.*
C_1—.1 μfd., 600 v. cond.
J_1, J_2—Phone tip jack
PL_1—NE-51 neon lamp*
S_1, S_2—12-pos. selector sw. (Yaxley 31112J—9 positions used)
V_1—7-pin miniature socket (Eby)
V_2—9-pin miniature socket (Eby)
V_3—Octal socket (Amphenol 78RS8)
V_4—Loctal socket (Amphenol 78RS8L)
** If a pilot light assembly (Dial Light Company of America #95408-931) is used, resistor R_1 can be omitted as it is built into the assembly.*

Schematic and parts list for test unit.

Rear view of the compact and handy tester.



Under chassis view showing the wiring.



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ADDENDUM

The American Recording Society of New York has advised that its records are cut according to AES-RCA Victor characteristics. This information is intended to supplement the data provided in the equalizer table accompanying Charles P. Boegli's article "New Developments in Phono Equalizers" (April 1953 issue).

SANTA CLARA BARBECUE

THE annual Central California barbecue will be held this year at Cedarbrook Park in San Jose on August 8th.

Sponsored by the Santa Clara County Amateur Radio Association, the event is scheduled for 3 p.m. A full program and plenty of prizes have been planned by the committee in charge.

Reservations may be made by writing the club, P. O. Box 6, San Jose, California. —30—

"SUBSCRIBER-VISION"

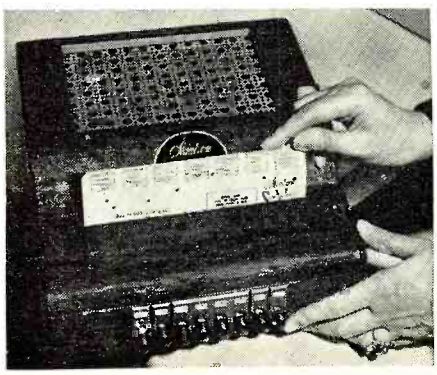
SKIATRON Electronics & Television Corp. of New York City recently previewed its new "Subscriber-Vision" television system before a group of invited guests.

The new system consists of a "coder," three portable units which are installed at transmitting locations to scramble the video and audio signals and a "decoder" for the home. Only TV set owners who have decoders attached to their receivers can unscramble the jumbled sound and video carriers.

Each decoder, a small unit which can be attached to any standard TV set, has a slot at the top where subscribers insert subscription program cards that are sent to them periodically and are the key to control of the decoder. These cards make it possible for subscribers to pay only for the programs they order.

This system, like other "pay-as-you-see" television units currently being tried out, is subject to FCC approval.

—30—



The Skiatron "Subscriber-Vision" decoder unit with the electronic program card being inserted. With the card fitted into the slot, the TV viewer can then order the program being offered, simply by pushing a button. System was previewed recently.

INDEX OF Advertisers

AUGUST 1953

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

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RADIO ENGINEERING

COMPLETE radio, electronics theory & practice: television; broadcasting; servicing; aviation, marine, police radio. 12 or 18 months. Catalog. Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

FOR SALE

TAPE Recorders, Tapes, Accessories. Unusual Values. Dressner, 624-R East 20th St., N.Y.C. 9.

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NEW RCA 3AP1A original cartons, $8.75 each. Tubes, surplus—bought, sold. Free list. Write, Mark, Box 14, New York City 72.

DIAGRAMS Radio, 75c; Record Changers, Recorders, $1.25: Television with Service Data, $2.00. Where model unknown give part numbers. Kramer's Radio Service, Dept. J53, 36 Columbus Ave., New York 23, N. Y.

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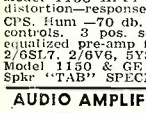

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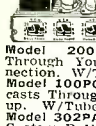

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2C40	7.29	6AS5	.79	12BF6	.85	CK525AX	1.29
2C43	17.75	6AS6	2.49	12BH7	1.29	CK526AX	1.49
2C43/464A	9.49	6AT6	1.10	12BY7	1.35	CK527AX	1.49
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2E31	1.49	6AV6GT	1.29	12SF5GT	.72	531	1.89
2E43	1.49	6AV6	.49	12SF7GT	.49	CK532DX	1.89
2G21	1.49	6AW6	1.89	12SG7	.83	WLS32	3.98
2J31	27.00	6B4G	1.23	12SH7	.63	CK533AX	1.29
2J31A	79.95	6BA6	1.27	12SJ7GT	.59	CK534AX	.99
2J32	37.00	6BA7	1.27	12SK7	.72	CK536AX	.99
2J33	37.00	6BC5	.63	12SL7GT	.65	CK537AX	3.04
2J34	27.00	6BC7	1.23	12SN7GT	.75	CK538DX	.98
2J36	108.00	6BD5GT	1.25	12SQ7GT	.63	CK539DX	2.19
2J37	12.70	6BD6	.83	12SR7	.63	CK541DX	1.19
2J38	11.75	6BE6	.59	FG17	3.95	CK543DX	.99
2J39	44.00	6BF5	.98	19T8	1.09	CK544DX	.99
2J42	187.00	6BF6	.65	19X8	1.62	CK546DX	1.99
2J48	24.25	6BG6G	1.39	24G/3C24	1.90	CK547DX	1.98
2J49	67.25	6BG7	1.98	25BQ6GT	1.19	CK571AX/	
2J50	21.25	6BH6	.63	25L6GT	.69	CK573AX/	
2J52	249.50	6BK5	.69	25Z5	.63	5629	3.49
2J55	85.00	6BK7	2.15	25Z6GT	.99	WL673	117.00
2J56	149.00	6BL7GT	1.45	FG27A	8.70	WL676	39.95
2J61	49.95	6BN6	1.79	28D7	1.95	WL686	35.00
2J62	49.45	6BN7	1.63	FG32/		703A	4.75
2K22	39.45	6BQ6GT	1.20	5558	13.85	705A	1.98
2K23	39.45	6BQ7	1.65	35Z5GT	.59	707A	7.90
2K25	28.49	6C21	29.45	RK39	2.89	707B	13.50
2K25/		6C86	.69	45Z3	7.50	715A	6.00
723AB	24.90	6CG7/6G	1.69	50L6GT	.69	715B	11.90
2K28	29.00	6D4	2.70	RK61/XFG1	3.05	715C	24.00
2K33	259.00	C6J/SC21.	9.89	80	.69	717A	.90
2K35	389.95	6J4	6.66	81	1.69	719A	28.50
2K41	126.00	6J5GT	.47	82	1.19	721A	2.49
2K48	120.00	6J6	.62	82V	1.39	722A/287	2.45
2K2	.49	6K4A	6.45	83	1.45	723A	11.95
2K32	2.49	6L6	2.09	83V	1.79	723A/B	25.00
3B23/RK22	4.95	6L6G	1.35	184/6Z4	.99	724B	3.95
3B24	6.97	6L6GA	1.35	FG95/		724C	3.45
3B25	4.50	6L6GAY	2.25	5560	24.85	725A	8.49
3B26	3.70	6L6GAY	2.25	FG98	19.95	726A	21.97
3B28	7.90	6SA7GT	.63	100TH	7.83	726B	45.00
3C22	89.00	6SC7	.90	FG104	37.98	726C	79.95
3C23	9.90	6SD7GT	.80	FG105	17.64	801A	.45
3C31/C1B	3.45	6SF5	.77	117L/M7GT	1.59	803	3.89
3C33	14.98	6SH7	.72	117N7GT.	2.49		
3C45	12.89	6SH7	.61	117P7GT.	1.39		

"TAB" TESTED & GUARANTEED

PRICES SUBJECT TO CHANGE
WRITE FOR COMPLETE TUBE LISTING

805	3.90	1N21	1.25
807	1.65	1N22	1.25
809	2.43	1N23	1.35
810	9.95	1N23A	1.20
811	2.90	1N23B	2.25
812	2.29	1N25	4.98
813	12.49	1N26	8.75
814	2.97	1N27	1.55
815	5.97	1N34	.90
832A	2.95	1N34A	.90
833A	39.45	1N35	1.65
834	5.95	1N38	1.43
836	4.75	1N38A	1.20
837	1.45	1N39	4.15
849	29.45	1N41	8.95
860	4.90	1N42	16.95
861	23.95	1N53	1.75
865	1.35	1N54	.89
866A	1.50	1N54A	1.15
872A	3.29	1N56A	4.00
CK1005	.85	1N58A	1.15
CK1027	2.98	1N57	.89
5554	2.79	1N58	1.19
5670	5.30	1N60	.60
CK5672	1.29	1N61	2.07
CK5678	1.89	1N63/K63	2.49
5687	5.49	1N64	.69
CK5702	3.49	1N65	.69
CK5703	1.29	1N69	.98
Xtal Diodes		1N69A	1.75
1N21A	$1.55	1N70	2.98
1N21B	1.89	1N70A	3.50
1N21C	21.50	1N86	1.15
1N22	1.25	1N87	1.15
1N23	1.35	1N88	1.15

FEDERAL SELENIUM RECTIFIERS BATTERY CHARGER RECTIFIER

10-0-10V (CT) 100 Amp., fan cooled. Replace your old inefficient sulfide rectifier w/new selenium type. SPECIAL...$11.98

SELENIUM RECTIFIERS

We specialize in Rectifiers and Power supplies to your spec's. Immediate delivery.

Current (cont.)	18/14 Volts	36/28 Volts	54/40 Volts	130/100 Volts
1AMP	1.35	2.15	3.70	7.50
2AMP	2.20	3.60	5.40	10.50
4AMP	4.25	7.95	12.95	25.25
6AMP	4.75	9.00	13.50	33.00
10AMP	5.75	12.75	20.00	40.00
12AMP	8.50	16.25	25.50	45.00
20AMP	13.25	25.50	39.00	79.50
24AMP	16.25	32.50	45.00	90.00

Full-Wave Selen Rect & Trans. in Kit Form. All 115V/60 cy inputs.
up to 14VDC at 12 amps.....$23.98
up to 28VDC at 12 amps..... 31.98
up to 28VDC at 48 amps.....129.00

RECTIFIER XFMRS

18-12-9-CT-9-12-18V/4 Amp .....$ 8.75
18-12-9-CT-9-12-18V/12 Amp 16.75
18-12-9-CT-9-12-18V/24 Amp 35.75
18 Volt/2 Amp.....$1.98; 3 for 5.49

FEDERAL ½ WAVE RECTIFIERS

130V RADIO & TV

CURRENT CONT.	LIST PRICE	"TAB" PRICE	LOTS OF 12
65 MA	$1.50	$0.59	$6.48
75 MA	1.85	.69	7.58
100 MA	2.05	.79	8.68
150 MA	2.25	.99	10.78
200 MA	3.15	1.39	14.98
300 MA	3.30	1.49	15.98
400 MA	4.25	1.89	20.38
500 MA	4.40	1.98	21.28

Your Selection of any 12 Rectifiers Deduct 10% from "TAB" Price.
18V/230MA.....59c; 12 for.....$5.98
36V/230MA.....89c; 12 for.....$8.38
300V/250MA....1.39; 12 for.....$14.98

RECTIFIER CHOKES

4 AMP	.07 HY	.6	OHM	$ 7.95
12 AMP	.01 HY	.1	OHM	14.95
24 AMP	.004 HY	.025	OHM	29.95

MICA CONDENSERS

A

B

C

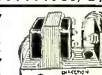
Fig.	MFD	WVDC	PRICE
A	.03	600	69c; 5 for 2.39
A	.02	600	69c; 5 for 2.25
A	.015	2500	1.75; 2 for 3.00
B	.01	600	56c; 3 for 1.20
B	.01	1200	69c; 3 for 1.49
A	.005	2500	1.19; 3 for 2.95
B	.004	600	49c; 3 for 1.10
A	.002	2500	98c; 3 for 2.25
A	.001	1200	55c; 3 for 1.20
C	.00075	5000	2.98; 2 for 5.00
C	.0007	3000	89c; 3 for 2.39
C	.0004	2500	39c; 6 for 1.95
A	.0001	600	25c; 5 for 1.00
C	.0001	3000	89c; 3 for 2.00
C	.00005	3000	39c; 4 for 1.00

RHEOSTATS

AT BARGAIN PRICES

6 ohm 25W Model LH..$1.49; 2/$2.49
15 ohm 25W w/knob ... 1.49; 2/ 2.49
20 ohm 50W Model J.. 1.98; 2 for 3.50
60 ohm 50W w/knob ... 2.25; 2/ 3.98
100 ohm 50W Model K ... 1.98; 2/ 3.50
200 ohm 25W Model D ... 1.49; 2/ 2.49
250 ohm 25W 1.19; 3/ 2.98
300 ohm 225W Model P 2.98; 2/ 5.00
350, 500, 5000 ohm Slotted shaft, 25 watt 79c; 3/ 2.00

DC POWER SUPPLY



0 to 12 VDC/2 Amp. Variable DC supply, uncased and completely built-inpt. 115v/60 cy. Usable LAB supply, filament D.C. plating, battery charging, model railroad. includes voltage or speed control and center off reversing sw. Ideal for two "HO" locomotives. "TAB" SPECIAL....$10.95; 2 for $20.00

INFRARED SNOOPERSCOPE

SEE-IN-DARK TUBE

Image-Converter Tube HiSensitivity simplified design 2" dia. Willemite screen—Resolution up to 350 line/in. Complete data & tube, ea. ..... $4.98; 2 for $9.49
SNOOPERSCOPE PWR SUPPLY
1800VDC 35MA, Using Doubler Crkt. Transformer. Rectifiers. Socket. Resistors. Capacitors and Diagram.....$6.98

"B" PLUS BOOSTER RTMA GTD.

5TV4 $3.30
LOTS OF 3
Service dealers, write for quantity price

- Replaces 5U4G Rectifier
- Boosts "B" Plus 30-40 Volts
- Built in Time Delay, to Protect TV
- Corrects Shrunken Pictures
- Extra Picture Height & Width
- Extra Gain for Fringe Areas
- Lesser Quantities, Each $3.88

RM-29 REMOTE CONTROL

Can be used as field phone or control of Transceiver from a distant point. 15 mile, 2 wire operation, good for Television Antenna Installation. New $10.95

SOLDERING IRONS & GUNS

"WELLER" Gun 115VAC 100 Watt.$8.69
"WEN" Gun 115VAC 250 Watt..... 9.49
"PRIMAX"Gun115VAC Korodless Tip 7.69
PHILIPS "VERSA TOOL" 115VAC 250 Watt and 4 Tips.....10.83

ESICO IRONS 120V AC/DC

55Watt/⅜Tip/11½Lng/.38Lbs. $1.25
60Watt/¼Tip/12"Lng/.38Lbs. 1.91
100Watt/⅜Tip/12"Lng/.5Lbs. 2.55
130Watt/¼Tip/12"Lng/.75Lbs. 3.17

ESICO INDUSTRIAL CONST. USE IRONS
Similar to American Beauty As Shown

61A60/60W/⅛Tip/7"Lng/2.5oz. $3.20
#38/AM.Beauty3138/100W/⅜Tip .. 5.29
#58/Am.Beauty3158/200W/⅝Tip .. 6.30
#78/Am.Beauty3178/300W/⅞Tip .. 8.18
#98/Am.Beautv3198/550W/1⅛Tip .. 10.08
Esico Temp Regulating Stand..... 4.20
Solder 1 lb. roll 60c; $1.29 or with any soldering iron. Special.....90c

CONDENSER SPECIALS

2 MFD 330 VAC
1000 VDC **25c**
STD MFGR Lots of 10
Smaller Quantities.
Each 49c; 3 for $1.25
2MFD 600VDC Porcelain Insulators W/Adj Mtg Clamp .....3 for $1.50

LINEAR SAWTOOTH DC POTENTIOMETER KS15138

Electric power is supplied through 2 fixed taps 180° apart. 2 rotating taps, and take-off brushes are provided for output voltage. Varying position of the brushes, varies the output voltage in accordance with a linear sawtooth wave. **$3.95**
Special.....
WRITE FOR ADDITIONAL INFO

866A KIT AND XFORMER

2 Tubes. Sckts, xfmr INPT 115VAC, output. 2.5vct. 10A/Hvinsul. SPECIAL..$4.98

GENUINE SWEDISH CROSSCUT SAWS

FIRST QUALITY

STOCK NUMBER	SIZE	TEETH PER/IN	REG. PRICE	"TAB" PRICE
701-20-10	20"	10 PT	$9.95	$3.95
701-24-10	24"	10 PT	9.75	4.15
701-24-8	24"	8 PT	9.75	4.15
701-26-8	26"	8 PT	10.85	4.25
701 26-6	26"	6 PT	10.85	4.25
701-26-10	26"	10 PT	10.85	4.25
701-28-8	28"	8 PT	10.85	4.35
701-28-6	28"	6 PT	11.50	4.70
701-30-6	30"	6 PT	11.00	4.50

OIL CONDENSER

WAREHOUSE CLEARANCE SALE
RECTANGULAR CASE

.5MFD 1500VDC .....95c; 2 for $1.50
2MFD 1000VDC .....55c; 4 for 1.95
5MFD 600VDC .....1.50; 3 for 4.00
10MFD 600VDC .....$1.98; 2 for 3.50
3MFD 330VAC 1000VDC ...3 for 1.20
2X2MFD 600VDC .....89c; 2 for 1.59

BATHTUB SIDE TERMINALS

1MFD 600VDC .....39c; 3 for $1.00
4MFD 50VDC .....50c; 5 for 2.00
1MFD 2000VDC .....$1.05; 5 for 4.50
2X .1MFD 400VDC .....49c; 2 for 2.00
WRITE FOR CONDENSER LISTING

BC-442-A

Antenna current indicator & Relay switching. Includes 750MA "RF" meter, 19.5 millivolt movement, current XFMR, thermocouple & relay. Complete as shown, less vacuum condenser. New...$5.69

Money Back Guarantee (Cost of Mdse. Only) $5 Min. Order F.O.B. N.Y.C. Add Shpg. Charges & 25% Dep. Tubes Gtd. via R-Exp. only. Prices subject to Change Without Notice.
Rector 2-6245

THAT'S A BUY "TAB" THAT'S A BUY
DEPT. 8RN 111 LIBERTY STREET NEW YORK 6, N. Y., U. S. A.

PRINTED IN U.S.A.

this TV set IMPROVES WITH AGE

Five years old next week—and now better than ever. When the original tube wore out it was replaced with a Rauland. Now pictures are brighter, sharper, clearer. Another Rauland success story—your cue to sell *improvement* through *replacement* with Rauland—and chalk up plus business.

THE RAULAND CORPORATION 4245 NORTH KNOX AVENUE
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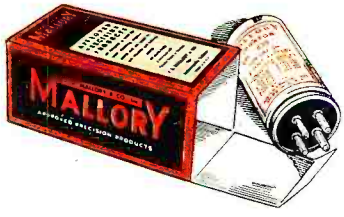
ZENITH SUBSIDIARY

Burton Browne advertising

Approved Precision Quality

"Better Than Ever"

"I put a Mallory Vibrator in it. Used 'em for years on all my service work and haven't had a call-back yet."



That is the main reason you'll find 5 out of 6 service men using Mallory Vibrators for all their service work. When you put a Mallory Vibrator in a set, the job stays sold . . . no call-backs . . . no wasted time to run up costs.

The patented, tuned mechanism in Mallory Vibrators is the secret of their dependability and long life . . . the reason they are more widely used as original equipment than all other makes combined.

These exclusive performance features give you better vibrators, available in a complete line, meeting or exceeding original equipment specifications . . .

Slow contact make . . . for less wear

High contact pressure . . . for low resistance

Fast clean break . . . for reduced arcing

Next time you order vibrators . . . ask for Mallory. It is a sure way to beat the call-back problem . . . be sure all your service jobs stay "sold".

P. R. MALLORY & CO. Inc

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CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
RECTIFIERS • POWER SUPPLIES • FILTERS • MERCURY BATTERIES

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